Fort Sam Houston, Texas

Base Realignment and Closure (BRAC) Actions

Final Environmental Impact Statement

6 March 2007

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FINAL ENVIRONMENTAL IMPACT STATEMENT

BASE REALIGNMENT AND CLOSURE (BRAC) ACTIONS FORT SAM HOUSTON, TEXAS

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ES-1 INTRODUCTION

This Environmental Impact Statement (EIS) analyzes and documents environmental effects associated with the Army's compliance with the Base Realignment and Closure (BRAC) and other transformation activities at Fort Sam Houston (FSH), Texas, and related field training activities at Camp Bullis, Texas. Its purpose is to inform decision makers and the public of the likely environmental consequences of the proposed action and alternatives. This EIS identifies, documents and evaluates all relevant impacts, conditions and issues associated with the proposed realignment actions at FSH and Camp Bullis.

This EIS was prepared in accordance with 32 Code of Federal Regulations (CFR) Part 651, Environmental Analysis of Army Actions, Final Rule (29 March 2002). The regulations are the specific instructions adopted by the Army to implement Section 102(2) of the National Environmental Policy Act. The Army is directed to develop its instructions by the President's Council on Environmental Quality; those regulations are published at 40 CFR §§1500 to 1508.

On 8 September 2005, the Defense Base Realignment and Closure Commission (BRAC Commission) recommended that certain realignment actions occur at FSH and Camp Bullis. These recommendations were approved by the President on 23 September 2005 and forwarded to Congress. Congress did not alter any of the BRAC Commission's recommendations, and on 9 November 2005, the recommendations became law. The BRAC Commission recommendations now must be implemented.

ES-2 INSTALLATION SETTING AND MISSION

FSH is located in the City of San Antonio, Texas, and Camp Bullis is north of San Antonio. Loop 410 circles the city center and encloses a densely populated urban environment. FSH is located within Loop 410 to the east of the city center. The 2,940-acre installation is surrounded by developed property, widely used highways and arterial roadways. There is no room for land expansion, and additional development is confined within the installation's borders.

Since 1845, FSH has performed important roles for the Army and has served as a Headquarters (HQ), logistical base, mobilization and training site, garrison and medical provider. After construction of the Quadrangle in 1876, the Army began to move facilities to the current site of FSH. FSH is one of the oldest installations and has more than 800 historic buildings in various historic zones. Camp Bullis was established in 1917 approximately 20 miles northwest of FSH. During World War II, the camp was an important venue for training troops stationed at FSH. Subsequently, the focus at FSH and Camp Bullis began to change toward training Army medical personnel; FSH became the "schoolhouse" for doctrinal training of medics and medical students. Camp Bullis still is used as their field training site.

The installation's prominence in medical training and research advancement has led to significant tactical and organizational innovations. Medical treatment of casualties evacuated by air was performed here as early as 1917. At the end of World War II, FSH was designated as the principal Army medical training facility. With this decision came the determination to develop Brooke General Hospital into a premier Army medical center.

ES-3 PROPOSED ACTION

To implement the BRAC recommendations, FSH will be receiving personnel, equipment and missions from various realignment and closure actions within the U.S. Department of Defense. Additionally, the Army had planned to conduct a series of transformations to position its forces strategically for the future. These transformations are not BRAC-related yet require consideration in conjunction with the BRAC initiatives at FSH. The BRAC also is considered part of another initiative to restructure the Army's overseas basing. This and other considerations (such as installation sustainability and security) that may affect any restructuring or reconfiguration at FSH must be considered as well. To enable implementation of the BRAC Commission recommendations and accommodation of the other concurrent Army initiatives, the Army must provide the necessary facilities/buildings and infrastructure to support the changes in force structure.

The BRAC Commission made the following recommendations concerning FSH:

- Close Fort McPherson, GA, and relocate the Army Contracting Agency (ACA) Southern Region HQ to FSH (Recommendation #3).
- Realign FSH and Randolph Air Force Base (AFB), Texas, by relocating the installation management functions to Lackland AFB, Texas (Recommendation #146).
- Realign the Zachary Taylor Building, a leased installation in Arlington, VA, by relocating the Army Installation Management Agency (IMA) HQ to FSH (Recommendation #148).
- Realign Rock Island Arsenal, IL, as follows:
  - Relocate the Army IMA Northwest Region HQ to FSH, and consolidate it with the Army IMA Southwest Region HQ to form the Army IMA Western Region.

  - Relocate the Army Network Enterprise Technology Command (NETCOM) Northwest Region HQ to FSH and consolidate it with the Army NETCOM Southwest Region HQ to form the Army NETCOM Western Region (Recommendation #148).

- Realign Seven Corners Corporate Center, a leased installation in Falls Church, VA, and 4700 King Street, a leased installation in Alexandria, VA, by relocating the Army Community and Family Support Center to FSH (Recommendation #148).

- Realign Rosslyn Metro Center, a leased installation in Arlington, VA, by relocating the Army Family Liaison Office to FSH (Recommendation #148).

- Realign Skyline Six, a leased installation in Falls Church, VA, by relocating the ACA HQ to FSH (Recommendation #148).

- Realign the Hoffman 1 Building, a leased installation in Alexandria, VA, by relocating the ACA E-Commerce Region HQ to FSH (Recommendation #148).

- Realign Fort Buchanan, PR, by relocating the ACA Southern Hemisphere Region HQ to FSH (Recommendation #148).

- Realign Aberdeen Proving Ground, MD, by relocating the Army Environmental Center (AEC) to FSH (Recommendation #148).

- Realign Walter Reed Army Medical Center, Washington, DC, as follows:

  - Relocate enlisted histology technician training to FSH.

  - Relocate the Combat Casualty Care Research sub-function (except for those organizational elements performing neuroprotection research) of the Walter Reed Army Institute of Research (Forest Glen Annex) and the Combat Casualty Care Research sub-function of the Naval Medical Research Center (Forest Glen Annex) to the Army Institute of Surgical Research, FSH (Recommendation #169).

- Close Brooks City-Base, San Antonio, Texas, and relocate the Naval Health Research Center Electro-magnetic Energy Detachment and the Directed Energy portion of the Human Effectiveness Directorate of the Air Force Research Laboratory to FSH (Recommendation #170).

- Close Brooks City-Base, San Antonio, Texas, and relocate the Army Medical Research Detachment to the Army Institute of Surgical Research, FSH (Recommendation #170).

- Realign Lackland AFB, Texas, by relocating the inpatient medical function of the 59th Medical Wing (Wilford Hall Medical Center [WHMC]) to the Brooke Army Medical Center (BAMC), FSH, establishing it as the San Antonio Regional Military Medical Center, and converting WHMC into an ambulatory care center (Recommendation #172).

- Realign Naval Air Station (NAS) Great Lakes, IL; Sheppard AFB, Texas; Naval Medical Center Portsmouth, VA; and Naval Medical Center San Diego, CA, by relocating basic and specialty enlisted medical training to FSH (Recommendation #172).
- Realign Facility 42, 8901 Wisconsin Avenue, Bethesda, MD, by relocating the Combat Casualty Care Research sub-function of the Naval Medical Research Center to the Army Institute of Surgical Research, FSH (Recommendation #174).
- Realign NAS Great Lakes, IL, by relocating the Army Dental Research Detachment, the Air Force Dental Investigative Service and the Naval Institute for Dental and Biomedical Research to the Army Institute of Surgical Research, FSH (Recommendation #174).

These actions will impact several areas at the installation, as well as specific field training areas on Camp Bullis. The concentration of buildup of facilities and personnel will be in the four mission-related subareas at FSH and the training area at Camp Bullis:

- The patient care subarea due to the consolidation of the Air Force WHMC onto the BAMC site
- The medical research, development, testing and evaluation subarea collocated with the major patient subarea due to the movement of the directed energy research function from Brooks City-Base
- The medical training subarea due to the introduction of the new student and instructor loading in the buildup of the Medical Education Training Center (METC)
- The HQ and administration subarea due to additions and changes to the Fifth Army, the Sixth Army/U.S. Army South (USARSO) and 470th Military Intelligence (MI) functions; joint basing; relocation of IMA HQ and Assistant Chief of Staff for Installation Management field operating agencies; and relocation of ACA-Southern Hemisphere
- Two training sites (approximately 130 acres total) in the southwest portion of Camp Bullis

Additionally, permanent facilities will be constructed or renovated to house the Army Modular Force (AMF) units, including the 470th MI Brigade and various HQ units of the new Fifth Army/U.S. Army North (ARNORTH) and Sixth Army/USARSO, which currently are located in a mix of temporary and existing facilities. This EIS analyzes and documents environmental effects associated with the Army's accommodation of BRAC process and other transformation activities at the installation associated with the 470th MI BDE, Fifth Army/ARNORTH and the Sixth Army/USARSO.

ES-4 ALTERNATIVES

Table ES-1 summarizes the preferred alternative.

Table ES-1 Summary of the Preferred Alternative

Mission-related Subarea	Location
Patient Care	• Additional inpatient facilities would be located within the existing BAMC campus. • BAMC outpatient facilities would be located along west side of Garden Road north of Schofield Road, and on the south side of Harney Road west of Garden Road. • Pharmacy to be constructed along the east side of Scott Road north of Allen Road.
Medical and Other RDTE	• All medical research activities of the Center of Excellence for Battlefield Health and Trauma would be located in an existing space and new facilities within and adjacent to BAMC. • Medical and non-medical research activities of the Tri-Service Research facility would be developed on Pershing Field across from the BAMC campus. • CHPPM-South would be placed in renovated space in Building 2630, which is located on the north side of Schofield Road west of Patch Road. • A bridge would be constructed over Salado Creek, connecting Nursery Road and W.W. White Road. • A 440-meter outdoor laser range would be constructed north of Pershing Field.
Medical Training	• Additional METC facilities would be located within the AMEDDC&S campus. Five existing barracks facilities between Koehler and W.W. White Roads potentially would be reused. • An additional medical training facility at Camp Bullis would be constructed in a 125-acre area along and west of Lewis Valley Road north of the cantonment area.
Headquarters and Administration	• AEC, HQ IMA, NETCOM, ACA and, if possible, the 470th MI BDE would be assigned the use of renovated space in Facilities 2263, 2264 and 2266. • The AFCSC Entertainment Division would use existing warehouse and administrative space in Facilities 2270 and 4197, and new trailer parking space on Ludington Road. • Use of existing and renovated space in Facilities 164 and 258 and temporary locatable facilities adjacent to Facility 16 by the Fifth Army would continue. • If the 470th MI BDE administrative space requirements cannot be accommodated in renovated space, additional portable locatable facilities would be needed. • The Sixth Army/USARSO would continue to use existing space and require additional administrative space that will be available in the future. Portable locatable facilities may be used until the additional space is available. • The 470th MI BDE, Fifth Army, and Sixth Army/USARSO will have separate motor facilities, collocated in the industrial area along Parker and Ludington Roads. • An information systems facility would be constructed near Jessup Road and Second Street. • An MWR Academy would be constructed near Wilson and Third Streets. • A battalion (BN) interrogation range would be constructed at Camp Bullis north of the cantonment area approximately 2,000 feet north of the Marne and Lewis Valley Roads intersection.
Community Facilities (Located Within HQ and Administration Subarea)	• A Chapel would be constructed near Schofield and Funston Roads. A Shoppette/Post Exchange would be located north of Wilson Street near Scott Road. An area near Allen and Funston Roads would be utilized for a Youth Center.

FSH has limited options in siting new facilities due to the constraints and current intensive use in many areas. There are a limited number of alternative sites for specific facilities within the preferred alternative subareas. These alternative sites are listed as follows.

Perimeter Parking and Walking Spaces in Medical Education Training Center

Planning guidance is to develop a walking campus approach to the new METC campus between the boundaries of Schofield and Hardee Roads. The Conceptual Land Use Master Plan envisions converting parking space along Hardee and Koehler Roads into the BN HQ Building. The parking lot between Buildings 1382 and 1387 will be used as a potential expansion area for three BN HQ Buildings, each of which would be 14,560 sf in area. This siting would provide a variation from the lack of potential parking spaces within the campus.

Additional Dormitory Space for Medical Education Training Center

The additional student population from the Air Force and Navy will drive requirements for additional dormitory space.

Temporary Motor Pool Space

Temporary motor pool space may be provided in the existing Defense Reutilization and Marketing Office (DRMO) storage hardstand area if DRMO releases it to FSH, or DRMO may remain temporarily in the existing warehouse area located off Parker Road or the existing troop motor pool.

Additional Portable Relocatable Temporary Facilities

Although not part of the long-term plan, the use of temporary facilities is probable to support the AMF stationing locations through 2011.

ES-5 NO ACTION ALTERNATIVE

Under the no action alternative, FSH would not implement the proposed action. Organizations currently assigned to FSH would continue to train at and operate from the installation. FSH would use its current inventory of facilities, though routine replacement or renovation actions could occur through normal military maintenance and construction procedures as circumstances independently warrant. The no action alternative is evaluated for environmental impacts at the same level of detail as the preferred alternatives in this EIS.

ES-6 ENVIRONMENTAL CONSEQUENCES, MITIGATION RESPONSIBILITY AND PERMIT REQUIREMENTS

Implementation of the preferred alternative will have no long-term, significant impacts on the environmental resources of FSH or Camp Bullis or their surrounding areas. Potential minor impacts to visual resources from implementation of the preferred alternative would generally occur only within the physical boundaries of FSH. No long-term significant impacts to earth (geology, topography, caves, karst features or soils) or wetlands are expected at either installation. Potential land use impacts are expected at FSH. Use of utilities and generation of hazardous and non-hazardous wastes would increase at both installations.

Cultural resources and hazardous wastes would be impacted with the removal or renovation of existing facilities on FSH, some of which are potentially eligible for registration as historic facilities. Planned undertakings within the National Historic Landmark District (NHLD), including the demolition of existing buildings and construction of new buildings, will be reviewed using the Installation Design Guide (IDG) historic review requirements and the standard operating procedures (SOPs) in the Historic Properties Component (HPC). If demolition cannot be avoided, the determination of harm to the NHLD and required mitigations will be determined per the HPC SOP. Minor air, noise and transportation impacts would also occur during short-term construction activities under the preferred alternative at both installations and continue after final construction and occupancy. No significant impacts to biological resources (vegetation, wildlife and threatened and endangered species) are expected from the implementation of the preferred alternative.

Most minor impacts could be reduced through proper engineering design, adherence to protective regulations and implementation of operations and management measures (such as conservation and waste minimization) after beneficial occupancy of facilities. Other Best Management Practices (BMPs) would reduce or eliminate the potential short-term effects to the environment due to demolition/deconstruction and construction activities.

The no action alternative provides the baseline conditions for comparison to the preferred alternative and would not have any environmental impacts resulting from the preferred alternative.

Table ES-2 summarizes the environmental consequences that will result from the no action and preferred alternative; the BMPs; and mitigation measures, if applicable.

Table ES-2 Summary of Potential Impacts, BMPs and Mitigation Measures

Resource Area	No Action Alternative	Preferred Alternative	Best Management Practices	Mitigation Measures if Needed
Land Use	No change to existing conditions.	• No effect on airspace, management or use on FSH or Camp Bullis. • Improved quality of facilities on FSH. • Loss of historic facilities on FSH. • Alteration of historic facilities on FSH. • Siting of non-medical research facility in conflict with FSH Land Use Plan and potential impact on nearby recreational vehicle park. • Siting of vehicle maintenance facilities within view of residential neighborhoods outside FSH. • Temporary siting of relocatable modular facilities during the renovation and construction period is not compatible with nearby historic properties. Build-out schedule may require longer than a five-year use.	• Consider incompatible neighboring uses when designing the non-medical research facility and the vehicle maintenance facilities and potential addition of screening with berms, landscaping or other means. • Provide screening for the relocatable modular facilities where sited near the Quadrangle. Relocate to an area on FSH that would not significantly impact the historic facilities and districts for more than five years. • Provide a berm to screen the laser from portions of the golf course east of Salado Creek.	• Not applicable
Aesthetics and Visual Resources	No change to existing conditions. Older facilities remain and continue to age.	• Potential positive or negative impact on aesthetics with new facilities and deconstruction of aged facilities. • Potential significant impact on historic viewscapes.	• Strictly follow procedures in the IDG, Landscape Master Plan and the HPC of the FSH Integrated Cultural Resources Management Plan (ICRMP) for alterations and replacement of historic facilities.	• Not applicable
Air Quality	No change to existing conditions.	• Potential short-term increase in criteria pollutants during construction and deconstruction activities. • Increased mobile and stationary emissions sources. • No significant impacts to local or regional air quality.	• Dust suppression BMPs during construction and deconstruction. • Selection of energy-efficient systems in new construction. • Selection and use of equipment per Texas Commission on Environmental Quality (TCEQ) air quality measures.	• Not applicable
Noise	No change to existing noise environment.	• No significant increase in noise resulting from increase in weapons training and use of ground burst simulators during training exercises at Camp Bullis. • Slight increase in noise from vehicle traffic and construction equipment. • Double the Medical Evacuation helicopter flights in the BAMC area. Nevertheless, no significant noise impact.	• No noise reduction measures required.	• Not applicable

Resource Area	No Action Alternative	Preferred Alternative	Best Management Practices	Mitigation Measures if Needed
Geology and Soils	No change to existing conditions.	• No significant effects to geologic resources or karst features would occur. • Improved control of erosion after facility construction and paving. • Increased potential for erosion during construction at FSH and Camp Bullis sites.	• Erosion control and silt control required during construction.	• Not applicable
Water Resources	No change to existing environment. Water consumption would remain the same. The existing Stormwater Pollution Prevention Plan (SWPPP); Spill Prevention, Control and Countermeasures (SPCC) Plan; and Pollution Prevention (P2) Plan would remain in force.	• Potential effects of increased stormwater runoff due to increased impervious surfaces on FSH and Camp Bullis. • Increased pumping from the Edwards Aquifer at FSH. • Increased pumping from the Trinity Aquifer at Camp Bullis. • No impact on wetlands.	• Engineered design of stormwater management structures, including retention ponds if needed, is required to prevent flooding on portions of FSH and prevent significant impacts on downstream off-installation properties. • Increased pumping at FSH would be offset partially by decreased pumping at Lackland AFB due to the transfer of medical activities from WHMC to BAMC. • Implementation of water conservation measures during design of facilities is required. • Utilizing reuse water for landscaping and other approved uses should be considered. • The existing SWPPP, SPCC Plan and P2 Plan would be updated to include new construction. • No measures are recommended for Camp Bullis.	• Not applicable
Biological Resources	No changes to existing biological resources.	• No significant effects on biological resources at FSH or Camp Bullis. • Noise during construction not expected to impact endangered species at Camp Bullis. • Karst protected species not found in construction areas at Camp Bullis.	• Adhere to procedures in the KMP.	• Not applicable
Cultural Resources	No change to existing conditions. No deconstruction or alteration of potentially eligible historic facilities.	• Deconstruction or alteration of several facilities on FSH potentially eligible for listing on the National Register of Historic Places. • Potential significant impact on viewscapes of historic districts. • No impact to identified archaeological resources.	• Strictly follow procedures in the IDG, Landscape Master Plan and the HPC of the FSH ICRMP for alterations and replacement of historic facilities.	• Not applicable at this time; mitigations for demolition within the NHLD would be determined per the HPC SOP

Resource Area	No Action Alternative	Preferred Alternative	Best Management Practices	Mitigation Measures if Needed
Socioeconomics	No change to baseline socioeconomic conditions.	• No significant effects on demographics, employment or income potential anticipated. • Substantial increase in construction-related spending would create substantial beneficial economic effects throughout the San Antonio Metropolitan Statistical Area. • No environmental justice concerns.	• None identified.	• Not applicable
Transportation	No change in current traffic conditions.	• Increase in vehicular traffic in southwestern and eastern areas of FSH. • Increased waiting time at access control points (ACPs) in southwestern and eastern areas of FSH. • Decreased Level of Service on several intersections and road segments on FSH.	• Continued permanent improvements inside and outside FSH ACPs. • Selected roadway widening and intersection traffic control to reduce congestion of FSH.	• Not applicable
Utilities	No change in current consumption or wastewater and solid waste generation.	• Increase in water and energy consumption. • Increase in wastewater generation and solid waste tonnage. • Utility systems and regional landfills are adequate to meet increased demands.	• Integrate water and energy conservation into the design of facilities. • Use reuse water for irrigation requirements at new facilities or xeriscape.	• Not applicable
Hazardous Materials and Waste Management	No change to existing conditions.	• Increased storage and use of hazardous materials for vehicle maintenance and medical services. • Increased quantities of hazardous wastes would be generated, primarily petroleum products and construction debris. • Increased quantities of biomedical wastes would be generated at the expanded patient care facilities.	• Included recycling incentives in deconstruction contracts. • Comply with existing procedures for tracking, handling, storage and use of hazardous and toxic materials. • Implement P2 product substitutions and waste minimization. • Comply with existing procedures for contract disposal of hazardous and biomedical wastes. • Survey for lead-based paint and asbestos-containing material before demolition. • Perform unexploded ordnance clearance, if necessary, before construction.	• Not applicable

1.0 PURPOSE, NEED AND SCOPE

1.1 INTRODUCTION

Fort Sam Houston (FSH) will be receiving personnel, equipment and missions from various realignments and closure actions within the U.S. Department of Defense (DoD) as a result of the Base Realignment and Closure (BRAC) actions. Additionally, permanent facilities will be constructed or renovated to house the 470th Military Intelligence (MI) Brigade (BDE) and various Headquarters (HQ) units of the new Fifth Army/U.S. Army North (ARNORTH) and Sixth Army/U.S. Army South (USARSO), which are currently located in a mix of temporary and existing facilities. This Environmental Impact Statement (EIS) analyzes and documents environmental effects associated with the U.S. Army's accommodation of the BRAC process and other transformation activities at the installation associated with the 470th MI BDE, Fifth Army/ARNORTH and the Sixth Army/USARSO. Details on this proposed action, and minor siting variations, are set forth in Sections 2.0 and 3.0.

1.2 PURPOSE AND NEED

The purpose of the proposed action is to implement the Base Realignment and Closure Commission's (BRAC Commission's) recommendations pertaining to FSH, and integrate existing and future facilities and infrastructure for Army Modular Force (AMF) units along with the large numbers of incoming BRAC personnel.

The proposed action is needed to improve the ability of the Nation to respond rapidly to challenges of the 21st century. In establishing the Defense Base Closure and Realignment Act of 1990, Congress waived certain procedural elements of the National Environmental Policy Act of 1969 (NEPA), including the installation realignment for a BRAC action. NEPA applies to realignment-related actions at the receiving installation.

1.2.1 Base Realignment and Closure

In previous rounds of BRAC, the explicit goal was to save money and downsize the military in order to reap a "peace dividend." In the 2005 BRAC round, DoD seeks to reorganize its installation infrastructure to most efficiently support its forces, increase operational readiness and facilitate new ways of doing business. Thus, BRAC represents more than cost savings. It supports advancing the goals of transformation, improving military capabilities and enhancing military value. The Army needs to carry out the BRAC recommendations at FSH in order to achieve the objectives for which Congress established the BRAC process.

1.2.2 Army Transformation and the Army Modular Force

On 12 October 1999, the Secretary of the Army and the Chief of Staff articulated a vision about people, readiness and transformation of the Army to meet challenges emerging in the 21st century and the need to be able to respond more rapidly to different types of operations requiring military action. The strategic significance of land forces continues to lie in their ability to fight and win the Nation's wars and to provide options to shape the global environment to the benefit of the United States and its allies. Transformation responds to the Army's need to become more strategically responsive and dominant at every point on the spectrum of operations. In March 2002, the Army published its *Programmatic Environmental Impact Statement for Army Transformation* for its proposal to conduct a multi-year, phased and synchronized program of transformation. Over a 30-year period, the Army will conduct a series of transformation activities affecting virtually all aspects of Army doctrine, training, leader development, organizations, installations, materiel and Soldiers. On 11 April 2002, the Army issued a Record of Decision (ROD) reflecting its intent to transform the Army. Transformation actions at FSH have already begun for the following AMF units: 470th MI BDE, Fifth Army and Sixth Army/USARSO. These units have moved to FSH and occupied existing facilities. These units now need to be integrated permanently into the existing and projected future facilities and infrastructure along with the large volume of incoming BRAC personnel who will be relocating to FSH. Parts or all of the AMF units may have to be relocated into existing facilities or new facilities. Therefore, the environmental effects of these AMF actions must be included in this EIS. This EIS evaluates a proposed action that comports with the transformation process, which is designed to provide the Nation with combat forces that are more responsive, deployable, agile, versatile, lethal, survivable and sustainable (U.S. Army Corps of Engineers [USACE], 2002).

1.2.3 Installation Sustainability

On 1 October 2004, the Secretary of the Army and the Chief of Staff issued *The Army Strategy for the Environment* (U.S. Army, 2004). The strategy focuses on the interrelationships of mission, environment and community. A sustainable installation simultaneously meets current and future mission requirements, safeguards human health, improves quality of life and enhances the natural environment. A sustained natural environment is necessary to allow the Army to train and maintain military readiness.

1.3 SCOPE

This EIS has been developed in accordance with NEPA and implementing regulations issued by the President's Council on Environmental Quality (CEQ) and the Army.[1] Its purpose is to inform decision makers and the public of the likely environmental consequences of the proposed action and alternatives.

This EIS identifies, documents and evaluates environmental effects of realignments at FSH. An interdisciplinary team of environmental scientists, biologists, planners, economists, engineers, archaeologists, historians and military technicians has analyzed the proposed action and minor siting variations in light of existing conditions, and has identified relevant beneficial and adverse impacts associated with the action and variations. The proposed action, minor siting variations and the no action alternative are described in Sections 2.0 and 3.0. Conditions existing as of 2006, considered the "baseline" conditions, are described in Section 4.0. The expected effects of the proposed action, also described in Section 4.0, are presented immediately following the description of baseline conditions for each environmental resource addressed in the EIS. Section 4.0 also addresses the potential for cumulative effects and identifies Best Management Practices (BMPs) where appropriate.

The Defense Base Closure and Realignment Act of 1990 specifies that NEPA does not apply to actions of the President, the BRAC Commission or DoD, except "(i) during the process of property disposal, and (ii) during the process of relocating functions from a military installation being closed or realigned to another military installation after the receiving installation has been selected but before the functions are relocated (Sec. 2905(c)(2)(A), Public Law 101-510, as amended)." The law further specifies that in applying the provisions of NEPA to the process, the Secretary of Defense and the secretaries of the military departments concerned do not have to consider "(i) the need for closing or realigning the military installation which has been recommended for closure or realignment by the Commission, (ii) the need for transferring functions to any military installation which has been selected as the receiving installation, or (iii) military installations alternative to those recommended or selected (Sec. 2905(c)(2)(B))." The BRAC Commission's deliberation and decision, as well as the need for closing or realigning a military installation, are exempt from NEPA. Accordingly, this EIS does not address the need for realignment but must address the environmental effects that are likely to result from implementing the BRAC Commission recommendations.

The Final Programmatic Environmental Impact Statement for Army Transformation (FPEIS) addressed

[1] CEQ *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act*, 40 Code of Federal Regulations (CFR) §§1500 to 1508, and *Environmental Analysis of Army Actions*, 32 CFR §651.

the impacts of Army transformation actions. The site-specific impacts at the receiving installation require additional environmental analysis, as does the BRAC process. The FPEIS states that, "Prior to implementation of transformation-related projects or proposed actions at specific sites, the Army would analyze each action to evaluate potential environmental effects. Identification of site- or project-specific mitigation would occur through this process (USACE, 2002).

The decision to be made is how, having taken potential environmental effects into account, the Army may realign its forces at FSH and, as appropriate, carry out mitigation measures that would reduce effects on resources. The decision on how to implement realignment would be based on strategic, operational, environmental and other considerations, including the results of this analysis.

1.4 PUBLIC INVOLVEMENT

The Army 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. A public scoping meeting was held on Tuesday, 2 May 2006, at the St. Patrick's Community Center from 2 p.m. to 4 p.m. and again from 7 p.m. to 9 p.m. Public notification was published in the 26 April 2006 edition of the *San Antonio Express News* and the 30 April 2006 edition of *La Prensa*. Specific agencies were mailed invitations to attend the 2 p.m. to 4 p.m. scoping meeting. The public notices not only invited interested parties to attend, but also requested the submission of comments or questions concerning the proposed action or scope of issues.

The meeting format was an information fair with experts from FSH attending display booths to answer questions and speak with the interested public about the proposed action and environmental areas of concern. Attendees were afforded the opportunity to learn more about the proposed action through the visual presentations at the display tables and interactions with knowledgeable individuals who provided more details concerning the proposed action and discussed resource areas that would be studied for environmental impacts during preparation of the EIS.

No major concerns or requirements were raised by the commenters that would broaden the scope of environmental analyses that had been developed prior to the scoping meeting. A few commenters were interested in the scope of the FSH development and requested the inclusion of consideration for improvements on- or off-installation in conjunction with the proposed action development. Nevertheless, none of these areas of interest are specifically linked to the proposed action and alternatives being considered in the EIS, and no formal plans, designs or funding would characterize them as reasonably foreseeable actions that would be considered in the EIS.

Additionally, a few commenters raised concerns about the potential of environmental impacts related to traffic congestion, air quality, stormwater management (retention) and socioeconomics. All of these areas of potential impacts are included in the scope of analyses of the EIS. Prior to the scoping meeting, the scope of analyses was developed thoroughly by experts from many fields, including installation personnel, to ensure that local issues were included. The public scoping meeting validated the scope of analyses for the EIS. Therefore, the scoping meeting did not bring to light any additional alternatives to the proposed action that would require additional environmental analyses or any areas of environmental analyses that should have been added to the EIS. The scoping report is included in Appendix A1.

The realignment (preferred) alternative, minor siting variations and the no action alternative have been analyzed for environmental impacts, and the results are included in the draft EIS that has been made available to the public for a 45-day comment period extending from 6 October through 19 November 2006. The Notice for the 45-day comment period was placed in the *San Antonio Express News* on 5 October 2006. A public hearing also was held on 24 October 2006 to clarify the findings and to solicit additional comments on the draft EIS. Comments were received from private citizens, housing associations and government agencies. The majority of the public comments addressed cultural resource and transportation issues. Comments regarding the Description of Proposed Action and Alternatives (DOPAA), land use, air quality, water resources, socioeconomics, hazardous materials and toxic substances and cumulative effects also were received. Comments received during the comment period and the public meeting, and the responses, are included in Appendix A2.

Throughout this process, the public has had the opportunity to obtain information on the status and progress of the proposed action and alternatives and their environmental impacts through the FSH Environmental Management Office by calling (210) 221-5093 or by fax: (210) 221-5419.

1.5 FRAMEWORK FOR REALIGNMENT AND ENVIRONMENTAL IMPACT STATEMENTS

The framework for the EIS analysis consists of accommodation of additional forces, renovation or construction of facilities and the BRAC-mandated schedule to implement. A decision on how to proceed with the proposed action rests on numerous factors, such as mission requirements, schedule, availability of funding and environmental considerations. This EIS has been prepared in compliance with all federal, state and local laws, regulations and policies applicable to the proposed and alternative actions. Federal regulations and Executive Orders (EOs) applicable to the proposed action are listed below:

- NEPA, as amended (42 U.S. Code [USC] §§4321 to 4370D)
- Endangered Species Act (ESA) of 1973, as amended (16 USC §§1531 to 1544)
- Sikes Act of 1960, as amended (16 USC §§670a to 670o)
- Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 (42 USC §§11001 to 11050)
- Resource Conservation and Recovery Act (RCRA) of 1976 (42 USC §§6901 to 69911)
- National Historic Preservation Act (NHPA) of 1966 (16 USC §470)
- Native American Graves Protection and Repatriation Act (NAGPRA) of 1990 (25 USC §§3001 to 3013; 43 CFR §10)
- Clean Air Act (CAA) of 1963, as amended (Public Law [PL] 101 to 549)
- Clean Water Act (CWA) (33 USC §§7401 *et seq.*)
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 USC §§9601 *et seq.*)
- Army Regulation (AR) 200-2, *Environmental Effects of Army Actions*
- Defense Base Closure and Realignment Act of 1990 (as amended through FY 2005 Authorization Act) (10 USC §§2687 *et seq.*)
- EO 11514 (*Protection and Enhancement of Environmental Quality*)
- EO 11988 (*Floodplain Management*)
- EO 11990 (*Protection of Wetlands*)
- EO 12088 (*Federal Compliance with Pollution Control Standards*)
- EO 12580 (*Superfund Implementation*)
- EO 12898 (*Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations*)
- EO 13045 (*Protection of Children from Environmental Health Risks and Safety Risks*)
- EO 13101 (*Greening the Government Through Waste Prevention, Recycling, and Federal Acquisition*)
- EO 13123 (*Greening the Government Through Efficient Energy Management*)
- EO 13148 (*Greening the Government Through Leadership in Environmental Management*)
- EO 13175 (*Consultation and Coordination with Indian Tribal Governments*)
- EO 13186 (*Responsibilities of Federal Agencies to Protect Migratory Birds*)

These authorities are addressed in various sections throughout this EIS when relevant to particular environmental resources and conditions. The full text of the laws, regulations and EOs is available on the U.S. Government's official Web site at http://www.firstgov.gov.

2.0 PROPOSED ACTION

2.1 INTRODUCTION

2.1.1 History

Since 1845, FSH has historically performed important roles for the Army and has served as an HQ, logistical base, mobilization and training site, garrison and medical provider. After construction of the Quadrangle in 1876, the Army began to move facilities to the current site of FSH. The size of the installation has increased from the original 92 acres to approximately 2,940 acres. Between the two World Wars, FSH was the largest Army installation in the Continental United States (CONUS). FSH is one of the oldest installations and has more than 800 historic facilities in various historic zones. Camp Bullis was first established in 1917 approximately 20 miles northwest of FSH. During World War II, the camp was an important venue for training troops stationed at FSH. Subsequently, the focus at FSH and Camp Bullis began to change toward training Army medical personnel; FSH became the “schoolhouse” for doctrinal training of medics and medical students. Camp Bullis was used as their field training site and still is today.

The installation’s prominence in medical training and research advancement has led to significant tactical and organizational innovations. Medical treatment of casualties evacuated by air was performed here as early as 1917. At the end of World War II, FSH was designated as the principal Army medical training facility. Along with this decision came the determination to develop Brooke General Hospital into a premier Army medical center.

2.1.2 Location

FSH is located in the City of San Antonio, Texas, and Camp Bullis is north of San Antonio, as shown in Figure 2-1. Loop 410 circles the city center and encloses a densely populated urban environment. FSH is located within this beltway to the east of the city center. The 2,940-acre installation is surrounded by developed property and widely used highways and arterial roadways. There is no room for land expansion, and additional development is confined within the installation’s borders.

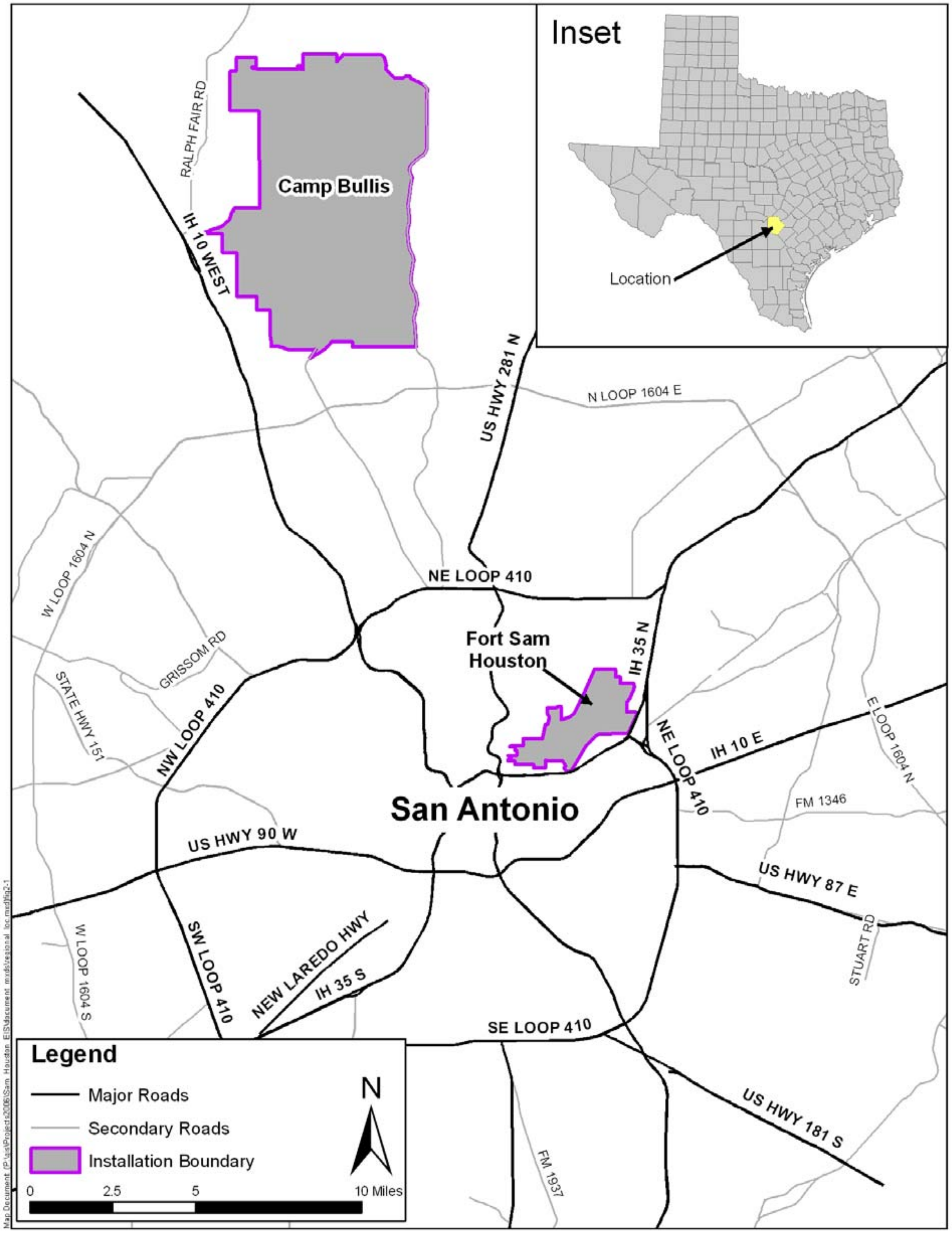

Figure 2-1 San Antonio Regional Map

FSH property use has increased over time as previously noted, and relatively few options exist for placement of new facilities to accommodate installation growth. Additionally, planning constraints must be recognized when planning for new mission facilities. As a historic facility, FSH is dotted with various historic properties. Nevertheless, the largest land constraints due to historic restrictions are from the myriad historic military family housing areas, historic parade fields and monuments that buffer the housing that wraps around and slices through the installation. Additionally, the Quadrangle area on the southern edge of the installation is historic in its own right.

The elongated shape of the FSH property and its segmentation caused by the Salado Creek 100-year floodplain, a railroad right-of-way and major collector streets and arterials have influenced the development of several distinct subareas within the installation's boundaries. To the north, a Veterans Administration (VA) cemetery, schools, recreation facilities, golf facilities and housing have used up the developable space, and its relative distance from the heart of the central installation make it less desirable for mission facilities.

Brooke Army Medical Center (BAMC) is in the east-central FSH. Also within this area are medical research activities, Soldier housing, military lodging, company and battalion (BN) HQ areas and housing for patients' families.

Within the central district are shopping areas, a gymnasium, gas stations, eating establishments and other community support facilities. Their location is central to the family housing, unaccompanied housing and mission support areas of the installation. Industrial and warehouse functions are located along the southern border of the installation and provide a buffer along the busy Interstate Highway 35 (IH-35) that parallels the border. Figure 2-2 shows existing open areas with development constraints.

Based on the current configuration of installation facilities, the master plan of FSH is characterized by four mission-related subareas: 1) patient care; 2) medical and other research, development, testing and evaluation; 3) medical training; and 4) HQ administration and AMF. Figure 2-3 shows the overview of the site and the four mission subareas. Additionally, housing, recreational, commercial and community facilities are located throughout the installation to primarily serve the active duty military and family members, and provide limited support for the civilian workforce.

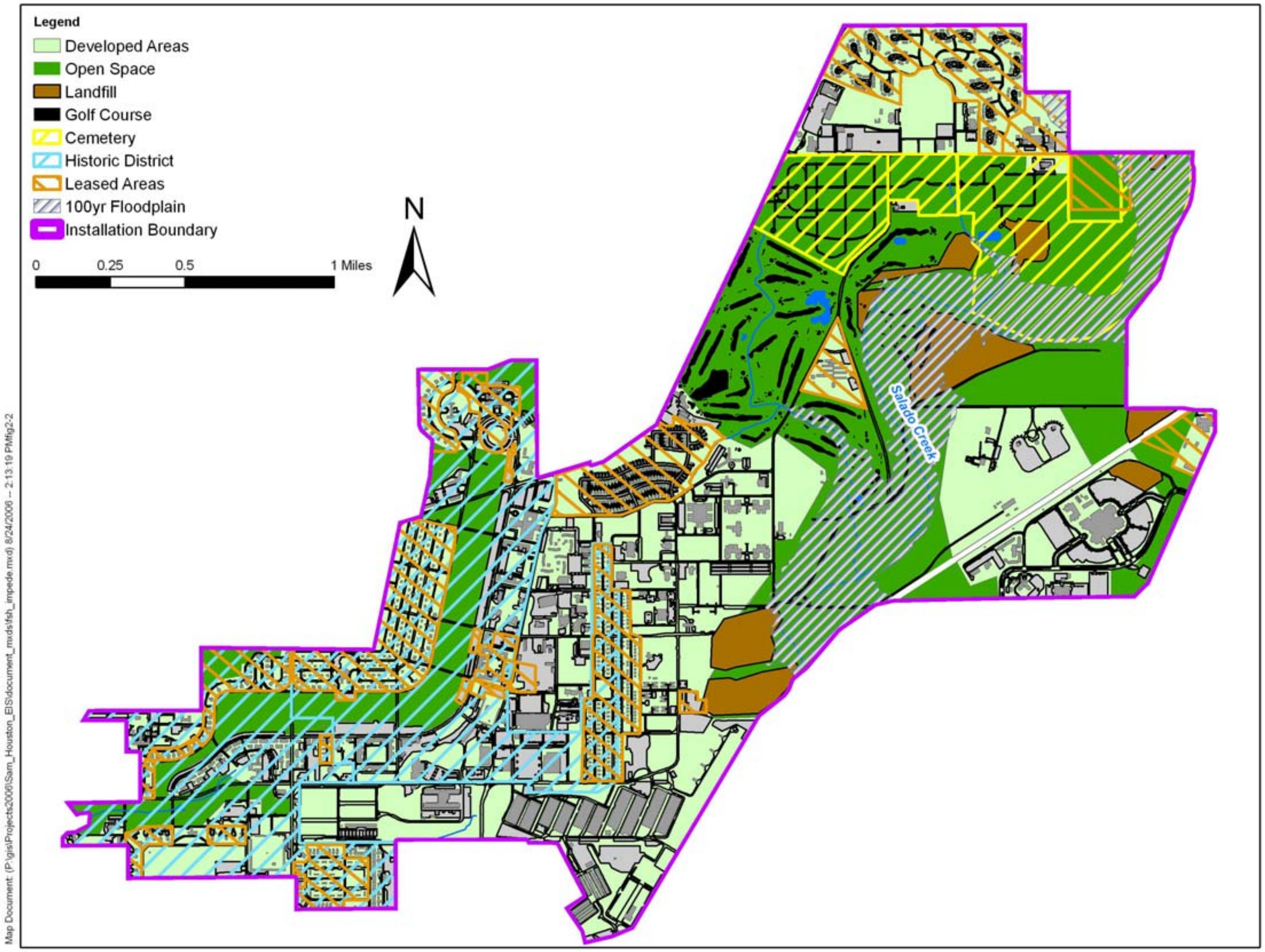

Figure 2-2 Impedance to the Development of Existing Open Spaces at Fort Sam Houston
Source: FSH GIS Department, 2006

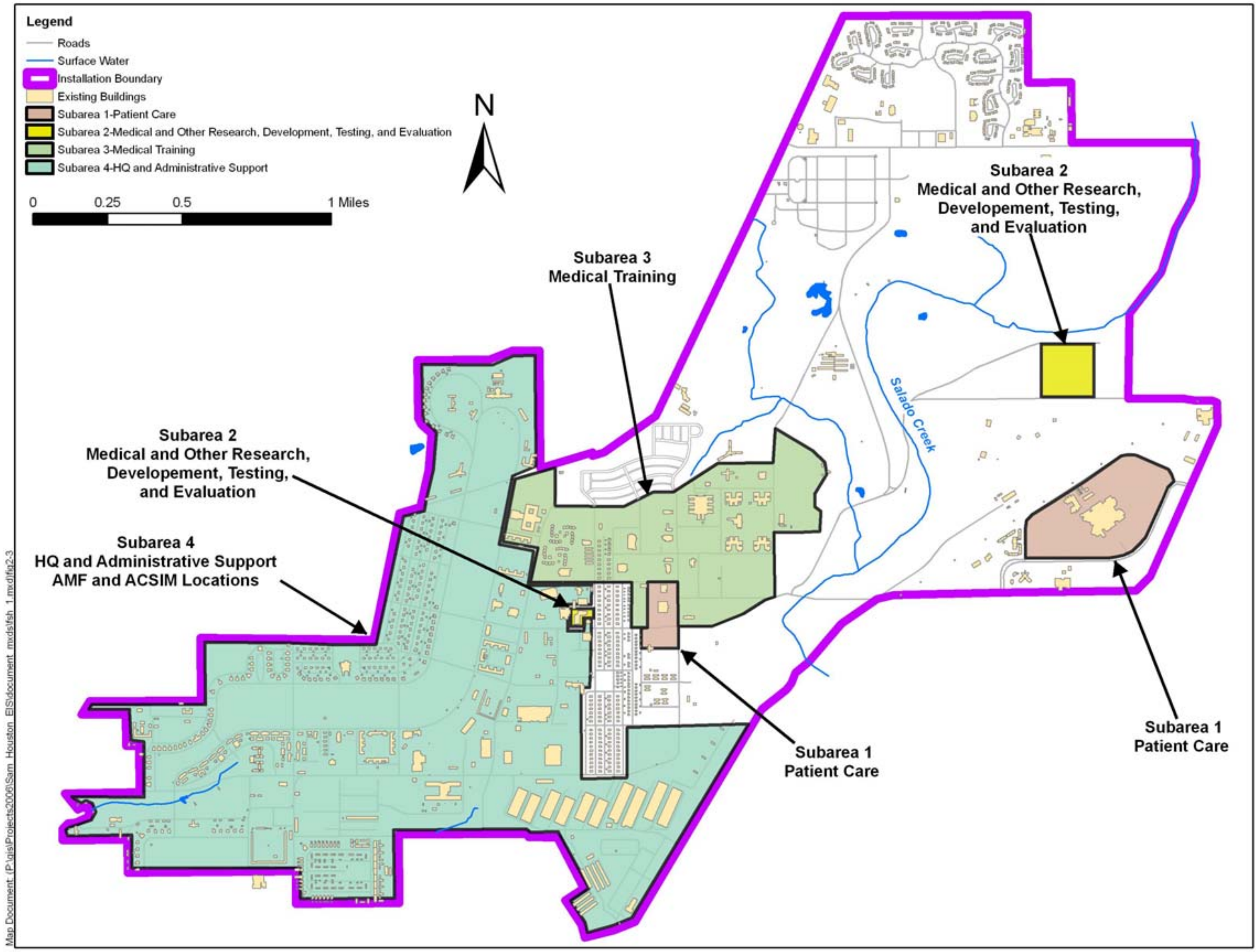

Figure 2-3 Four Mission Subareas, Fort Sam Houston, Texas

2.1.3 BRAC Recommendations

The BRAC Commission made the following recommendations concerning FSH:

1. Close Fort McPherson, GA, and relocate the Army Contracting Agency (ACA) Southern Region HQ to FSH (Recommendation #3)

2. Realign FSH and Randolph Air Force Base (AFB), Texas, by relocating the installation management functions to Lackland AFB, Texas (Recommendation #146)

3. Realign the Zachary Taylor Building, a leased installation in Arlington, VA, by relocating the Army Installation Management Agency HQ to FSH (Recommendation #148)

4. Realign Rock Island Arsenal, IL, as follows:

   - Relocate the Army Installation Management Agency Northwest Region HQ to FSH, and consolidate it with the Army Installation Management Agency Southwest Region HQ to form the Army Installation Management Agency Western Region

   - Relocate the Army Network Enterprise Technology Command Northwest Region HQ to FSH, and consolidate it with the Army Network Enterprise Technology Command Southwest Region HQ to form the Army Network Enterprise Technology Command Western Region (Recommendation #148)

5. Realign Seven Corners Corporate Center, a leased installation in Falls Church, VA, and 4700 King Street, a leased installation in Alexandria, VA, by relocating the Army Community and Family Support Center to FSH (Recommendation #148)

6. Realign Rosslyn Metro Center, a leased installation in Arlington, VA, by relocating the Army Family Liaison Office to FSH (Recommendation #148)

7. Realign Skyline Six, a leased installation in Falls Church, VA, by relocating the ACA HQ to FSH (Recommendation #148)

8. Realign the Hoffman 1 Building, a leased installation in Alexandria, VA, by relocating the ACA E-Commerce Region HQ to FSH (Recommendation #148)

9. Realign Fort Buchanan, Puerto Rico, by relocating the ACA Southern Hemisphere Region HQ to FSH (Recommendation #148)

10. Realign Aberdeen Proving Ground, MD, by relocating the Army Environmental Center to FSH (Recommendation #148)

11. Realign Walter Reed Army Medical Center, Washington, DC, as follows:

    - Relocate enlisted histology technician training to FSH

    - Relocate the Combat Casualty Care Research subfunction (except for those organizational elements performing neuroprotection research) of the Walter Reed

Army Institute of Research (WRAIR) (Forest Glen Annex) and the Combat Casualty Care Research subfunction of the Naval Medical Research Center (Forest Glen Annex) to the Army Institute of Surgical Research, FSH (Recommendation #169)

12. Close Brooks City-Base, San Antonio, Texas, and relocate the Naval Health Research Center Electro-Magnetic Energy Detachment and the Directed Energy portion of the Human Effectiveness Directorate of the Air Force Research Laboratory to FSH (Recommendation #170)
13. Close Brooks City-Base, San Antonio, Texas, and relocate the Army Medical Research Detachment to the Army Institute of Surgical Research, FSH (Recommendation #170)
14. Realign Lackland AFB, Texas, by relocating the inpatient medical function of the 59th Medical Wing (Wilford Hall Medical Center [WHMC]) to the Brooke Army Medical Center, FSH, establishing it as the San Antonio Regional Military Medical Center, and converting WHMC into an ambulatory care center (Recommendation #172)
15. Realign Naval Air Station Great Lakes, IL; Sheppard AFB, Texas; Naval Medical Center Portsmouth, VA; and Naval Medical Center San Diego, CA, by relocating basic and specialty enlisted medical training to FSH (Recommendation #172)
16. Realign Building 42, 8901 Wisconsin Ave, Bethesda, MD, by relocating the Combat Casualty Care Research subfunction of the Naval Medical Research Center to the Army Institute of Surgical Research, FSH (Recommendation #174)
17. Realign Naval Station Great Lakes, IL, by relocating the Army Dental Research Detachment, the Air Force Dental Investigative Service, and the Naval Institute for Dental and Biomedical Research to the Army Institute of Surgical Research, FSH (Recommendation #174)

These actions will impact several of the subareas of the installation, as well as specific field training areas on Camp Bullis. Nevertheless, the concentration of new facilities will be in the four FSH mission-related subareas (Figure 2-3). The major reasons for new facility space by subarea are as follows:

- The patient care subarea due to the consolidation of the U.S. Air Force (USAF) WHMC onto the BAMC site
- The medical research, development, testing and evaluation subarea collocated with the major patient subarea due to the movement of the directed energy research function from Brooks City-Base
- The medical training subarea due to the introduction of the new student and instructor loading in the buildup of the Medical Education Training Center (METC)
- The HQ and administration subarea due to additions and changes to the Fifth Army, the Sixth Army/USARSO and the 470th MI functions

2.1.4 Force Structure

Force structure refers to the numbers, size and composition of units comprising Army forces. Table 2-1 shows the current anticipated increase in personnel relocating to FSH as a result of the BRAC and AMF actions. Table 2-2 shows the estimated population of FSH that will work at FSH after all BRAC-directed and AMF personnel actions are completed.

Table 2-1 Summary of Approximate Personnel Changes from BRAC-directed Actions at Fort Sam Houston, Texas

Section 2.1.3 Item Number	BRAC-directed Organizational Move	Military Personnel	Civilian and NAF Personnel (1)	Contractor Personnel	Total Personnel
1	ACA Southern Region HQ	1	46	0	47
2	Installation Management Functions (Manpower Savings)	Loss of 27	Loss of 52	0	Loss of 79*
3	Army HQ IMA	23	244	167	434
4	Army IMA and NETCOM Northwest Regions	3	148	25	176
5	ACFSC	29	478	15	522
6	AFLO	0	2	4	6
7	ACA HQ	1	42	7	50
8	ACA E-Commerce Region HQ	0	7	0	7
9	ACA Southern Hemisphere HQ	8	40	0	48
10	AEC	3	193	220	416
11	Walter Reed Medical Center	4 staff, 30 students	10	20	64
12	Navy Health Research Center and Directed Energy Laboratory	44	75	141	260
13	Army Medical Research Detachment	11	21	4	36
14	Inpatient Function of 59th Medical Wing	1,608	332	0	1,940
15	Navy/USAF Basic and Specialty Enlisted Medical Training	942 staff, 5,090 students	140 staff	0	6,172
16	Navy Medical Research Combat Casualty Care Research	1	3	7	11
17	Army, Navy and USAF Dental Research	35	4	3	42
Totals		**7,806**	**1,733**	**613**	**10,152**

Notes:
* Based on COBRA Data (1) NAF = Non-appropriated Fund
Sources: FSH Personnel Summary (2208305MAY06).xls, 9-15-05, and EIS Statement of Work (USACE, 2006a)

Table 2-2 Projected Daytime Population at Fort Sam Houston Resulting from BRAC and AMF Actions

	Military Personnel	**Students** (2)	**Civilian, Contractor and NAF Personnel** (1)	**Total Personnel**
Existing Population	9,921	5,842	9,365	25,128
BRAC Incoming (3)	2,686	5,120	2,346	10,152
BRAC Discretionary (4)	20	0	64	84
AMF				
470th MI BDE	405	0	0	405
Fifth Army/ARNORTH	85	0	0	85
Sixth Army/USARSO	279	0	179	458
Totals	**13,396**	**10,962**	**11,954**	**36,312**

Notes:
(1) NAF = Non-appropriated Fund.
(2) Total student numbers are given. Students were included under military personnel in Table 2-1. For classroom space planning purposes, a different metric Average Daily Student Load (ADSL) is used. ADSL is the unit of measure to calculate student space requirements. ADSL is not the same as the total number of students.
(3) From Table 2-1.
(4) Includes the ACA Southern Regional Contracting Command - East, U.S. Army Center for Health Promotion and Preventive Medicine- (USACHPPM-) South and the Borden Institute.
Sources: Fort Sam Houston Stationing.ppt (3/22/06), FSH Personnel Summary (2208305MAY06).xls and EIS (USACE, 2006a) Statement of Work

2.1.5 Facilities

Implementation of the proposed action would require renovation of existing facilities and construction of new facilities to accommodate the increase in personnel assigned to FSH. Table 2-3 identifies proposed construction projects by project number and type of facility in mission-related subareas (USACE, 2006a). As shown, the type of construction for several facilities identified for BRAC actions is currently unknown. Nevertheless, the uncertainty is assumed to have no effect on the evaluation of environmental impacts for the EIS because the approximate square footage of the structures is known, the general siting locations are known and there is no significant difference between environmental impacts of different types of structures.

Table 2-3 Proposed Construction Projects to Implement BRAC, Community Support and AMF Actions[2]

Project No.	MPLS No.	Mission (Refer to Section 2.1.3)	Facility	Type of Construction	Square Footage
64192	083561a; 083561b	Medical Training (See Items 11 and 15)	Dining Facilities (2)	New Construction	86,000 (c)
64200	083562a; 083562b		Student Dormitories 1, Phase 1		360,000 (c) each (a total of 11 dorms is planned with an aggregate 3,960,000)
64201	083563a; 083563b		Student Dormitories 1, Phase 2		
64202	083564a; 083564b		Student Dormitories 2, Phase 1		
64211			Student Dormitories 2, Phase 2		
64206	083560a; 083560b; 083560c		Medical Training Facility, Phase 1		750,000 aggregate of four instruction facilities (c)
64205			Medical Training Facility, Phase 2		
64207			Medical Training Facility, Phase 3		
64183	CYRB093570		USAF Medical Training Facility-Bullis		220,000 (c)
64210		Medical Research (See Items 13, 16 and 17)	Center for Battlefield Health and Trauma Research	Alteration and Construction	30,400 (a); 102,700 (c)
64292			Facility 2630 for U.S. Army Center for Health Promotion and Preventative Medicine, CONUS Subordinate Command South (CHPPM-South)	Alteration and Reuse	17,500 (c)
64185		Medical and Non-medical Research (See Item 12)	Tri-Service Research Facility	New Construction	206,000 (c)
64179	083580b	Patient Care (See Item 14)	BAMC Addition/Alteration 1	Alteration and Construction	515,000 (a); 454,800 (c); 481,600 (d)
64180	083580a		BAMC Addition/Alteration Garage #1		
64181	083580c		BAMC Addition/Alteration Garage #2		
64184	093565		McWethy Health Clinic	Alteration and Construction	5,300 (a); 8,000 (c)
64188	083566		FSH Clinic (Primary Care Clinic)	Demolition/ deconstruction and Construction	84,200 (c); 8,600 (d)
64189			Budge Dental Clinic	Alteration and Construction	400 (a); 2,100 (c)
64212		HQ Support (See Items 1 and 3 to 10)	Convert 2266	Alteration and Construction	115,000 (a); 23,000 (c)
64209			Vehicle Parking and Roads	New Construction	334,000 (c)
64216			Repair 2000 and 2263 to Admin	Alteration and Demolition/ deconstruction	78,600 (a); 11,600 (d)

2 For the purpose of this analysis, it is assumed that PJN 45151 and the 2nd Vehicle Maintenance Shop will be constructed.

Project No.	MPLS No.	Mission (Refer to Section 2.1.3)	Facility	Type of Construction	Square Footage
64218			Repair 2264 to Admin	Alteration and Construction	110,000 (a); 4,000 (c)
64182			Repair 2270 for Theater	Alteration	No military construction data
64290			Tractor Trailer Parking	New Construction	41,400 (c)
64580; 64220			Convert 4197 for Warehouse	Alteration	124,400 (a); 50,000 roof conversion
64221			Morale, Welfare and Recreation (MWR) Academy	Construction	30,000 (c)
67614			Repair 2001	Alteration	19,541 (c)
None			Army Audit Agency (AAA)	**Unknown**	No military construction data
65543		Community Support	Information Systems Facility	Construction	48,400 (c)
64194			Chapel Facility		17,900 (c)
64191			Enlisted Unaccompanied Personnel Housing (UPH)		32,900 (c)
56100			Physical Evaluation Board	New Construction	6,250 (c)
64174			Construct Youth Center		16,000 (c)
64214			Fire Station 1 Company		6,900 (c)
None			Pharmacy	**Unknown**	No military construction data
None		AMF	470th MI BDE Site Development	New Construction	No military construction data
65310			Fifth Army Company HQ/Special Troops Battalion (HHC CO OPS)	New Construction	22,300 (c)
45151			Vehicle Maintenance Shop–470th MI BDE	New Construction	No military construction data
66029			470th MI BDE Complex	New Construction	72,800 (c)
66063			Company Operations (CO OPS) Facilities–470th MI BDE		80,000 (c)
66729			BN Interrogation Training Center, 470th and MI BN, Camp Bullis	New Construction	20,000 (c)
66824			Battle Command Training Center, FSH	New Construction	10,000 (c)
12253			Joint Operations Center (JOC)–Fifth Army	New Construction	107,000 (c)
None			Vehicle Maintenance Shop–Sixth Army/USARSO	New Construction	No military construction data

(a) alteration
(c) construction
(d) demolition/deconstruction
Notes: The community support and AMF projects are not BRAC Commission recommendations.
MPLS No. – USAF Mail Code for Lackland AFB
Source: USACE, 2006a

2.1.6 Schedule

Under the BRAC law, the Army must initiate all realignments no later than 15 September 2007, and complete all realignments no later than 15 September 2011.[3] Implementation of the proposed action is planned to occur over a span of approximately five years. The individual project construction schedules will be set at a later date. Facility space will be synchronized to meet the needs, on a priority basis, of units being relocated from other installations. Relocation of new units is planned to occur as facility space for their operations and support becomes available. Interim space may be provided through the temporary siting and use of portable modular facilities. Interim facilities have been included in the analysis where they are expected to be used.

2.2 DEVELOPMENT OF ALTERNATIVES

2.2.1 Means to Accommodate Realigned Units

Relocation of units and establishment of new units involve ensuring that the installation has adequate physical accommodations for personnel and their operational requirements. The Army considers five means of meeting increased space requirements:

1. Use of existing facilities
2. Modernization or renovation of existing facilities
3. Leasing of off-installation facilities
4. Construction of new facilities
5. Enhanced Use Leasing (EUL)

AR 210-20, *Master Planning for Army Installations*, establishes Army policy to maximize use of existing facilities. The regulation directs that new construction will not be authorized to meet a mission that can be supported by existing, underused, adequate facilities, if the use of such facilities does not degrade operational efficiency. Under this policy, selection and use of facilities to support mission requirements adhere to the foregoing five choices in the order in which they are listed; that is, if existing facilities are adequate to accommodate requirements and, absent other overriding considerations, further examination of renovation, leasing or construction alternatives is not required. Similarly, if a combination of use of existing facilities and renovation satisfies the Army's needs, leasing or new construction need not be

[3] Section 2904(a), PL 101-510, as amended, provides that the Army must "… initiate all closures and realignments no later than two years after the date on which the President transmits a report [by the BRAC Commission] to the Congress … containing the recommendations for such closures or realignments; and … complete all such closures and realignments no later than the end of the six year period beginning on the date on which the President transmits the report. …" The President took the specified action on 15 September 2005.

addressed. New construction may proceed only when use of existing facilities, renovation, leasing or a combination of such measures is inadequate to meet mission requirements (AR 210-20).

Leasing of off-installation facilities is not a viable option based on force protection requirements; however, EUL is another option to fund projects for new construction or renovation. EUL is a term used to describe the expanded DoD out-leasing authority resulting from changes to Section 2667 of Title 10 USC, National Defense Authorization Act. The Act expanded the purposes for which lease proceeds may be used and the type of consideration that may be accepted for out-leases of military properties as configured that are not conducive to supporting current or foreseeable future military requirements. Specifically, installations can now: 1) enter into long-term leases, providing greater flexibility for facility use and reuse; and 2) receive cash or in-kind consideration for income on leased property (USACE, 1995). According to the Assistant Chief of Staff for Installation Management (ACSIM, 2004), these can be used for:

- Alteration, repair and improvement of property or facilities
- Construction or acquisition of new facilities
- Lease of facilities or lease-back of renovated EUL facilities
- Facilities operation support

This method of facility construction or renovation uses private funding to provide the needed space on the installation to the Army under a long-term lease.

Environmental impacts could result from the increased population and mission activities, as well as the short- and long-term impacts of the facility changes and operation. If an EUL alternative was pursued and would result in a significant impact to historic resources, the Army may enter into a Memorandum of Understanding (MOU) with the Texas Historical Commission (THC) to resolve those effects since the Historic Properties Component (HPC) does not apply to EUL actions. Nevertheless, the method of accomplishing the change would not significantly impact these elements.

2.2.2 Siting of New Construction

The Army considers new construction of facilities when use of existing facilities, renovation or leasing would fail to provide for adequate accommodations of realigned functions. The Army considers both general and specific siting criteria for construction of new facilities.

General siting criteria include the following:

- Consideration of the compatibility between the functions to be performed and the installation land use designation for the site
- Adequacy of the site for the function required and the proximity to related activities
- Distance from incompatible activities
- Availability and capacity of roads and utilities
- Communication network availability, speed and bandwidth
- Efficient use of property and development density
- Potential future mission requirements and special site characteristics, including environmental incompatibilities

Specific siting criteria include consideration of location of the workforce and efficient, streamlined management of functions. As opposed to dispersion, collocation of similar types of functions allows more efficient use of equipment, vehicles and other assets.

2.2.3 Other Considerations

The timing to complete the proposed realignment actions is principally affected by three factors:

- The availability of facilities to house realigned personnel and functions
- Efforts to minimize potential disruption of mission activities based on the number of personnel involved in the relocation or the amount of work to be performed
- Early realization of benefits to be gained by completion of the realignments

In addition, BRAC funds cannot be used for construction of new facilities when space for the facility footprint is created by demolition/deconstruction of existing facilities (referred to as the "No Step-on"[4] Policy). This additional siting constraint guidance was used in the development of the realignment (preferred) alternative.

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[4] An important BRAC siting consideration is the "No Step-on" Policy. The Assistant Chief of Staff for Installation Management (ACSIM) issued planning guidance in the 22 December 2005 email to installations that states that BRAC funds cannot be used for construction of new facilities when space for the building footprint is created by demolition of existing facilities. To the extent possible, FSH has complied with this policy by re-siting new facilities to avoid "stepping on" existing facilities.

2.3 PROPOSED ACTION DESCRIPTION

This section provides a quantitative description of the proposed action in terms of personnel changes, facility square footage requirements and other factors within the subareas identified in Section 2.1.2 and Figure 2-3.

2.3.1 Patient Care

Figure 2-4 shows the patient care subarea at FSH. Under the 2005 BRAC, WHMC, located on Lackland AFB (also in San Antonio), and BAMC will be consolidated into one integrated medical operation, the San Antonio Military Medical Center (SAMMC), with two campuses: a north campus at FSH (SAMMC-N) and a south campus at Lackland AFB (SAMMC-S). All of the inpatient beds, trauma services and surgeries will be consolidated at FSH. An outpatient clinic with diagnostic services and an ambulatory care center will be developed at WHMC (HEERY International, Inc., 2005a, 2005b, 2005c).

Renovations to BAMC are required to meet Joint Commission on Accreditation of Healthcare Organizations requirements for standard of care for the obstetrics/gynecology, pediatric and other inpatient missions that are not currently located at SAMMC-N. BAMC is currently running at maximum capacity. Additional intensive care wards must be outfitted to meet the growing trauma mission requirements. The existing emergency room needs to be redesigned and expanded to a capacity of 50,000 patient visits per year and 2,500 trauma resuscitations per year, which will require approximately 150,000 square feet (sf) of expansion of the current facilities (Riley, 2006). BAMC will continue to accept medical evacuation (MEDEVAC) patients and to provide Level 1 trauma support to the San Antonio metropolitan area. The Transfusion Medicine workload is expected to double from the current level. In addition to the proportional expansion of staff to care for the larger population, the establishment of SAMMC-N will require distribution of 785 officers, 823 enlisted and 332 civilians, for a total of 1,940 additional medical personnel at BAMC (Wingler Sharp Architects & Planners, Inc., and CUH2A Architecture, Engineering, Planning [Wingler and CUH2A], 2006).

SAMMC-N is projected to require an estimated 460,000 sf of additional administrative and hospital space for the expansion of the emergency room needed to accommodate the consolidated trauma mission and bed realignment. Bed capacity at SAMMC-N will expand from 220 to 425 beds for inpatient care.

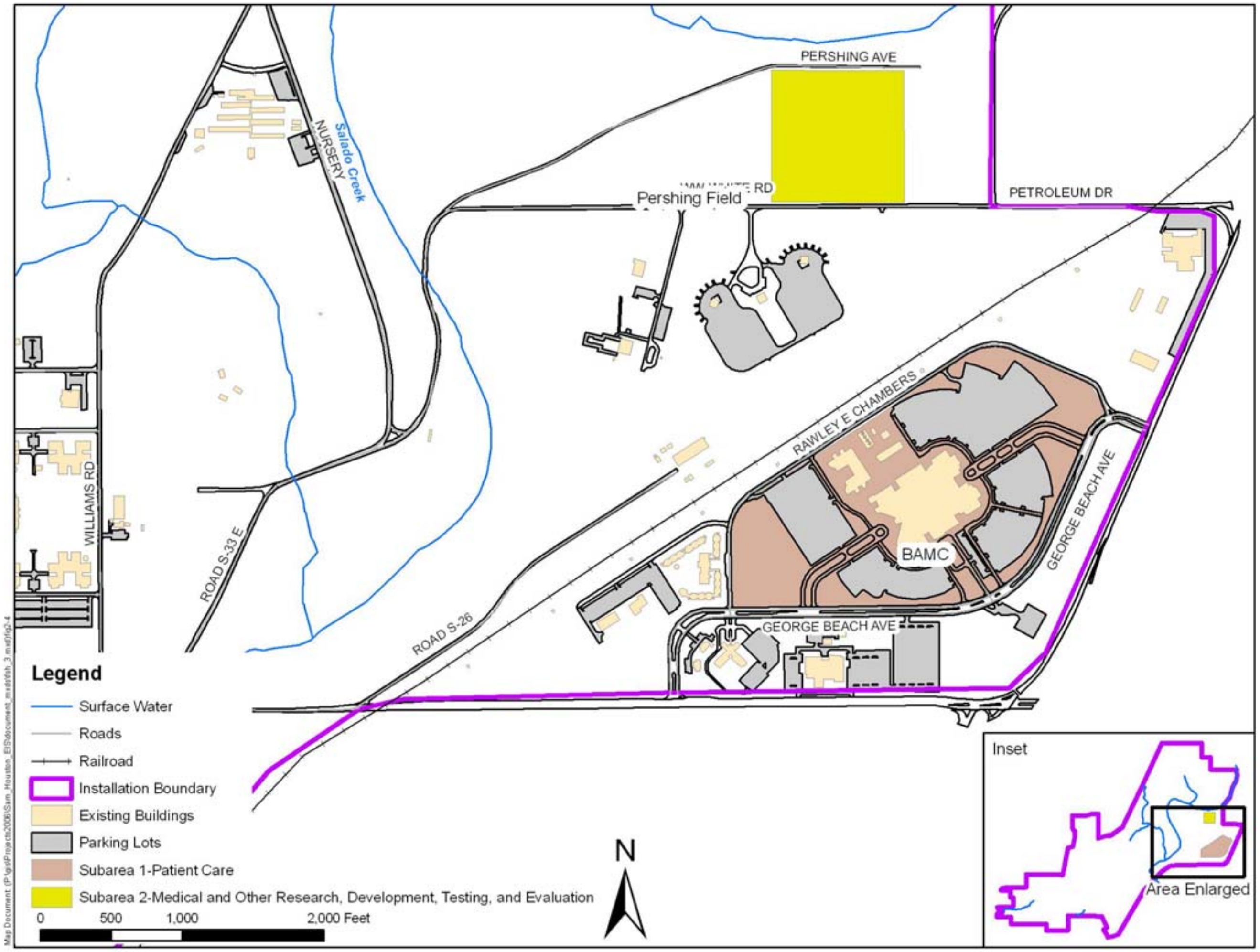

Figure 2-4 Subareas 1 and 2 – Patient Care and Medical and Other Research, Development and Testing Subareas at Fort Sam Houston, Texas

Implementation of the BRAC recommendations will result in a projected increase of 2,738 active duty personnel (excluding students) and 5,717 active duty family members. This influx of population exceeds the existing capacity of BAMC and the outpatient clinics at FSH. Without expansion of these medical facilities and the healthcare staff, the eligible service population would not receive adequate healthcare. Without expansion, the patient workload that exceeds the capacity of available facilities would have to be diverted to the local civilian health network. This may not be feasible, may not be economically advantageous to DoD and/or may not comply with current TRICARE beneficiary access standards. TRICARE is the managed healthcare program for DoD beneficiaries. A total of 134,000 TRICARE enrollees have chosen various San Antonio military treatment facilities, including BAMC and WHMC. Outpatient medical care at FSH is currently split between the Family Medicine clinic at BAMC, the McWethy Clinic and the clinic at Camp Bullis (HEERY International, Inc., 2005).

The existing McWethy Clinic is very crowded, with an annual patient load of 9,000 in a 30,000-sf facility that provides optometry, pharmacy, physical therapy, medical records, X-ray, primary care, Army Substance Abuse Programs and behavioral health services. The current Family Medicine clinic inside BAMC provides primary care services such as pediatrics, physical therapy, clinical laboratory, radiology and a pharmacy. The 21,724-sf clinic has an annual patient load of approximately 20,000. The available space in this clinic is inadequate to accommodate the increased service population. The estimated additional area needed for the dental clinic, family clinic and troop clinic expansion is 94,000 sf (HEERY International, Inc., 2005c).

New or refurbished dental facilities are needed to bring 1970s-era facilities up to 21st century standards. The BRAC actions will require an additional 2,465 sf of dental facilities and a pharmacy to support the increased student population of the joint METC. Five additional dental treatment rooms and associated support space are needed in the Budge Dental Clinic (HEERY International, Inc., 2005b).

2.3.2 Medical and Other Research, Development, Testing and Evaluation

Figure 2-4 shows the medical and other research, development, testing and evaluation (RDTE) subarea at FSH. Medical research that occurs at BAMC includes the Department of Clinical Investigations (DCI) and the ISR. The BAMC DCI is responsible for all human research regulatory requirements for the BAMC ISR. The ISR completes all regulatory animal research protocol requirements for both BAMC and the ISR, while BAMC uses the animal laboratories to train physicians in invasive procedures. ISR laboratories, offices and vivarium for holding large and small animals are currently housed in a two-story structure (Wingler Sharp Architects & Planners, Inc., and CUH2A Architecture, Engineering, Planning, 2006).

As a component of BRAC, a new Joint Center of Excellence for Battlefield Health and Trauma will be established at the ISR. The following groups, which are relocating to FSH to create this new Center of Excellence, will require 154,800 sf for medical research laboratories in addition to the current medical research laboratory space:

- WRAIR Combat Casualty Care – 98 staff requiring approximately 31,000 sf
- Navy Combat Casualty Care – 40 staff requiring approximately 12,400 sf
- Army Dental Great Lakes – 42 staff requiring approximately 19,600 sf
- Navy Dental Great Lakes – 38 staff requiring approximately 11,900 sf
- USAF Dental Great Lakes – 11 staff requiring approximately 5,300 sf
- Army Medical Research Detachment Brooks City-Base – 36 staff requiring approximately 17,800 sf (Wingler and CUH2A, 2006)

Additional vivaria (places for keeping and raising living animals and plants under natural conditions for observation or research) would be required to support medical research since the current one is not large enough. The requirement for use of large animals, such as sheep and swine, would effectively double the current large animal population at the ISR. A non-human primate (NHP) component of research from Brooks City-Base would be moved to the ISR. For EIS analysis purposes, it will be assumed that the NHP research component is coming to the ISR. The ISR does not currently house NHPs. Space is required to house sufficiently a 242-staff increase, Bio-safety Level (BSL) 2 laboratories, administrative offices and office support space. A BSL 2 laboratory is a secure, normal hospital laboratory where there is controlled access.

Vibration-sensitive equipment placed on an isolated slab will be required to support the NHP program research. Based on the current mission at the Naval Medical Research Center, Radiation Combat Injury Department, a Nuclear Regulatory Commission (NRC) license for special nuclear material may be required. For EIS analysis purposes, it will be assumed that the NRC license is required. Current accreditations will be maintained, including the Association for Assessment and Accreditation of Laboratory Animal Care International, College of American Pathologists (CAP) and Clinical Laboratory Improvement Program (CLIP).

The Army-, USAF- and Navy-directed energy bio-effects research activities will be located at the Center of Excellence for Battlefield Health and Trauma. These research activities are undertaken to determine the medical hazards of laser radiation and to characterize the effects of non-ionizing radiation emitted by military systems on Soldier performance; to determine medical triage and treatment of laser-induced injuries; and to ensure the protection and sustainment of Soldier health and safety in training, combat and special operations.

Complex interdisciplinary research to be conducted at FSH on health and safety aspects of radio frequency, laser and combined stressors will require additional physical and medical and non-medical research laboratory and animal holding space. This research is to be accomplished at a new Tri-Service Research facility containing electromagnetic energy and directed energy laboratories that will be constructed. A 440-meter outdoor laser range will be established, as well as a stationary aircraft test site. An increase of approximately 320 staff will work inside this facility.

CHPPM-South will be relocated due to the closure of Fort McPherson, GA (FSH, 16 August 2006). The new CHPPM-South will require laboratories, administrative and support space to house entomological, environmental health engineering, field preventive medicine, industrial hygiene and health promotion departments.

2.3.3 Medical Training

Figure 2-5 shows the medical training subarea at FSH. At present, FSH is the largest military medical training facility in the world. The Army Medical Department Center and School (AMEDDC&S) is an institution that annually trains students attending 170 officer, non-commissioned officer (NCO) and enlisted courses. Currently, 35 graduate medical education programs, including 170 courses spanning 14 specialties, exist at FSH.

BRAC for 2005 recommends the consolidation of the Army, Navy and USAF enlisted medical training into an METC at FSH. The BRAC report prepared by the BRAC Commission proposes relocation of medical training programs from the following locations:

- Sheppard AFB, Texas
- Naval Medical Center Portsmouth, VA
- NAS Great Lakes, MI
- Naval Medical Center San Diego, CA
- Walter Reed Army Medical Center, Washington, DC

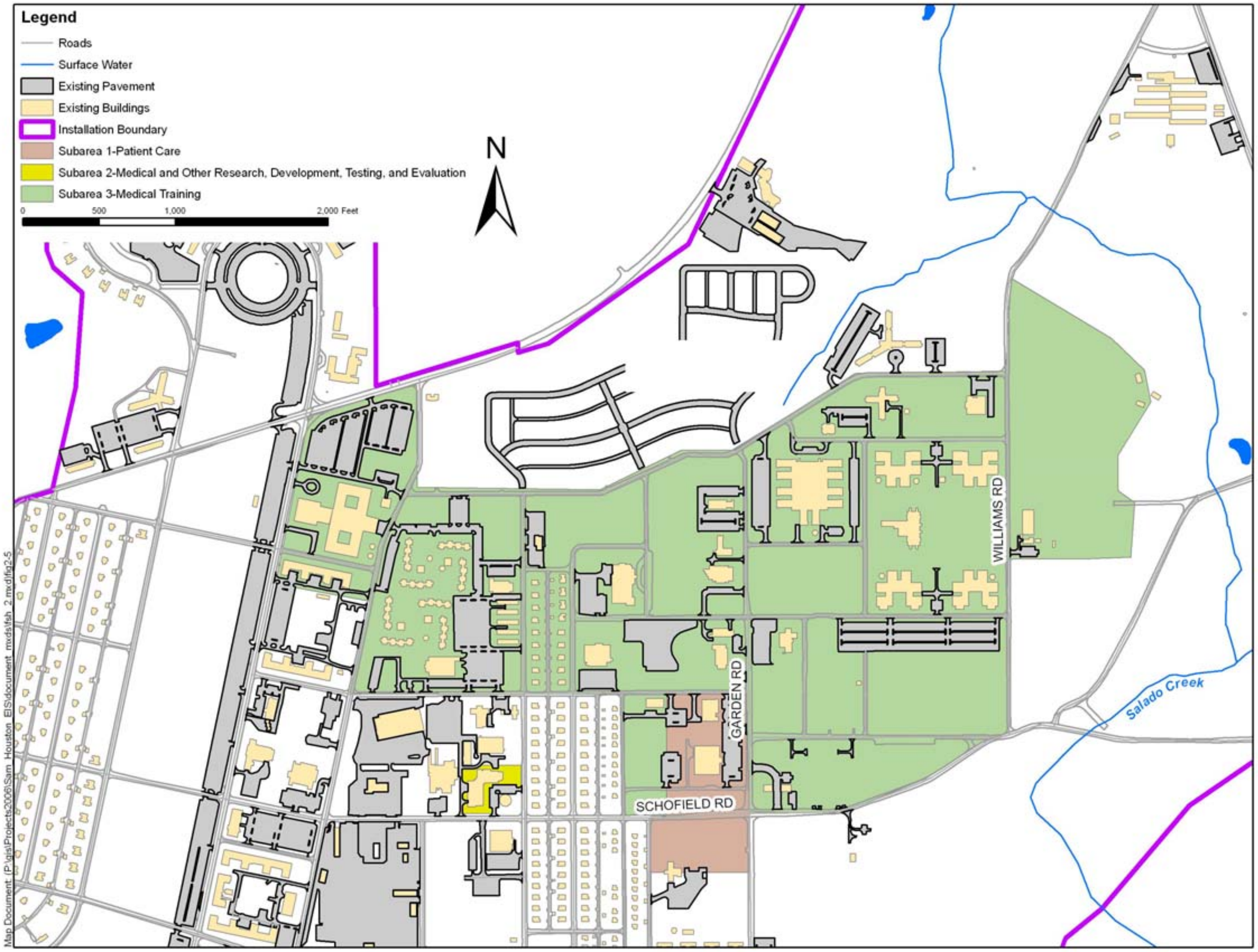

Figure 2-5 Subarea 3 – Medical Training Subarea at Fort Sam Houston, Texas

The METC will educate and train a diverse student population, including enlisted and officer personnel from USAF, the Navy and the Army. Programs of instruction will be tailored to meet the needs of this diverse group of students. Service schools traditionally educate this diverse population with extensive hands-on training using specialized equipment. Instructional programs are often required to train highly variable student loads due to changing manpower requirements within the military force structure. Such fluctuations in student loads are difficult to predict and often occur with little advance notice. In addition, emergency mobilization leads to a sudden and substantial increase in student and required staff populations. This can put extreme demands on both the service school staff and its facilities. These characteristics collectively differentiate service schools from civilian institutions (USACE, 2006b).

When BRAC is completed in September 2011, the METC will experience an ADSL of 9,003 students. The METC will require 3,600 faculty and administrative personnel. The typical length of stay for students will be one to two weeks. Currently, the METC has 1,900 faculty and administrative personnel and an ADSL of 4,965.

The AMEDDC&S contains 44 facilities with an aggregate area of 1.8 million sf, including over 720,000 sf of training/classroom space and 620,000 sf of UPH space. The BRAC METC Planning Team estimated the total additional facility space required for instructional space to be 750,000 sf.

Facilities currently in place at the AMEDDC&S include two physical fitness centers, two exchange service centers, an open dining facility, a recreation center and a library. Additional support facilities needed for the METC include student dormitories, enlisted UPH, a chapel and Post Exchange (PX) space (USACE, 2006b).

"Field" portions of medical training at FSH are conducted at Camp Bullis, located approximately 20 miles northwest of FSH. To support DoD medical training requirements at SAMMC-N, an additional medical training facility at Camp Bullis is needed to support the following seven medical readiness courses that are relocating from Sheppard AFB:

- Aeromedical Evacuation Contingency Operations Training (AECOT)
- Expeditionary Medical Readiness Course (EMRC)
- Contingency Counterterrorism Casualty Decontamination Course (DECON)
- Expeditionary Medical Support (EMEDS)
- Contingency Aeromedical Staging Facility (CASF)
- Expeditionary Sustainment Training to Advance Readiness Skills (ESTARS)
- Medical Readiness Planners Course (MRPC) (USAF, 2005)

Accommodation of all seven medical readiness courses requires:

- 21,700 sf of field training classrooms
- 10,000 sf of administrative offices
- 25,000 sf of warehouse space
- A 5,500-sf medical equipment repair shop
- A training aids center
- A 1,000-sf live tissue laboratory/moulage
- A 17,615-sf area for tent pads
- A craftsman's course (*Military Construction Project Data [Form 1391] for Projects in the EIS Scope of Work*, various dates) is a separate course not included or affiliated with the medical readiness training that will be conducted by Randolph AFB. This course is part of the Ground Security Forces training already conducted on Camp Bullis and will simply share land with the proposed site, but it is being analyzed as part of this EIS because of its collocation with the medical training facility.

2.3.4 HQ and Administrative Support

Figure 2-6 shows the HQ and administrative subarea at FSH. Under the BRAC Commission recommendations, FSH is acquiring new HQ and administrative support functions of ACSIM field operating agencies in addition to other existing AMF command and administrative missions, including:

- ACA HQ, ACA E-Commerce Region HQ, ACA Southern Region HQ and ACA Southern Hemisphere Region HQ
- ACA-Southern Region Contracting Command (SRCC) East
- Army IMA HQ
- Combining the IMA Northwest Region with the Southwest IMA Region to form the IMA Western Region
- Combining the NETCOM Northwest Region with the NETCOM Southwest Region to form the NETCOM Western Region
- AEC
- ACFSC Academy, Entertainment Division and Trial Camp Support Activity
- AFLO
- AAA Field Office

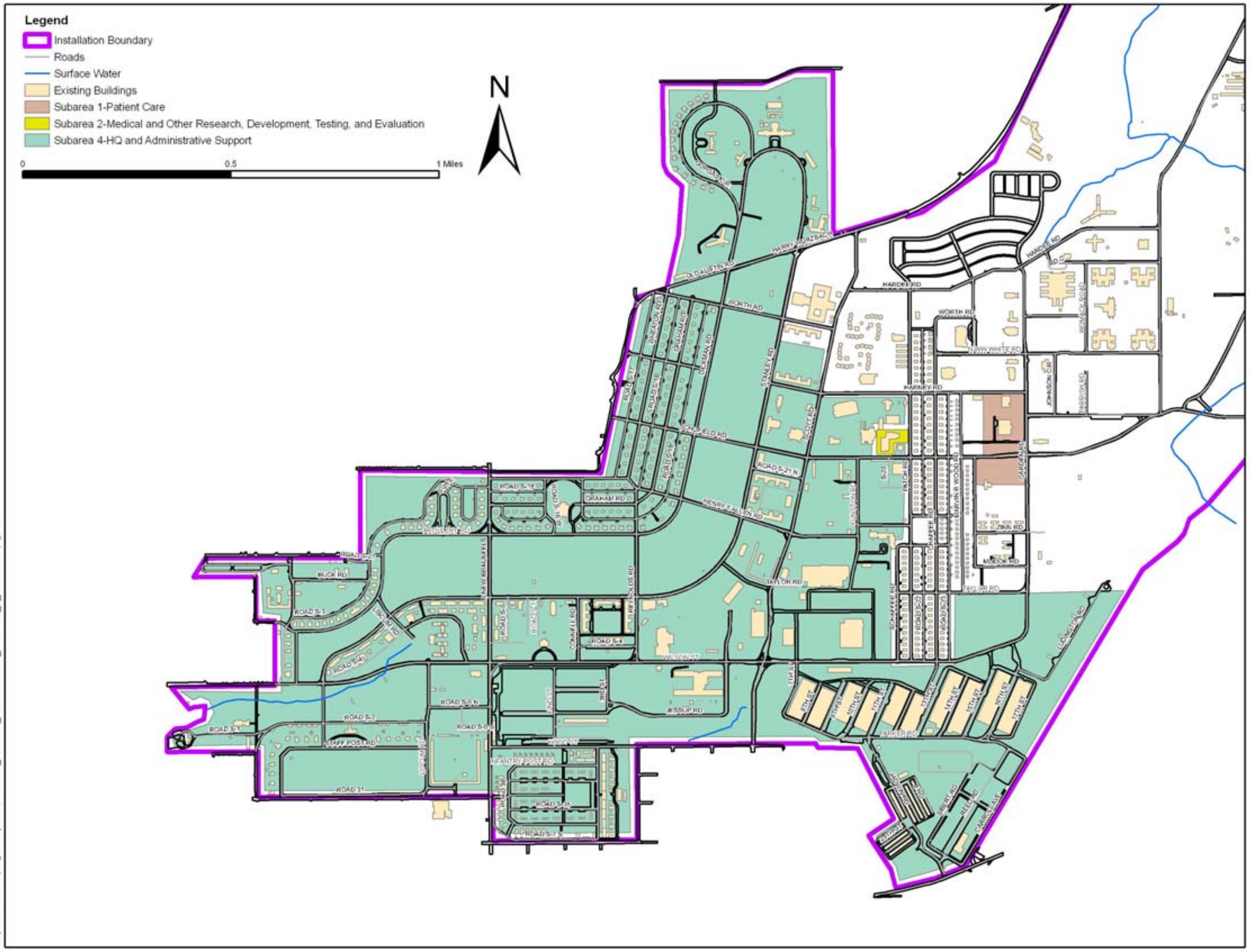

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Figure 2-6 Subarea 4 – Headquarters and Administrative Subarea at Fort Sam Houston, Texas

ACSIM Field Operating Agencies

An estimated 1,550 personnel from the IMA HQ and ACSIM field operating agencies (ACFSC, AEC, NETCOM, ACA and AFLO) will relocate to FSH. An estimated 241,000 sf of administrative space is required to accommodate the move (*BRAC Master Plan Elements Briefing* [FSH, n.d.]). The ACFSC will also require warehouse space, tractor-trailer parking space and theater space. NETCOM and the AAA Field Office will require space to accommodate an increase of up to 27 and 34 personnel, respectively (Schlatter, 2006b).

Army Modular Force

AMF units, including the 470th MI BDE, the Fifth Army/ARNORTH and the Sixth Army/USARSO, have already begun moving to FSH and have occupied existing facilities. The NEPA environmental analysis has already been completed for these moves (Schlatter, 2006a). Nevertheless, the AMF units are included in this EIS because these units now need to be integrated permanently into the existing and projected future facilities and infrastructure along with the large volumes of BRAC personnel who will be relocating to FSH. Parts or all of the AMF units may have to be relocated into existing facilities or into new facilities. Therefore, it is appropriate to analyze the environmental effects of AMF actions to be conducted by Army organizations included in this EIS. They are included in the HQ and administrative support subarea because they generally fall in this category with some industrial requirements that are included in the analysis as described in Sections 3.3 and 3.4.

470th MI BDE. This unit provides theater intelligence for the Intelligence Security Command and currently has 405 personnel at FSH. Current projected staffing levels for 2010 are 695 Active Component personnel and 80 Reserve Component personnel. The staffing increase is expected to occur in incremental phases. Full staffing is expected in the 2012 to 2015 timeframe. For EIS purposes, the full staffing level will be used. Immediate (pre-BRAC) space needs will be met through the use of portable relocatable facilities and/or reuse of existing facilities.

The 470th MI BDE requires:

- A General Purpose Administration Facility (60,000 sf) and BDE, BN and company headquarters (CO HQ) facilities (64,500 sf)
- A vehicle maintenance shop and a unit storage facility (25,000 sf)
- A parking area for up to 200 vehicles and an organizational classroom (4,500 sf)
- A UPH Enlisted Facility (50,000 sf)
- A BN interrogation range

Fifth Army/ARNORTH. The HQ, Fifth Army, which provides Active Component support to the U.S. Army Reserves, will be inactivated, and many of its assets will be transitioned to Fifth Army/ARNORTH. Fifth Army/ARNORTH will become the "new" Fifth Army and will provide command and control, planning and support for Army and Land Components Homeland Defense (HLD) and Defense Support to Civil Authorities (DSCA) operations in the Northern Command area of responsibility. In 2006, the functional transition from the Fifth Army to Fifth Army/ARNORTH will begin. In 2007, Fifth Army/ARNORTH will achieve Full Operating Capability (FOC) at a total personnel authorization of 511 (215 military, 283 civilian and 13 contractor positions), of which 420 will be located on FSH (172 military and 248 civilian). Currently, the Fifth Army has 335 personnel at FSH.

Fifth Army/ARNORTH currently occupies Facilities 16 and 258, Portable Relocatable Buildings 1 to 5 (behind Facility 16) and a portion of Facility 44. At full operating capacity, Fifth Army/ARNORTH will require:

- Approximately 23,000 sf of space for a CO HQ Facility in which administrative and supply activities (such as unit supply nuclear, biological and chemical [NBC] storage; communication storage; unit training space; and weapons storage) will be performed
- A 2,250-square-yard (sy) hardstand area for securing 30 commercial-sized vehicles
- A 19,000-sf area for administrative space and miscellaneous requirements
- 16,000 sf of warehouse space for equipment
- Contingency lodging for HLD and DSCA activities during crisis events such as large hurricanes; it is assumed for the EIS that a maximum 50,000 sf will be required (AR 5-10, *Decision Package for ARNORTH*)

No additional land is required to support Fifth Army/ARNORTH unit training at FSH. The Army recently completed a comprehensive environmental analysis for Camp Bullis to evaluate the environmental impacts of increased training activity. This analysis was documented in the *Final Environmental Assessment of Current and Proposed Mission Activities at Camp Bullis, Bexar and Comal Counties, Texas* (Mission EA). This comprehensive analysis of increased training encompasses the type of training that Fifth Army/ARNORTH could schedule at Camp Bullis (U.S. Army, 2006).

The Camp Bullis Mission EA analyzed the environmental impacts of continuing to use Camp Bullis for field training of DoD personnel at a more intense level to fulfill the needs resulting from the demands of the Global War on Terrorism (GWOT) and realignment of missions, forces and installations to better prepare DoD for future conflicts. The Mission EA analyzed the proposal to authorize use of facilities at

Camp Bullis to increase up to 1 million man-days annually from the 2004 baseline of approximately 750,000 man-days of training (U.S. Army, 2006).

The training activities included classroom and training site "mockup," non-tactical training for tenant units, tactical field maneuver areas and other outdoor training areas. The Fifth Army/ARNORTH activities would fit under the activities assessed in the Mission EA. The CEQ regulations provide for tiering of environmental analyses and previous decisions that are relevant to a subsequent action in order to avoid unnecessary duplication. The Fifth Army/ARNORTH training activities would potentially increase the training activity at Camp Bullis to a level that is within the scope of the previously completed analyses. No new or diverted land requirements will be needed to support Fifth Army/ARNORTH unit training at Camp Bullis.

Sixth Army/USARSO. Effective 15 July 2008, Sixth Army/USARSO will be inactivated. The personnel and equipment currently assigned to Sixth Army/USARSO will be reassigned to the HQ, Sixth Army/USARSO. The total number of civilian and military personnel in the HQ will increase from the current 420 Sixth Army/USARSO authorization to 810. This conversion will increase the civilian and military authorizations at FSH by 179 and 279, respectively. Sixth Army/USARSO currently occupies Facilities 1000 and 4191 and Warehouse Bays C and D (*HQ Sixth Army Support Requirements Summary [Stationing Package]*, n.d.).

To achieve the Initial Operating Capability by October 2008, the Sixth Army/USARSO will require an additional maintenance facility, an HHC CO OPS building and 51,000 sf of additional administrative space at FSH. The HHC CO OPS facility will require sufficient space for administrative and supply activities, unit supply, NBC storage, communication storage, unit training and weapons storage (*HQ Sixth Army Support Requirements Summary [Stationing Package]*, n.d.).

The maintenance facility (motor pool) area requirement is 7,500 sf. Approximately 23,000 sf is needed for the HHC CO OPS building. A 16,500-sy fenced-in, lighted, hardstand area with overhead cover will be required to secure 120 high-mobility, multi-wheeled-vehicle- (HMMWV-) sized vehicles and trailers (*HQ Sixth Army Support Requirements Summary [Stationing Package]*, n.d.).

Camp Bullis can support all training requirements for the Sixth Army/USARSO. No additional land at FSH will be needed to support Sixth Army/USARSO unit training. The comprehensive analysis of increased training documented in the Camp Bullis Mission EA encompasses the type of training that the Sixth Army/USARSO could schedule at Camp Bullis. The Sixth Army/USARSO training activities potentially would increase the training activity at Camp Bullis to a level that is within the scope of the previously completed analyses. Section 4.0 incorporates the findings of the Camp Bullis Mission EA as appropriate to discuss the effects of training by the Sixth Army/USARSO at Camp Bullis.

2.3.5 Community Facilities

In 2005, the management and ownership of Army family housing at FSH were transferred to the FSH Family Housing, Limited Partnership, under the Residential Communities Initiative (RCI). The DA and Lincoln Military Housing are members of this partnership. In September 2003, a Housing Market Analysis (HMA) determined a need for an additional 409 new houses with a total of 1,334 units. Nevertheless, DA provided guidance in May 2004 that the current inventory of 925 units would be maintained (based on an HMA audit) (*Fort Sam Houston Family Housing, LP, Community Development Management Plan, Vol. 1* [FSHFH], n.d.).

The Community Development Management Plan (CDMP) for the RCI includes a five-year initial development period that calls for demolition/deconstruction and replacement of 181 homes in Harris Heights, and major and minor renovations of 684 homes, including 386 historic homes (FSHFH, n.d.). The demolition/deconstruction of Harris Heights is complete. In accordance with the DA guidance to maintain and not expand the current family housing inventory on FSH, the provision of additional on-installation family housing to support BRAC actions is not contemplated. The proposed action will assume that all family housing requirements will be met by absorption into the San Antonio area residential market.

3.0 DESCRIPTION OF ALTERNATIVES

3.1 INTRODUCTION

A bedrock principle of NEPA is that an agency should consider reasonable alternatives to a proposed action. Considering alternatives helps avoid unnecessary impacts and allows analysis of reasonable ways to achieve the stated purpose. To warrant detailed evaluation, an alternative must be reasonable. To be considered reasonable, an alternative must be "ready" for decision making (any necessary preceding events having taken place), affordable, capable of implementation and satisfactory with respect to meeting the purpose of and need for the action. The previous discussions in Sections 2.1.2 and 2.3.1 indicated that additional development on FSH is extremely limited due to existing facilities and site constraints such as floodplains, historic properties and security considerations. These existing conditions effectively eliminated the possibility of generating detailed siting alternatives to the realignment (preferred) alternative that would still meet mission requirements and could be developed physically. Nevertheless, a limited number of minor siting variations within the realignment alternative that were not eliminated from consideration are described below and are also evaluated in this document. This section also describes the no action alternative.

3.2 NO ACTION ALTERNATIVE

The BRAC legislation precludes the decision maker from actually selecting the no action alternative; however, the CEQ regulations require inclusion of the no action alternative for BRAC-directed actions. The no action alternative serves as a baseline against which the impacts of the proposed action and alternatives can be evaluated.

Under the no action alternative, FSH would not implement the proposed action. Organizations currently assigned to FSH would continue to train at and operate from the installation. FSH would use its current inventory of facilities, though routine replacement or renovation actions could occur through normal military maintenance and construction procedures as circumstances independently warrant. Characteristics of the baseline conditions, population and other salient features are covered in Section 4.0. Section 4.0 also reflects the affected environment, as well as the conditions that would prevail under no action. The no action alternative is evaluated for environmental impacts at the same level of detail as the preferred alternatives in this EIS.

3.3 REALIGNMENT (PREFERRED) ALTERNATIVE

Given that the decision to relocate to FSH has already been made, the physical layout of existing facilities and FSH's tight siting restrictions, the preferred alternative is the only feasible alternative that is available. Section 3.4 is a composite of potential minor siting variations under the preferred alternative.

The Army's realignment (preferred) alternative would consist of additional facilities for the following subareas: 1) patient care; 2) medical and other RDTE; 3) medical training; and 4) HQ and administrative. Furthermore, community facilities would be located in the HQ and administrative subarea. The locations of these facilities are summarized in Table 3-1 and described in detail in Sections 3.3.1 through 3.3.5.

Table 3-1 Location of Proposed BRAC Facilities
(Individual Projects for Each Mission-related Subarea are Shown in Table 2-3)

Mission-related Subarea	Location
Patient Care	• Additional inpatient facilities would be located within the existing BAMC campus (Figure 3-1). • All BAMC outpatient facilities would be located at the locations shown in Figure 3-2. • Pharmacy (Figure 3-3).
Medical and Other RDTE	• All medical research activities of the Center of Excellence for Battlefield Health and Trauma would be located in an existing space in Facility 3611 and constructed new facilities, as shown in Figure 3-1. • Medical and non-medical research activities of the Tri-Service Research facility would be on Pershing Field across from the BAMC campus, as shown in Figure 3-1. • A 440-meter laser range would be added along the north side of Pershing Field. • CHPPM-South would be placed in Facility 2630 after its renovation (Figure 3-2). • A bridge would be constructed over Salado Creek, connecting Nursery Road and W.W. White Road. The bridge construction is part of the Tri-Service Research facility Military Construction Army (MCA) Project 64185.
Medical Training	• Additional METC facilities would be located within the AMEDDC&S campus (Figure 3-2). Five existing barracks facilities between Koehler and W.W. White Roads potentially would be reused. • An additional medical training facility at Camp Bullis would be constructed at the location shown in Figure 3-4. • The following roads may be removed: Johnson Circle, Forage Avenue and Parish, Binz-Engleman, Williams, W.W. White, McGee, Womack, Koehler, Worth and Murphy.
HQ and Administration	• AEC; HQ IMA; NETCOM; ACA; and, if possible, the 470th MI BDE would be assigned the use of Facilities 2263, 2264 and 2266 (South Beach) after their renovation (Figure 3-3). • The ACFSC Entertainment Division would use warehouse space in Facility 4197, new trailer parking space and Facility 2270 (Figure 3-3).

Mission-related Subarea	Location
	• Use of Facilities 16, 44, 258 and 4168 and temporary locatable facilities adjacent to Facility 16 by the Fifth Army would continue. Facility 258 would be converted to a CO OPS facility (Figure 3-3). • If the 470th MI BDE administrative space requirements cannot be accommodated at South Beach, 17 additional portable relocatable facilities would be needed. • The Sixth Army/USARSO would continue to use Facilities 1000 and 4191, and require additional administrative space that will be available in the future in Facility 1000. Portable relocatable facilities may be used until the additional space is available in Facility 1000 (Figure 3-3). • The 470th MI BDE, Fifth Army and Sixth Army/USARSO will have separate motor facilities, collocated in the industrial area (Figure 3-3). • An information systems facility would be constructed. • An MWR Academy would be constructed. • A BN interrogation range would be constructed at Camp Bullis (Figure 3-4).
Community Facilities (Included in HQ and Administration Subarea)	• The Chapel, Youth Center, Shoppette and Main Exchange would be located at sites shown in Figure 3-3.

3.3.1 Patient Care Locations

Additional patient care facilities would be located as shown in Figures 3-1, 3-2 and 3-3. As shown in Figure 3-1, all inpatient facilities would be accommodated by renovating approximately 515,000 sf of existing space within BAMC and constructing the following additions:

- An administrative addition (approximately 305,532 sf)
- An emergency room and bed tower addition of approximately 149,237 sf
- A 5,370-sf ambulance garage
- A 194,500-sf parking garage to accommodate 2,500 to 5,000 vehicles (*Military Construction Project Data [Form 1391] for Projects in the EIS Scope of Work,* various dates).

Outpatient facilities shown in Figure 3-2 would be accommodated through the following actions:

- A new FSH Soldier Family Clinic would be constructed south of the METC along Schofield Road and west of Garden Road.
- The existing McWethy Clinic, located north of Schofield Road and west of Garden Road, would be expanded and altered. An addition of 8,000 sf would be made, and an area of over 5,300 sf would be altered (HEERY International, Inc., 2005c).
- The existing Budge Dental Clinic, on the south side of Harney Road west of Garden Road, would be expanded and altered. An addition of approximately 2,100 sf would be made along with alteration of over 400 sf (HEERY International, Inc., 2005b).
- A pharmacy as shown in Figure 3-3.

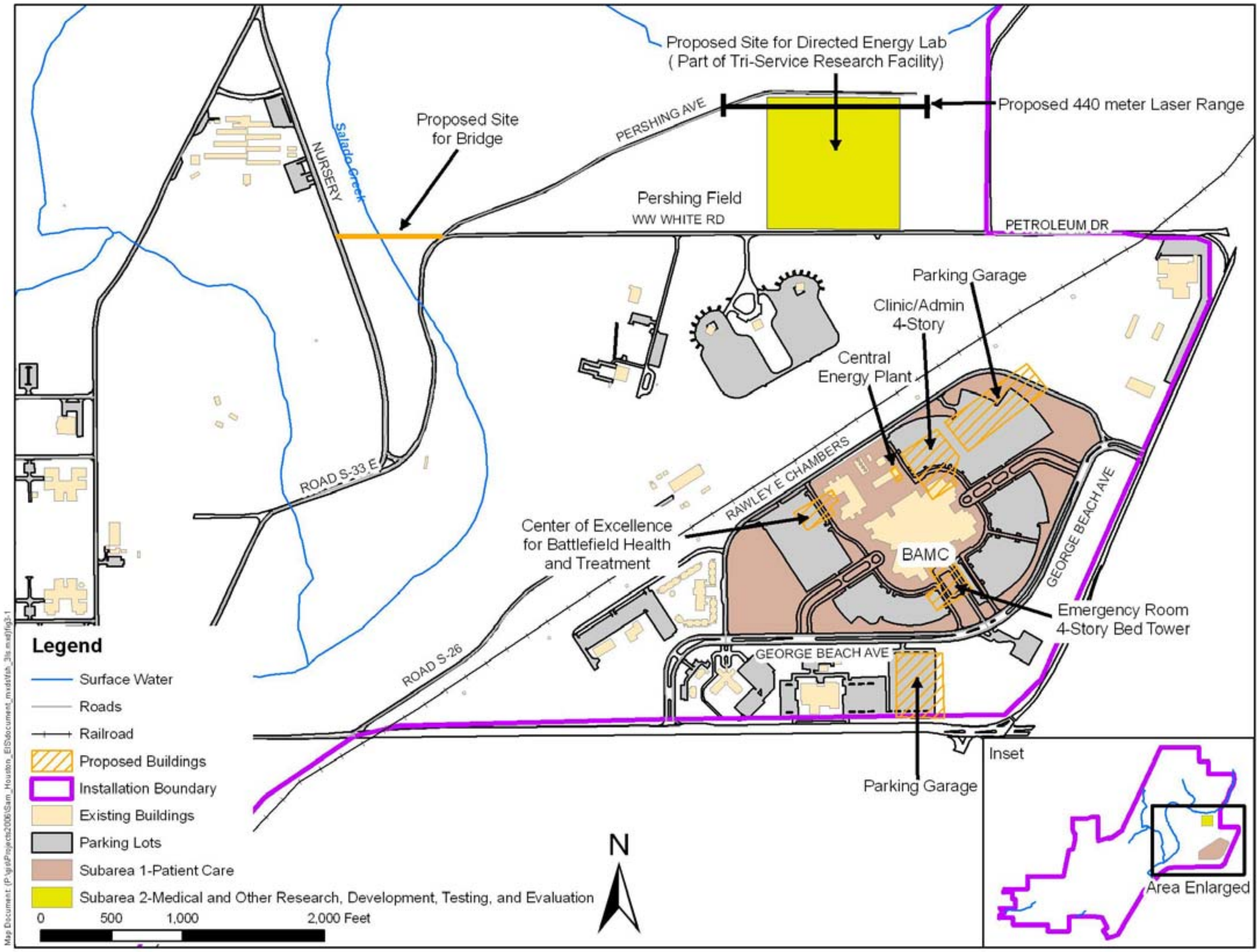


Figure 3-1 Proposed BRAC Patient Care, Medical and Other Research, Development, Testing and Evaluation Locations, Fort Sam Houston, Texas

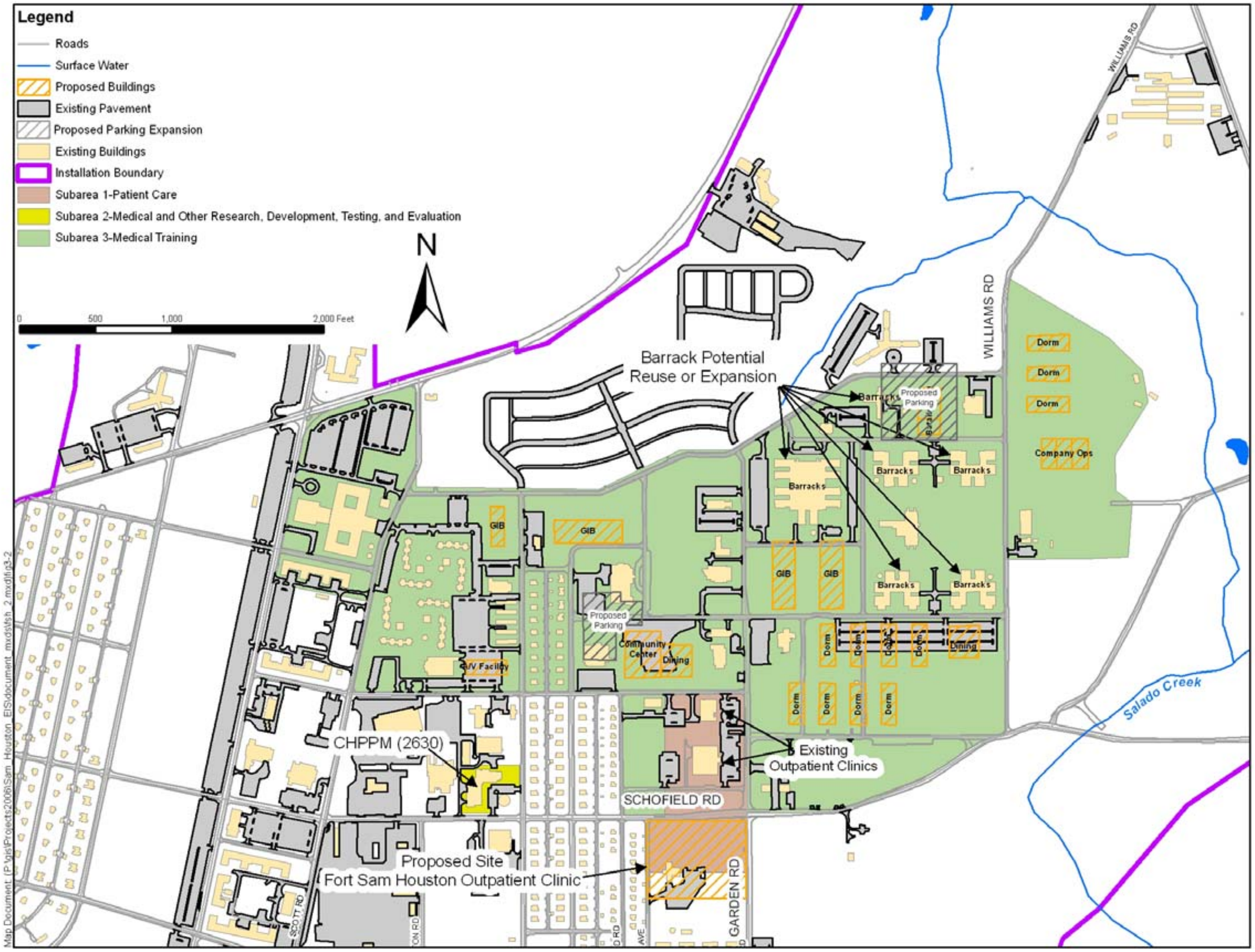


Figure 3-2 Proposed BRAC Medical Training Area Locations, Fort Sam Houston, Texas

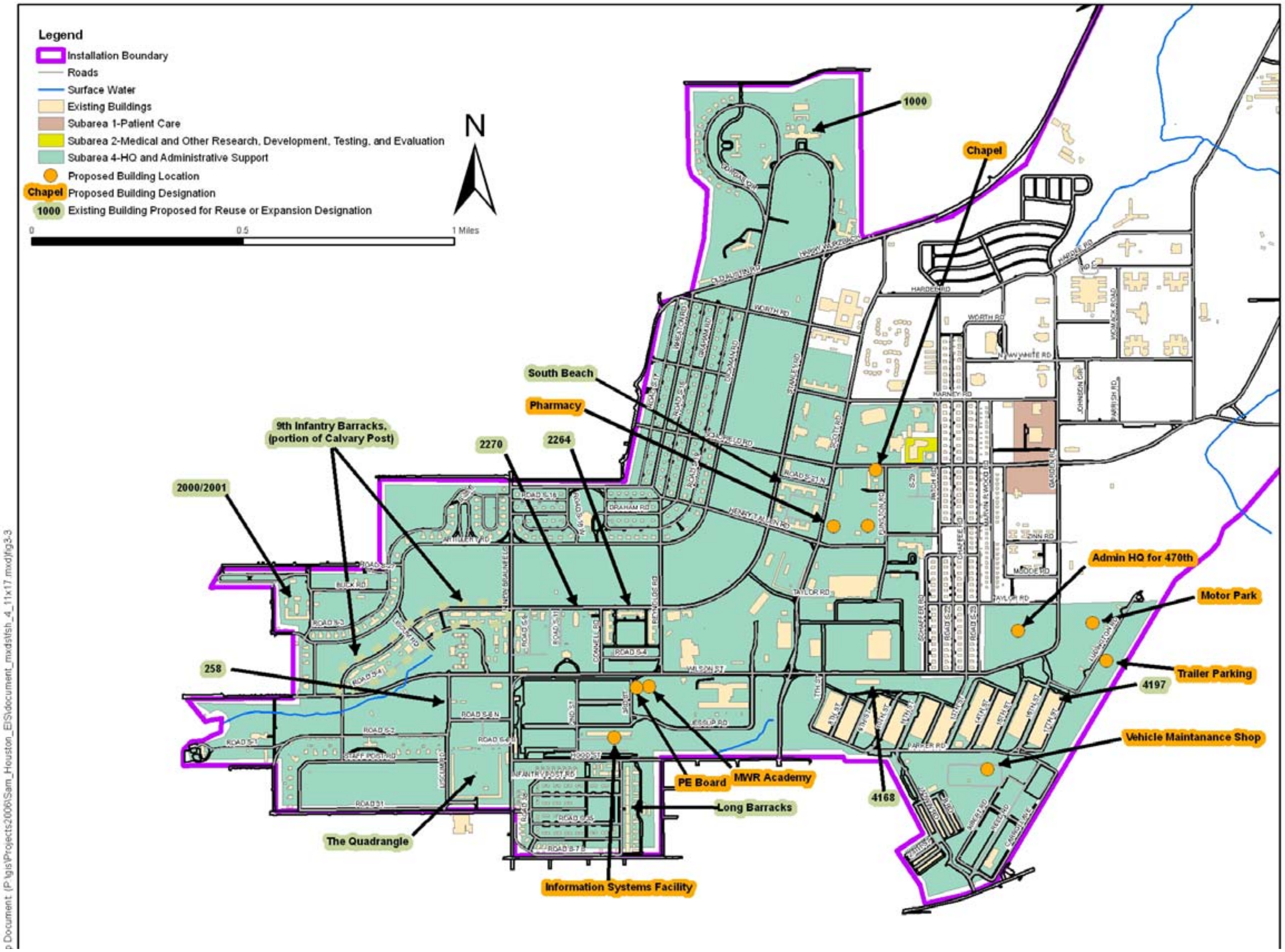


Figure 3-3 Proposed BRAC Headquarters and Administration Locations, Fort Sam Houston, Texas

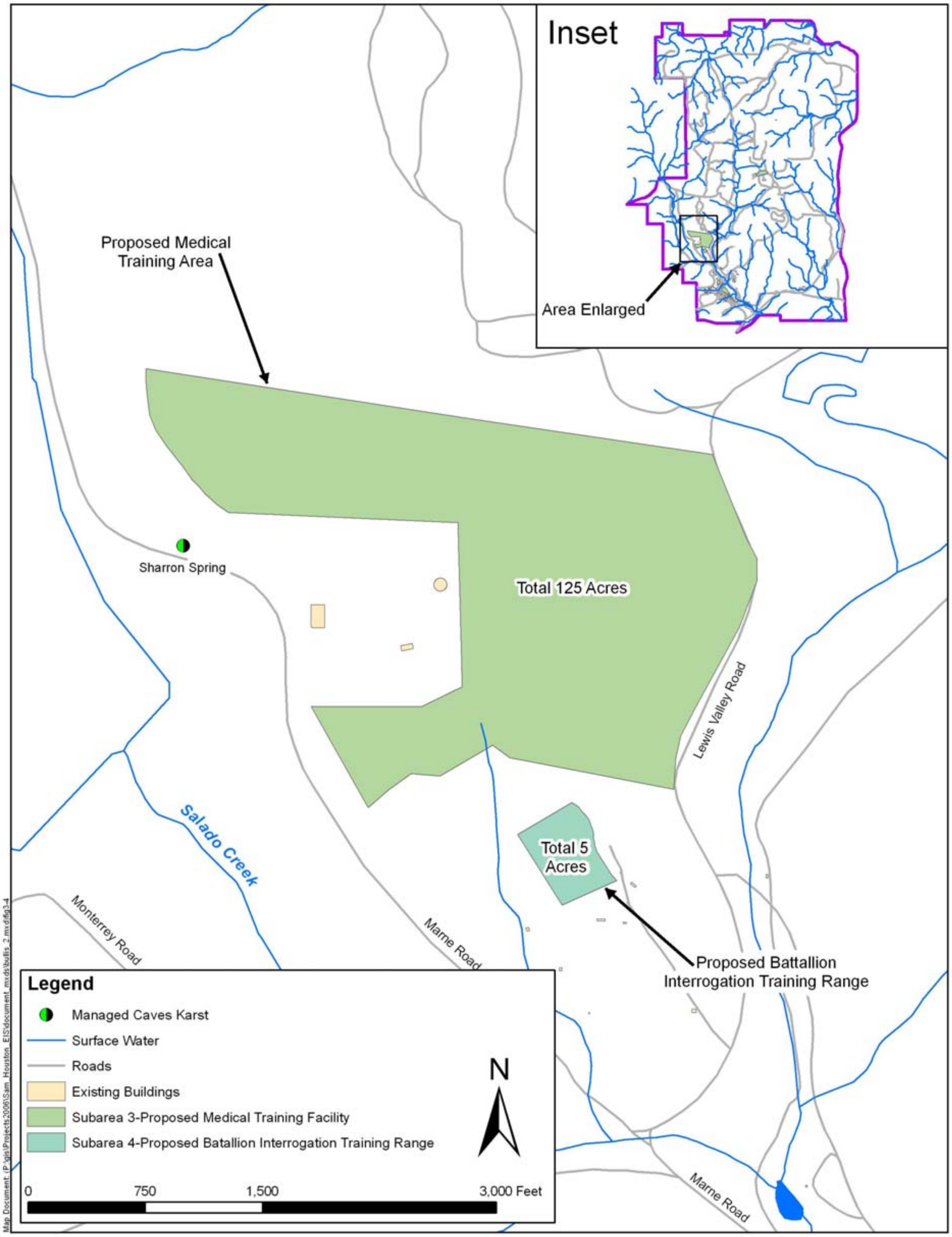


Figure 3-4 Proposed BRAC Medical Training Facility, Camp Bullis, Texas

3.3.2 Medical and Other RDTE Locations

Figure 3-1 shows the locations of the medical research activities of the Center of Excellence for Battlefield Health and Trauma that would be used by altering approximately 30,400 sf of existing laboratory space in Facility 3611, constructing a 52,100-sf addition to the existing vivarium facility and constructing a new ISR facility of approximately 103,000 sf. Medical and non-medical research activities of the Tri-Service Research facility would be constructed on Pershing Field north of the BAMC campus, as shown in Figure 3-1. CHPPM-South would be placed in Facility 2630 after its renovation. This facility, which is currently a veterinarian laboratory, is north of Schofield and between Funston and Patch Roads (Figure 3-2). A 440-meter outdoor laser range for the Tri-Service Research facility would be constructed north of Pershing Field, as well as a bridge connecting Nursery Road to W.W. White Road (Figure 3-1). A Navy fighter station display also would be included in the laser range.

3.3.3 Medical Training Locations

Additional METC facilities within the existing AMEDDC&S campus would be constructed at the locations shown in the Conceptual Land Use Plan (Figure 3-2). Additional facility planning studies may indicate the need to adjust the size and location of facility footprints. For EIS analysis purposes, the METC facility footprints and sizes shown in the Conceptual Land Use Plan will be used. This plan provides for 4 General Instruction Facilities (GIBs), 3,600 bed spaces, 2 dining facilities, 3 battalion headquarters (BN HQs) and 3 CO OPS facilities. The four GIBs will have an aggregated 750,000 sf. All of the dormitories would be five stories tall, containing 360,000 sf each. The USAF preference is for a three- or four-story dormitory. Any higher dormitory will have operational impacts. The BN HQ and CO OPS facilities would be 14,560 and 20,135 sf, respectively. Depending on the availability of funding, the five existing barracks facilities between Koehler and W.W. White Roads potentially would be reused or expanded (USACE, 2006b).

Most cross roads through the campus would be removed to provide for a pedestrian mall. Portions of the following roads may be removed: Johnson Circle, Forage Avenue, Parrish, Binz-Engleman, Williams, W.W. White (east of Garden), McGee, Womack, Koehler, Worth and Murphy. A stormwater retention pond would be constructed west of Williams Road in the southeast corner of the campus (USACE, 2006c).

As shown in Figure 3-4, the proposed medical training facility at Camp Bullis would consist of a 125-acre site in the southwest portion of the installation. The proposed site would be used for construction of

21,700 sf of field training classrooms, 10,000 sf of administrative offices, 25,000 sf of warehouse space, a 5,500-sf medical equipment repair shop, a training aids center, a 1,000-sf live tissue laboratory/moulage, a mock airfield parking apron with static aircraft training and a 17,615-sy area for tent pads (*Military Construction Project Data [Form 1391] for Projects in the EIS Scope of Work,* various dates). Medical training activities at Camp Bullis also would occur at the existing Mobile Operations on Urban Terrain (MOUT) facilities.

3.3.4 Headquarters and Administrative Locations

Assistant Chief of Staff for Installation Management

As shown in Figure 3-3, AEC, HQ IMA, NETCOM and ACA would be assigned the use of Facilities 2263, 2264 and 2266 after their renovation. These facilities historically have served as barracks, with Facility 2264 encompassing 110,235 sf. Elevator towers, entry ramps, and handicapped-accessible bathrooms would have to be constructed to meet current building standards. Environmental remediation of the facilities to remove lead-based paint (LBP), mercury-containing thermostats, polychlorinated-biphenyl- (PCB-) containing fluorescent light tube ballast and asbestos-containing materials (ACM) would be required (*Military Construction Project Data [Form 1391] for Projects in the EIS Scope of Work* [USACE, 2006a]).

The ACFSC Entertainment Division would use warehouse space in Facility 4197 at the east edge of the warehouse area for equipment storage. The Entertainment Division also would use new trailer parking space at the east edge of the installation along Ludington Road. The ACFSC Entertainment Division also would use Facility 2270, which is a historic theater. Prior to their occupancy of the theater, it will be repaired and refurbished in accordance with the Installation Design Guide (IDG) and the Secretary of the Interior’s Standards for Rehabilitation. In addition, the 20,000-sf MWR Academy and a parking area will be constructed near Wilson Street and Reynolds Road. An information systems facility also would be sited north of Hood Street near the Long Barracks (*Military Construction Project Data [Form 1391] for Projects in the EIS Scope of Work,* various dates).

Army Modular Force

Space requirements for the AMF will necessitate the use of existing and new facilities as follows. Figure 3-3 shows locations of the new facilities.

<u>470th MI BDE Locations.</u> The 470th MI BDE would occupy a motor park sited for construction northeast of the warehouse area between Ludington and Garden Roads and a vehicle maintenance shop on Parker Road in the warehouse area. The motor park would include a parking area for up to 117 vehicles

and maintenance and storage facilities covering a total of 25,000 sf (*470th MI BDE Facility Requirements Solutions Information Analysis Decision Briefing*, n.d.). Their mission and administrative space requirements largely would be met by the South Beach complex located between Stanley, Scott, Schofield and Henry T. Allen Roads (Figure 3-3). The South Beach Pavilion contains approximately 122,000 sf of space on 4 floors and can accommodate up to 763 personnel (FSH, 2006). Eight portable relocatable facilities may be used temporarily until South Beach is ready for occupancy. The proposed location for these portable facilities is at Hood Street and New Braunfels Avenue. If this unit is not placed in South Beach, an additional 17 portable relocatable buildings would be required to meet their space needs. In addition, a BN interrogation training range will be constructed on a 5-acre site at Camp Bullis (Figure 3-4).

Fifth Army/ARNORTH Locations. The use of Facilities 16 (the Quadrangle), 44 and 4168 by the Fifth Army will be continued. Facility 258 would be converted to a CO OPS facility with a special foundation (AR 5-10 Decision Package).

Sixth Army/USARSO Locations. The Sixth Army/USARSO would continue to use the existing EUL space in Facility 1000 (old BAMC Hospital) and Facility 4191 (Bays C and D) for warehouse space. They will use additional administrative space in Facility 1000. Temporary motor park space may be provided east of Facility 4197 until another alternative is developed. Eight portable relocatable facilities may be required to house 200 personnel temporarily until Facility 1000 is available (*HQ Sixth Army Support Requirements Summary [Stationing Package],* n.d.). The 470th MI BDE, Fifth Army/ARNORTH and Sixth Army/USARSO will have separate motor pool facilities, but they will be collocated in an industrial area.

3.3.5 Community Facilities Locations

The following community support facilities would be sited at the locations specified in Figure 3-3:

- Youth Center near Henry T. Allen and Funston Roads
- A 6,250-sf Physical Evaluation Board facility northeast of the gym
- A 200-seat Chapel with 17,900 sf and parking at the intersection of Schofield and Funston Roads
- Main Exchange containing 320,043 sf north of Wilson Street and the warehouse area
- Shoppette with 6,100 sf, two 20,000-gallon underground storage tanks (USTs), a retail sales store and 65 parking spaces near Wilson Street and Scott Road (USACE, 2006a)

3.4 MINOR SITING VARIATIONS

FSH has limited options in siting new facilities due to the constraints and current intensive use in many areas, as described in Section 2.1. Nevertheless, there is a limited number of alternative sites for specific facilities within the preferred alternative subareas. These modifications are listed and described in the following paragraphs and shown in Figure 3-5.

3.4.1 Patient Care Siting Variations

No siting variations are considered for the patient care locations.

3.4.2 Medical and Other RDTE Siting Variations

No siting variations are considered for the medical and other RDTE locations.

3.4.3 Medical Training Siting Variations

Perimeter Parking and Walking Spaces in the Medical Education Training Center

Compliance with the "No Step-on"[5] Policy will result in increased facility density and a lack of opportunity to site additional parking space within the campus. The Conceptual Land Use Master Plan envisions converting parking space along Hardee and Koehler Roads into the BN HQ Building. The parking lot between Facilities 1382 and 1387 will be used as a potential expansion area for three BN HQ facilities, each of which would be 14,560 sf in area.

Additional Dormitory Space for Medical Education Training Center

The Army also will consider the following modification to the medical facilities realignment (preferred) alternative: potential expansion of the dormitory area south of Schofield Road and east of Garden Road.

The 95 percent Area Development Plan for METC concluded that all of the above-described development would not fit within the campus adequately. The "modified" location south of Schofield Road was selected as the most appropriate dormitory site outside the METC.

[5] An important BRAC siting consideration is the "No Step-on" Policy. The Assistant Chief of Staff for Installation Management (ACSIM) issued planning guidance in the 22 December 2005 email to installations that states that BRAC funds cannot be used for construction of new facilities when space for the building footprint is created by demolition of existing facilities. To the extent possible, FSH has complied with this policy by re-siting new facilities to avoid "stepping on" existing facilities.

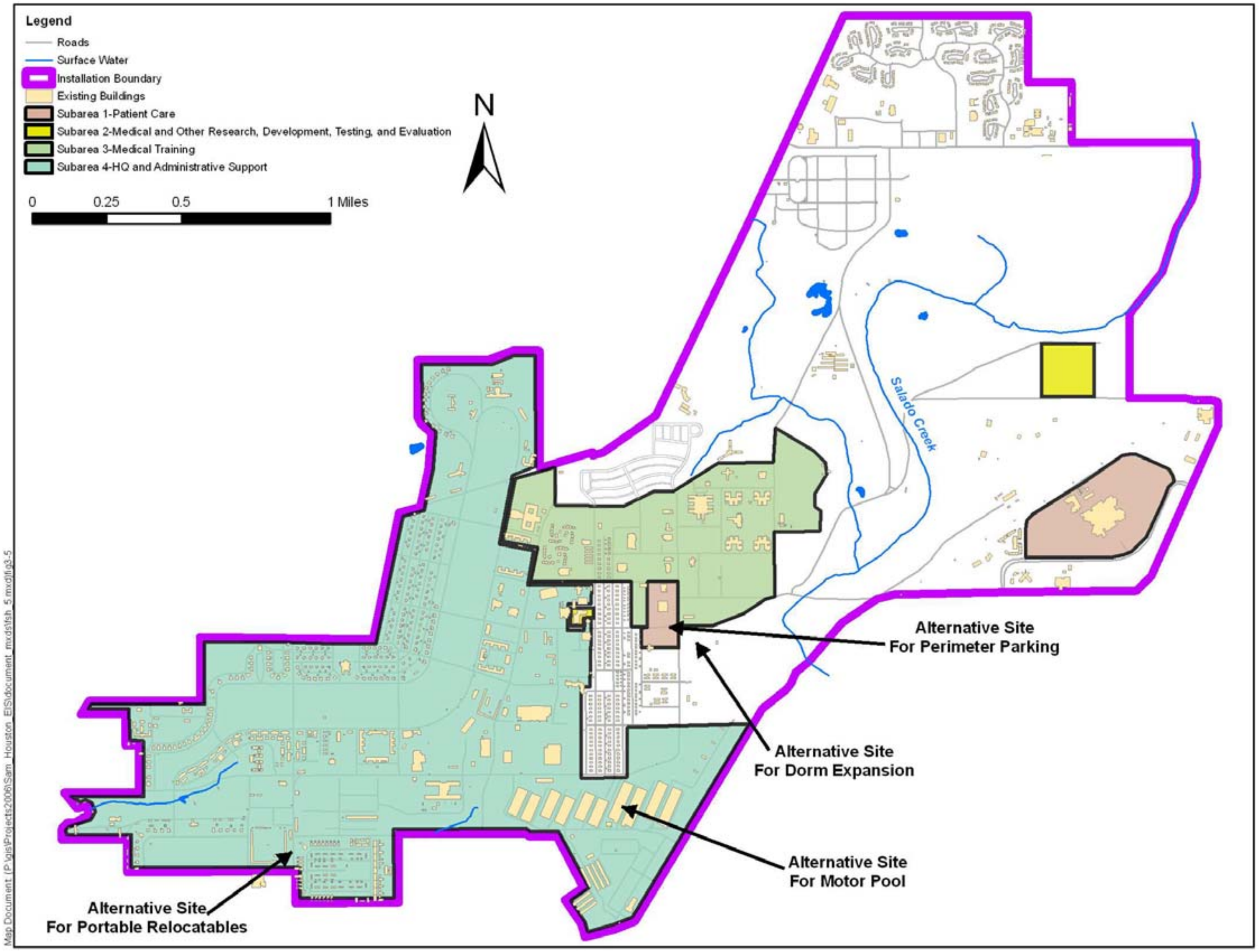


Figure 3-5 Minor Siting Variations, Fort Sam Houston, Texas

3.4.4 Headquarters and Administrative Siting Variations

Temporary Motor Pool Space

Temporary motor pool space may be provided in the existing Defense Reutilization and Marketing Office (DRMO) storage hardstand area after DRMO releases it to FSH, or they may remain temporarily in the existing warehouse area located off Parker Road or the existing troop motor pool.

Additional Portable Relocatable Temporary Facilities

Although not part of the long-term plan, the use of temporary facilities is probable to support the AMF stationing locations through 2011.

3.4.5 Community Facilities Siting Variations

No siting variations are considered for community facilities.

4.0 AFFECTED ENVIRONMENT AND CONSEQUENCES

4.1 INTRODUCTION

Effects on the following environmental resources and installation facilities and programs at FSH and Camp Bullis were evaluated for the proposed action implementation alternatives described in Sections 3.2 through 3.4: land use, aesthetics and visual resources, air quality, noise, geology and soils, water resources, biological resources, cultural resources, socioeconomics, transportation, utilities and hazardous and toxic substances. The analyses for these resources and programs are presented in Sections 4.2 through 4.13, respectively. Baseline conditions are presented as the "no action alternative." Cumulative effects regarding environmental impacts on these resources and installation facilities and programs from implementing the preferred alternative also were evaluated. These effects are presented in Section 4.14. BMPs necessary to reduce or eliminate environmental impacts are identified and described in Section 4.15. Each of these sections also discusses the potential environmental impacts that may result from modifying the preferred alternative by implementing minor siting variations described in Section 3.4.

4.2 LAND USE

Land use and master planning initiatives were evaluated for Army facilities in the San Antonio and surrounding areas in the *Fort Sam Houston, Camp Bullis, and Canyon Lake Recreation Area Master Plan Final Programmatic Environmental Impact Statement* (USACE, 1996). Information presented in this section is primarily from this source unless otherwise noted.

AR 210-20, *Real Properties Master Planning for Army Installations (2005)*, describes the purpose and process for real property master planning on Army installations. The master planning process is based on the assigned mission, Army guidance and policy and available resources. A Land Use Plan for an installation is like a zoning map that represents a long-range organization of land use to provide efficient, safe and compatible arrangement of activities. As such, it is a tool used for making decisions about redevelopment, siting facility expansions and new facilities and reuse of land and physical assets on the installation. Other sources of information are used to develop the Land Use Plan, as well as making final project-specific siting decisions. These sources include but are not limited to:

- Environmental quality
- Natural and cultural resources baseline analyses
- Utility assessments or studies
- Transportation plans or traffic analyses
- The IDG

- The Integrated Natural Resources Management Plan (INRMP)
- The Integrated Cultural Resources Management Plan (ICRMP)

4.2.1 Affected Environment

Regional Geographic Setting and Location

FSH is located in south-central Texas in the City of San Antonio, approximately 2.5 miles northeast of the central downtown area of the city. The 2,940-acre Army installation roughly comprises the land area enclosed on the south by IH-35, on the west-northwest by the Old Austin Highway and Harry Wurzbach Highway, on the north by Rittiman Road and Holbrook Road-IH-35 on the east-southeast. The installation is surrounded by developed property and widely used highways and arterial roadways.

Camp Bullis is located in Bexar and Comal Counties, Texas, and is a sub-installation to FSH. It encompasses 27,987 acres approximately 18 miles northwest of FSH. The installation runs approximately 10 miles from north to south and 4 miles from east to west. The surrounding area is primarily rural but has become increasingly urbanized as the suburbs of San Antonio have radiated outward to extend closer to Camp Bullis.

Region of Influence

The FSH mission is focused on medical training and practice, and its activities and facility requirements primarily are characterized as administrative, classroom, hospital and clinic space. The installation does not have an airfield or warfighting maneuver or training ranges. Therefore, the region of influence (ROI) generally is limited to the immediate adjacent properties, but there are occasional helicopter operations at the installation in support of regional MEDEVAC requirements to its major Army hospital (BAMC) and occasional special airlift to and from the main installation (USACHPPM, 2006).

The Camp Bullis mission is to provide target ranges, training areas, airspace, facilities, outdoor recreation programs and necessary installation support to all of its customers. Camp Bullis provides target ranges and field training areas for the Army, USAF, Marine Corps and the Armed Forces reserve units in the San Antonio area, as well as serving as an exercise site for many military units from outside the region. The ROI generally is confined to the installation. Noise from ground combat blast simulators and small- and large-caliber weapons fire generally is confined to the installation; however, limited helicopter flights and occasional fixed wing operations on a Combat Assault Landing Strip (CALS) would project noise into the surrounding areas (USACHPPM, 2006).

Land Use

The FSH master plan has evolved over time to meet changing mission requirements. The resulting master plan layout of FSH is characterized by four mission-related subareas:

- Patient care
- Medical training
- Medical and other RDTE
- HQ and administration

Additionally, housing, recreational, commercial and community facilities are located throughout the installation, primarily to serve the active duty military and dependents, and provide limited support for the military retirees and civilian workforce.

The FSH preferred alternative, as described in Section 3.0, comprises a mixture of new facilities construction and existing facilities renovation, alteration and demolition/deconstruction. Additionally, the preferred alternative includes provisions for temporary modular buildings to facilitate interim moves during construction. The project locations and descriptions are found in the figures in Section 3.0 and in Table 2-3.

Existing land use on the installation is shown in Figure 4-1. Land areas are described according to the dominant use categories, which reflect functions that are typical on military installations. The older and more developed areas occur in the southwestern and south-central portions of the installation. These areas contain most of the HQ/administrative, housing, community support and training facilities. The Arthur McArthur Field, a long contiguous tract of land, is used as parade grounds and athletic fields. The central core of FSH is made up of a variety of land uses, including family housing, troop housing and bachelor officers quarters, intermingled with HQ/administrative, community support, educational and smaller recreation facilities. The south-central part of the installation is an industrial area primarily dedicated to logistics, facilities services, vehicle and equipment maintenance, supply distribution and warehousing.

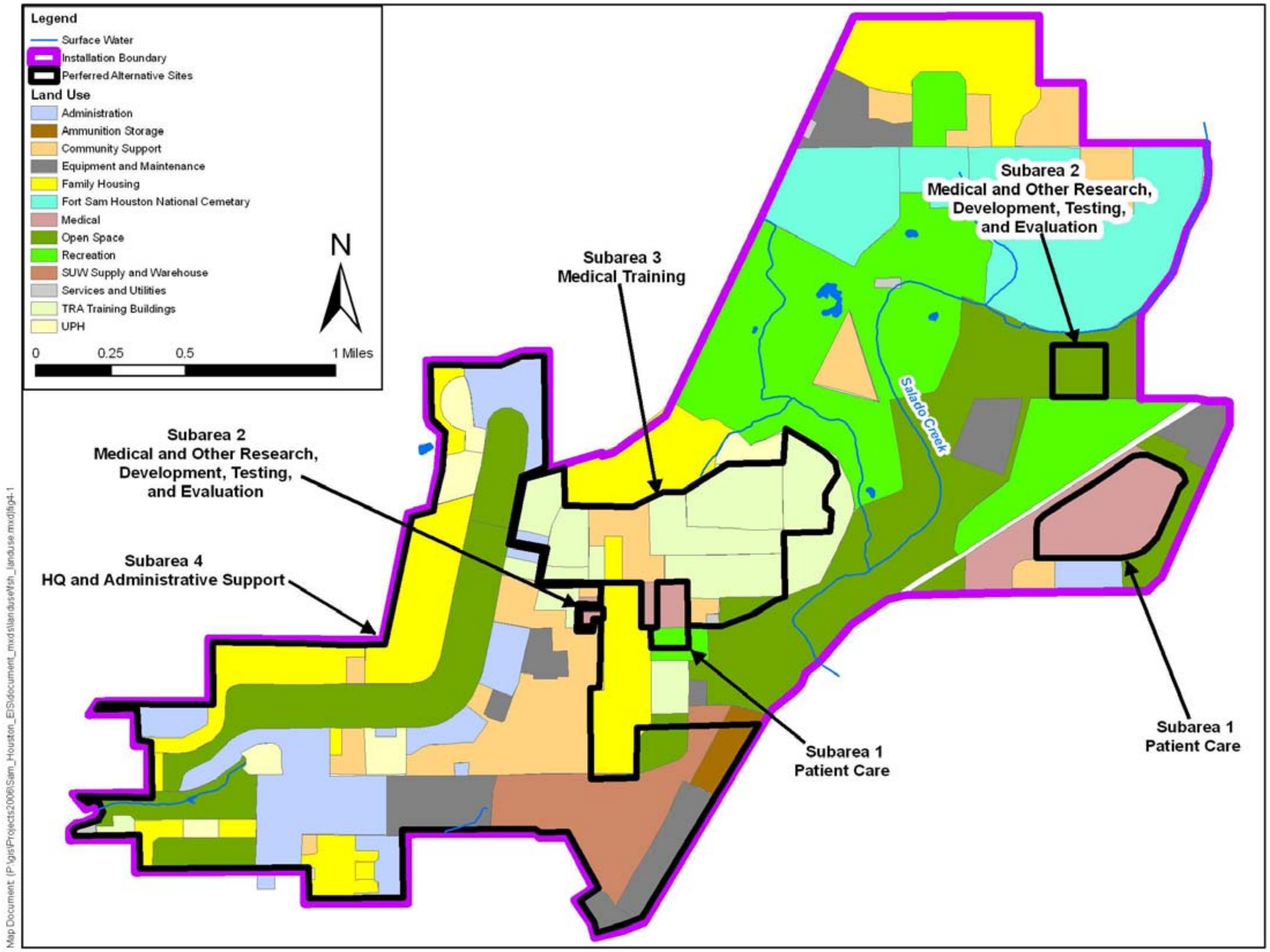


Figure 4-1 FSH Land Use Map
Source: Fort Sam Houston GIS Department Land Use (Zoning) Map March 2004a

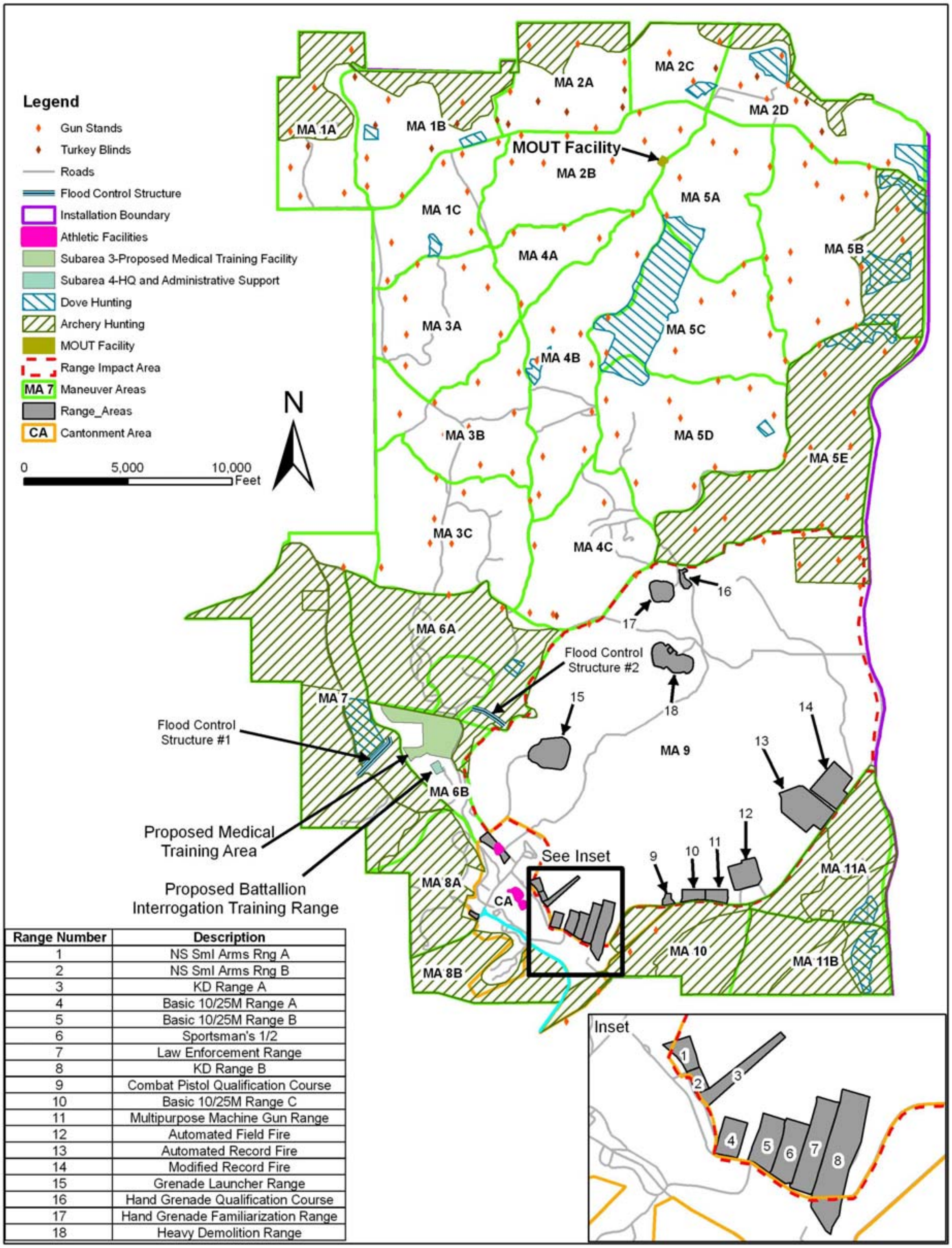
The north end of FSH is less densely developed, with family housing, schools, outdoor recreation and a national cemetery. Salado Creek runs through FSH from north to south along the eastern border of the northern section. Development potential of the floodplain areas is limited, and therefore, mostly it has been used as an open training area and for outdoor recreation. There are two 18-hole golf courses, picnic and camping areas and a riding stable in this area. Other smaller recreation areas can be found throughout the installation. Salado Creek also divides the southwest and south-central main installation from the easternmost portion of the installation that primarily supports patient support and research. The easternmost area houses over 1 million sf of BAMC and support facilities.

The Camp Bullis master plan is structured to support its primary use for military training. It is divided into three general areas. The cantonment area (about 600 acres) in the southwest part of the reservation, the impact area (about 6,000 acres) in the southeast and the maneuver areas (MAs) (about 21,400 acres) comprise the bulk of the land area. Each area (shown in Figure 4-2) is used for a variety of functions. These areas are described in detail in the *Mission EA for Camp Bullis* (U.S. Army, 2006) and are summarized below.

The portion of the preferred alternative located at Camp Bullis is described in Section 3.3 and shown in Figure 4-2. The medical training facility and the BN interrogation training range would be constructed in a designated training area north of the cantonment area and would be compatible with the Camp Bullis master plan. As shown in Figure 4-2, the preferred alternative is located in Area MA 6.

The Camp Bullis cantonment area has most of the administrative and support functions and facilities. There are offices, warehouses, classrooms, barracks, munitions and explosives storage and water and wastewater treatment systems.

The impact area (MA 9) (Figure 4-2) for the firing ranges occupies most of the southeast part of the reservation. Firing ranges located along the east and northern edge of the cantonment area are used for firing a variety of weapons into the impact area. At the northern edge of MA 9 is an explosive ordnance demolition range. Detonations at the site currently are limited to 200 pounds at any one time, but detonations above 100 pounds require a special request to FSH for an exemption to Army policy.



Range Number	Description
1	NS Sml Arms Rng A
2	NS Sml Arms Rng B
3	KD Range A
4	Basic 10/25M Range A
5	Basic 10/25M Range B
6	Sportsman's 1/2
7	Law Enforcement Range
8	KD Range B
9	Combat Pistol Qualification Course
10	Basic 10/25M Range C
11	Multipurpose Machine Gun Range
12	Automated Field Fire
13	Automated Record Fire
14	Modified Record Fire
15	Grenade Launcher Range
16	Hand Grenade Qualification Course
17	Hand Grenade Familiarization Range
18	Heavy Demolition Range

Figure 4-2 Camp Bullis Land Use Map
Source: Fort Sam Houston GIS Department Land Use (Zoning) Map March 2004a

Other MAs provide a variety of features and facilities supporting different missions and training activities. These include four drop zones and a CALS (in the northern part of the reservation) used for air missions and several special training areas with constructed obstacles, natural features and facilities to support specific training needs (U.S. Army, 2006). Track vehicle training is performed on trails in the southern, eastern and central portion of the installation (FSH, 2001).

Camp Bullis supports activities of other entities, mostly governmental, that will not impede or inhibit the military mission, on about 80 percent of the land through easements, outgrants or permits. The San Antonio River Authority (SARA) and the Natural Resource Conservation Service (NRCS) monitor and maintain two flood control reservoirs on 700 acres. Another 700 acres is outgranted for a variety of uses. The Federal Aviation Administration (FAA) operates radar and air traffic control equipment on leased land north of the cantonment area. There are several borrow pits and quarrying operations dispersed throughout Camp Bullis. One commercial oil and gas license is in effect (FSH, 2001).

Camp Bullis provides recreational opportunities for military and civilian personnel. Soccer, softball and volleyball facilities are available for military personnel. FSH and Camp Bullis personnel have access to about 21,000 acres for deer, dove and quail hunting during state-designated hunting seasons. There is also a sportsman’s shooting range. The entire Camp Bullis land area is used for conservation and restoration of natural resources consistent with the peacetime mission and federal policy.

Historical Aspects of Land Use

Since 1845, FSH has performed important roles for the Army and has served as an HQ, logistical base, mobilization and training site, garrison and medical provider. After construction of the Quadrangle in 1876, the Army began to move facilities to the current site of FSH. The installation has expanded from the original 92 acres to 2,940 acres. Between the two World Wars, FSH was the largest Army installation in the CONUS. FSH is one of the oldest installations. It has the largest collection of more than 800 historic facilities located in various historic zones that depict their eras.

The installation’s prominence in medical training and research advancement has led to significant tactical and organizational innovations. Medical treatment of casualties evacuated by air was performed here as early as 1917. At the end of World War II, FSH was designated as the principal Army medical training facility. With this decision came the determination to develop Brooke General Hospital into a premier Army medical center.

FSH is not only a modern installation providing state-of-the-art training for DoD medical training, but also provides a wealth of historical information about the Army transformation from the mid-1800s to the 21st century. The Army is required to comply with the requirements of the NHPA, the Archaeological Resources Protection Act (ARPA) and the NAGPRA, as well as other related laws, regulations and EOs. In carrying out this responsibility at FSH, actions or undertakings must be screened to determine whether there is potential for significantly impacting National Register of Historic Places- (NRHP-) listed properties, or properties eligible for inclusion in the NRHP. Procedures outlined in the 2006 HPC of the FSH ICRMP must be followed in the event of a planned undertaking that might significantly impact historic and cultural assets.

Camp Bullis was established in 1917. Camp Bullis has expanded as FSH has expanded. During World War II, the camp was an important venue for training infantry troops. Subsequently, the focus at FSH and Camp Bullis began to change toward training of the Army's medical personnel; FSH became the "schoolhouse" for doctrinal training of combat medics and medical students, with the camp used as their field training site. The presence of one of the Army's preeminent research and teaching facilities (BAMC) encouraged this shift away from infantry training toward field medical training. In 1995, the Army transferred these companion installations from the Army Forces Command (FORSCOM) to the Army Medical Department (AMEDD) Major Command (MACOM) in recognition of the changed focus.

Designated as a geographically separate training site of FSH, Camp Bullis was a directorate-level activity of the Garrison Command. In 1990, Camp Bullis received recognition as a separate sub-installation with its own HQ Detachment that reports to the Garrison Commander of FSH.

Over time, doctrinal changes in Army force structure led to a shift of combat service support units (*e.g.,* the Quartermaster, Ordnance, Medical Support and Finance units and branches) from the active component into the Army Reserve and the placement of combat arms units (*e.g.,* the Infantry, Artillery and Armor branches) into the Army National Guard. As a result, Reserve Component forces (which include the National Guard) began to use Camp Bullis extensively.

Other military services have noted the value of Camp Bullis as a field training site. During the 1960s, USAF began to increase the use of Camp Bullis as a training facility for its airmen undergoing basic training in San Antonio at Lackland AFB, along with those training to be security police. Similar to the influence that the presence of BAMC had on FSH, the presence of USAF's largest and preeminent medical facility (WHMC) at Lackland AFB has led USAF to train its combat medics at Lackland AFB and perform field training at Camp Bullis.

With the end of the Cold War era, many military facilities were closed or had their missions realigned to other installations. This led to increased use of Camp Bullis by Navy and Marine Corps units for field exercises and small arms training.

Airspace

FSH is not an Army aviation facility, nor does it include range facilities for launching or firing weapons that would restrict airspace use. Nevertheless, BAMC has a heliport that supports MEDEVAC flights and occasional transport within the San Antonio area. The heliport is located on the southeast perimeter of the BAMC campus.

Airspace use in San Antonio is controlled by FAA. There are major flight activities north, east, south and southeast of FSH from San Antonio International Airport (SA IAP), Randolph AFB, Stinson Field and the Kelly Field Annex to Lackland AFB. The aviation activity associated with FSH is helicopter operations for local area MEDEVAC and transport. Takeoffs and approaches generally follow the major adjacent roadways, more specifically IH-35. The centerline of Runway 30L on approach/12R on departure for SA IAP is close to the BAMC site. Turns to and from centerline are approximately 4,000 feet north of the BAMC site (U.S. Army, 1988-89).

Camp Bullis has a CALS located near its northern boundary in MA 2. No aircraft are based there; instead, it is a training area used occasionally by C-130/C-17 aircraft to practice combat assault operations, during which aircraft land under simulated tactical conditions and on-load or off-load troops, supplies or mock casualties. A Camp Bullis heliport is located in the cantonment area of the installation. The heliport lies in uncontrolled airspace. The cantonment area is approximately 6 miles northwest of the threshold of Runway 12R at SA IAP. Medical combat routes also are used by helicopters at Camp Bullis in support of medical training to evacuate casualties under simulated combat conditions.

Surrounding Land Use

FSH lies within the City of San Antonio. The City Planning Department oversees the master planning efforts in the city and compliance with existing ordinances, such as Volume I, Part II, of the Unified Development Code, Article 3, *2006 Zoning*. The Alamo Area Council of Governments (AACOG) is a voluntary association of local governments and organizations that provides technical planning assistance and coordination within the region between parties that include the federal Government. AACOG has the objective to coordinate public and private investments and plans, manage development of communities and minimize conflict between land uses. Although FSH does not fall under the jurisdiction of the City of San Antonio, land use changes on FSH may have impacts on the surrounding community.

The City of San Antonio and the surrounding region have a rich history. The site of the battle for the Republic of Texas (the Alamo) attracts many visitors each year. Additionally, San Antonio has an abundance of other historic structures, sites, landmarks and districts. San Antonio has 22 locally designated historic districts in addition to 19 National Register Historic Districts. The *Government Hills Neighborhood Plan* addresses specific concerns for economic revitalization and historic preservation in areas adjacent to the FSH Quadrangle area along Grayson Street. Like the installation, the Government Hills area has been struggling with preservation costs in light of basic community needs for affordable housing and commercial opportunity (FSH and Camp Bullis Real Property Master Plan [RPMP] Digest, 2004).

Land use surrounding FSH is varied and includes single- and multi-family residential, lodging, commercial business, light industrial, office space, warehouse/distribution, institutional, religious and recreational uses. The southeast border of the installation runs parallel to IH-35, a major thoroughfare that defines a corridor of various land uses along the service roads.

The southwest and west mostly are developed, with older single- and multi-family residential areas interspersed with neighborhood and strip commercial uses at intersections and along primary roadways. To the northwest are the San Antonio Botanical Center, the San Antonio Country Club, single-family residential areas in the City of Terrell Hills and limited office-type commercial along adjacent arterials. Areas to the north are medium-density, single-family residential neighborhoods.

The eastern boundary is largely open, with rural land and sporadic houses. Some industrial use is interspersed, but floodplains constrain further developments. To the southeast and south, open land along the boundaries and highways is zoned mostly for industry and is being developed as such. The city's John James Park and the FSH National Cemetery (owned and administered by the VA) are contiguous with FSH property on the northwest end of the installation (FSH and Camp Bullis RPMP Digest, 2004).

Camp Bullis is located predominantly within Bexar County. A small amount of land (about 2,000 acres) on the north boundary falls within Comal County. Some original rangeland still is found along the northern boundary of Camp Bullis, but most surrounding land is being subdivided and used for suburban development. On the west side, Camp Stanley abuts Camp Bullis. On the southwestern boundary is the 323-acre City of San Antonio Eisenhower Park. Also to the south of the installation are rock quarries and a cemetery. Some commercial and industrial developments are located along the primary highways south of the installation.

San Antonio city limits surround two-thirds of Camp Bullis. Land use controls (LUCs) in unincorporated areas are governed by Texas Local Government Code, Title 7, Subtitle B (n.d.). Typically, counties regulate subdivision of land but do not have the power to control land use. Under Texas Local Government Code, Chapter 42, *Extra Territorial Jurisdiction of Municipalities* (n.d.), the areas within a specified distance of an incorporated boundary (depending on the population of the adjacent municipality) are within an extraterritorial zone (ETZ). The City of San Antonio and City of Boerne have vied over control of land use in the unincorporated areas around Camp Bullis. Also within the ETZ, adjacent to Camp Stanley on the northwest side of Camp Bullis, is the incorporated city of Fair Oaks Ranch. An approximately 0.5-mile-wide strip of Fair Oaks extends to the east along the top (north border) of Camp Stanley and abuts Camp Bullis's western border for approximately 0.5 mile north of Camp Stanley.

4.2.2 Consequences

Realignment (Preferred) Alternative

Land Use

During the BRAC accommodations planning process, FSH followed the master plan and the IDG in determining the suitable locations for the mission elements. BRAC guidance required the reuse of available facilities and new construction only if facility space was unavailable after a thorough investigation of potential real estate assets. The resulting preferred alternative closely follows the approved FSH Land Use Plan. The preferred alternative would entail facility development actions in the southwestern, central and easternmost areas of FSH.

The patient care facilities primarily are focused in the BAMC campus area on the eastern portion of the installation. This land use is compatible with the current use. Additional outpatient care facilities also are included in the preferred alternative; however, they are sited as satellite facilities in the medical training subarea primarily to support the increased student load. This is compatible land use, and it should serve to decrease travel time and costs to transport students to the BAMC campus.

The METC Conceptual Land Use Plan is focused primarily on providing classroom space and student dormitories. The facility work is primarily new construction and associated demolition/deconstruction of aged and inadequate facility space.

Medical and non-medical research facilities would be constructed under the preferred alternative on the BAMC campus and north of the campus, respectively. The medical research operation is related functionally to the hospital and would be a compatible land use. Medical and non-medical research would be supported by a Tri-Service Research facility that would be sited in an open, previously disturbed tract north of the BAMC campus (Pershing Field). This facility would require changing the current open space land use designation. Its physical separation from the recreational vehicle (RV) park and visiting quarters should prevent incompatible use issues. A 440-meter outdoor laser range also would be constructed north of Pershing Field near the directed energy laboratory facility.

HQ and administrative support facilities are primarily renovation projects. Siting of the functions fits the current land use designations in the master plan.

Miscellaneous operational support facilities also are sited in accordance with the FSH master plan. These include vehicle maintenance and warehouse facilities sited in the current industrial/warehouse area in the south-central part of the installation. Community support facilities are sited in the central area of the installation to support the customers.

Overall, implementing the preferred alternative would not have significant impacts on land use, on FSH or Camp Bullis. Some open land would be lost at FSH for non-medical research uses, but this would not be a significant impact due to the sufficient availability of non-developable open space at FSH. The 440-meter outdoor laser range would be constructed with a berm and fencing to prevent potential health hazards. Coordination with the safety engineer would be completed prior to scheduling outdoor operations. The safety engineer also would be notified at the start of the day, when energy would be discharged. Range operation would require the notification by email of all personnel in the Directed Energy Bioeffects Compound prior to commencement of firing. Signs and barricades would be placed at key locations. Range safety observers with two-way radios would be posted at all entry points. The fence would keep people from unknowingly entering the firing range. All outdoor operations would be suspended during inclement weather or “black flag” conditions.

Historical Aspects of Land Use

Development at FSH under the preferred alternative would have to consider the presence of historic and cultural assets found on FSH. The potential adverse effects on eligible or potentially eligible historic properties due to the construction, renovation or demolition/deconstruction work would have to comply with the requirements outlined in the FSH HPC of the ICRMP so that no significant impacts would occur.

The specific facilities potentially impacted are discussed more fully in Section 4.9. Architectural and landscaping considerations are discussed in Section 4.3.

Development at Camp Bullis of the medical training facility and BN interrogation training range would not impact known historical land uses.

Airspace

The FSH and Camp Bullis preferred alternative would not alter airspace at either installation. At FSH, the number of MEDEVAC flights to BAMC would increase slightly. The Camp Bullis medical training facility and BN interrogation training range do not include added helicopter flights.

Surrounding Land Use

The FSH and Camp Bullis preferred alternatives would not create land use incompatibilities with their surrounding off-installation land uses.

Minor Siting Variations

Minor siting variations described in Section 3.4 fit the current land use designations in the master plan.

No Action Alternative

FSH and Camp Bullis land use would not change under the no action alternative. No BRAC-related new construction, renovation or demolition/deconstruction would occur.

4.3 AESTHETICS AND VISUAL RESOURCES

4.3.1 Affected Environment

Architectural Compatibility

FSH lies on a site originally characterized as a relatively open, sloping chaparral thicket descending from one of the highest hills in San Antonio on the southern boundary where the Quadrangle Tower was constructed. The tower provided a view for over 30 miles in almost every direction (USACE, 1999). From the higher elevations in the southeastern area at ground level, FSH offers some open views of the surrounding areas. There are no natural landforms of particular visual interest. The on-site green spaces include mowed lawns, a variety of landscape features, large parade fields, two golf courses, outdoor picnic areas, street trees, formally landscaped facilities and natural vegetation areas unsuitable for building. These features break up the land areas, provide shade, hide or enhance facility features, define routes and walkways and collectively provide a variety of interesting vistas throughout the installation. Future construction on the installation must comply with the requirements set forth in the FSH IDG and the FSH Historic Landscape Master Plan (USACE, 1999).

From a visual perspective, the majority of Camp Bullis has remained in a relatively natural state (USACE, 2001c). Camp Bullis provides a rustic setting with natural vegetation and geologic features typical of this region of Texas. The cantonment area fits well in this natural, park-like atmosphere, with a mixture of old and newly constructed facilities with predominantly earth tones that fit among mature canopy trees and other native vegetation well adapted to this climate and terrain. The area surrounding the cantonment area provides a natural, park-like backdrop with natural vistas. Most of the development on Camp Bullis is concentrated on less than 10 percent of the land area. Nevertheless, infrastructure and man-made facilities are dispersed and evident in much of the installation. In a few places, these alterations have produced highly noticeable cuts and intrusions in the natural landscape. The cantonment area has the highest concentration of facilities, but the extent of development is much less than at FSH. From most locations, views of open space and the natural surroundings provide a “rural”-type context.

The FSH IDG applies not only to the main installation, but also to the sub-installations. Although Camp Bullis is not a defined zone in the IDG, design guidance for zones with similar characteristics forms a basis for site planning and construction details at Camp Bullis.

Historic/Cultural

The architectural styles of FSH facilities vary due to influences of major construction during different phases of its history; the National Historic Districts are shown in Figure 4-3. The earliest construction was the Quadrangle. This was followed by the Staff Post development, with its impressive Victorian-style permanent officer’s quarters that integrated native stone and large shade trees and were located around a parade field. The next phase introduced the Long Barracks and Sally Port, extended parade grounds framed by Georgian-Revival-style brick officer’s quarters, and a Band Barracks (Infantry Port) with a third-story belvedere. In 1903, FSH was designated a BDE Post, and the parade fields were extended north in a winding configuration following a ridgeline where additional housing was developed.

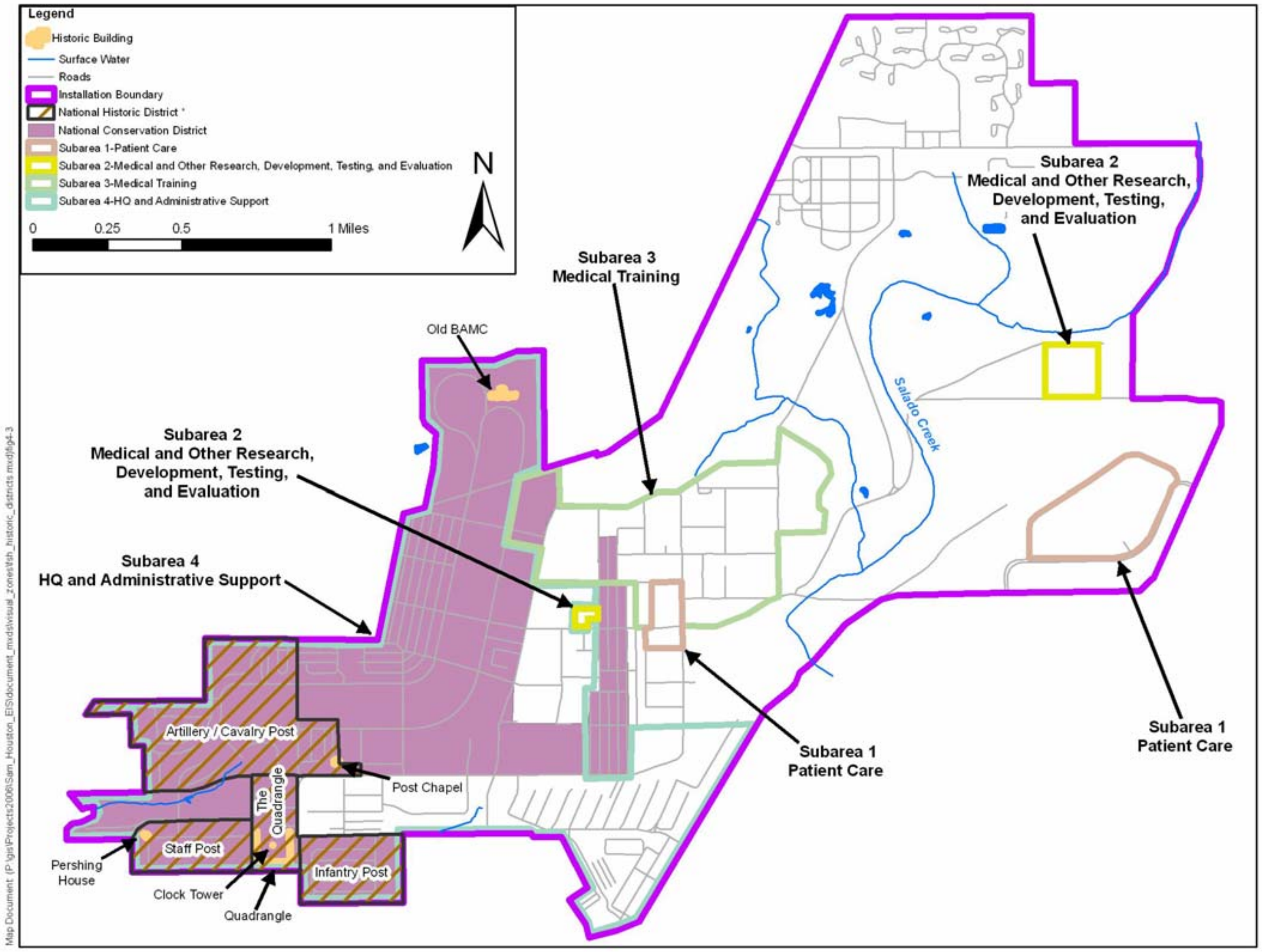


Figure 4-3 Historic Preservation Areas
Source: FSH PAM 210-20-3, Installation Design Guide (IDG), No date, p. 1-10, 2-13, A-1, Figure A-1, p. A-9

In an effort to accommodate expansion and modernization at FSH after World War I, the architect and planner chose a Spanish Mission style of architecture and landscaping that was incorporated in additional housing for all ranks from Garrison Commander to NCOs. The light stucco exteriors, tile roofs and palm trees are prominent elements of this style and are found throughout this region. The construction of the early hospital facilities and additional dormitories, warehouses, administrative and training facilities and community support facilities located throughout the installation has carried this Spanish Mission theme with varying degrees of architectural features and landscaping (USACE, 1999).

Standardized paint colors, brickwork, signage and other common features also have been used to tie the facilities together. Nevertheless, the historic preservation requirements have demanded additional attention to detail within the National Historic Districts and their viewscapes.

An architectural inventory and evaluation by M.D. Freeman determined that Camp Bullis had statewide and national significance during the period from 1929 to 1939. Facilities associated with that period were considered likely to be eligible as a National Historic Landmark District (NHLD) under Criterion A (significant events) and Criterion C (architecture). An inventory and evaluation process has been completed for Camp Bullis. Seventy-six architectural resources were noted primarily in the cantonment area. They are also significant for the distinctive design and method of constructing the permanent facilities, using local limestone for foundations, steps, retaining walls and fireplaces. The cantonment area layout and architectural style reflect the attributes of the planning policies developed by the Quartermaster Corps of the War Department in the late 1920s (FSH, 2001).

Surrounding Area Aesthetics

FSH is densely developed more on high ground at the southwest and central portion of the installation. The dense, older growth landscaping and canopy trees obscure most off-installation development to the south and west, other than high-rise facilities such as the USAA Towers outside the Stanley Road/Harry Wursbach entrance. The views overlooking the countryside to the east and the north are wide vistas covering miles outside the installation boundaries from certain vantage points. The size and scale of most facilities in the surrounding area blend into a pleasing mix of colors, shapes and textures among the landscape foliage and generally provide a pleasant viewscape. The view from the central installation to the east is accented by the impressive brick structures of the BAMC campus on the horizon.

4.3.2 Consequences

Realignment (Preferred) Alternative

The FSH preferred alternative would add, alter and demolish/deconstruct facilities on FSH. Unplanned or unconstrained design could significantly impact the aesthetics and visual resources on the installation and impact its neighbors. Nevertheless, as stated previously, FSH has implemented a master plan, developed plans to effectively deal with historic preservation and developed an overarching policy for facility development in the IDG. Appendix D of the IDG contains historic review requirements for all projects with the potential to impact the National Historic Districts. These requirements include review of the conceptual, preliminary and final phases of alterations to the landscape within the Historic Districts. Projects requiring historic review and approval are projects in Visual Zones 1 to 3 and part of Visual Zone 5 (Figure 4-4). These zones and additional historic review requirements are discussed in Section 4.9.

For the preferred alternative, many of the new structures are sited in the portion of the medical training area that is outside the Historic Districts. The area is characterized by a mixture of facilities of various architectural styles and ages resulting from additions over time due to changing mission requirements. The addition of new massive dormitory facilities and large classroom facilities, along with selective demolition/deconstruction of aged facilities and renovation of others under the preferred alternative, would provide an opportunity to impact this subarea positively and improve its aesthetics and visual appeal. The area has an inviting green space, rolling hills and mature trees and landscaping. The location of the facilities is buffered from the perimeter of the installation and the FSH historic areas, so there should be little or no impact on the views from outside the installation or significant impacts on the Historic Districts. Some facilities to be demolished or renovated are or potentially are eligible historic properties, and must be addressed in accordance with the HPC. These facilities are discussed further in Section 4.9.

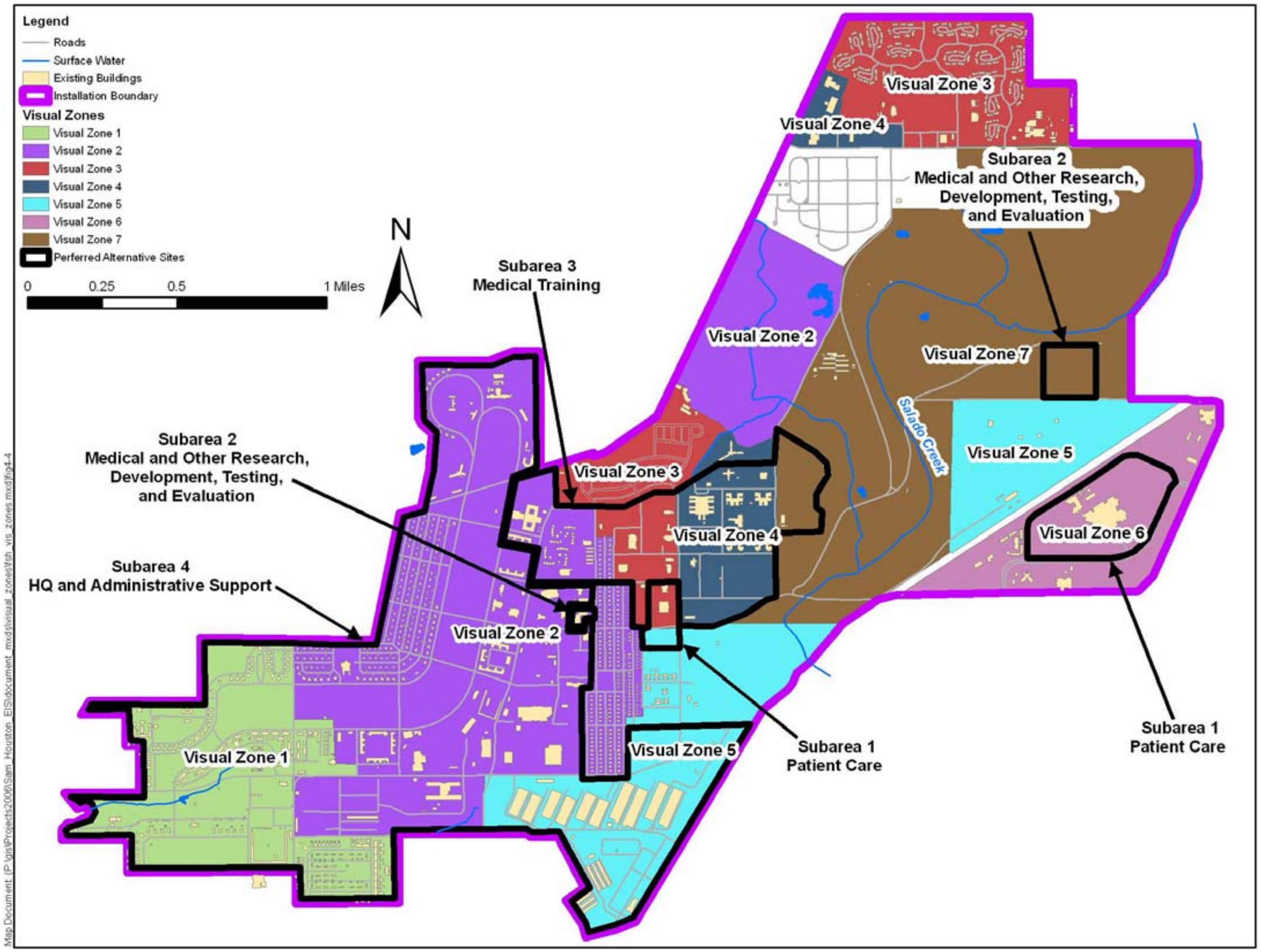


Figure 4-4 Visual Zone Map of FSH
Source: IDG, FSH PAM 210-20-3

Construction at the BAMC campus subarea, if integrated architecturally with the relatively new hospital facilities, is not expected to significantly impact the aesthetics or visual resources on the installation or outside the boundaries. The new non-medical research facility is a massive 210,000-sf facility sited north of BAMC in an open area visible from BAMC, an RV park and temporary lodging facilities. The view from the north is blocked by dense tree growth around the Salado Creek floodplain. Following the IDG would reduce significant impacts of this facility. A primary goal of the IDG is to provide guidance for improving the quality of the visual environment by defining the placement and design of the elements of new facilities such as the buildings' architectural styles, features, colors and textures, landscaping, roads, walkways and signage.

The construction of the vehicle maintenance facilities and warehouse in the industrial area should be compatible with the existing facilities within this subarea. Views from outside the installation boundaries from Grayson Street and side roads in housing areas close to the installation will be considered in the design and layout of the facilities. Visual detractors could be diminished using berms, landscaping, fencing or some other visual screening.

The plan to provide administrative space for the HQ and other administrative functions is primarily through renovation of existing space in the southwestern portion of the installation that abuts several historic areas, as shown in Figure 4-3. Adherence to the FSH HPC and attention to the IDG are critical in this area to avoid significant impacts to the historic quality of the installation. If properly done, facilities improvement in this subarea could positively impact the Government Hill historic neighborhood outside the installation boundary. Government Hill is located adjacent to the Quadrangle and the Staff Post historic areas. Any exterior work to preserve or maintain the historic properties or new work that would contribute to the visual setting potentially would complement the adjacent off-post historic properties.

The Camp Bullis preferred alternative would be an isolated camp environment buffered by natural areas. New facilities would be compatible with existing site field training facilities. No structures are planned that would be visible from the cantonment area, which is separated physically from the training areas and visually by heavily wooded rolling terrain. The medical training facility and BN interrogation training ranges would not impact the cantonment area.

Minor Siting Variations

Minor siting variations described in Section 3.4 would have the same impacts as the preferred alternative. Following the FSH IDG is the standard used by the installation to preserve or enhance the visual environment. Compliance with the IDG is assumed in determining potential impacts, rather than imposing its use to mitigate potential impacts.

No Action Alternative

FSH and Camp Bullis aesthetics and visual resources would remain unchanged under the no action alternative. No new construction, renovation or demolition/deconstruction would occur.

4.4 AIR QUALITY

4.4.1 National Ambient Air Quality Standards Status

The CAA (42 USC §§7401 to 7671q) and its amendments empowered the U.S. Environmental Protection Agency (USEPA) to establish primary and secondary air quality standards for six criteria air pollutants:

- Ozone (O_3)
- Carbon monoxide (CO)
- Lead (Pb)
- Nitrogen dioxide (NO_2) or more commonly oxides of nitrogen (NO_x)
- Respirable particulate matter (particulate matter with an aerodynamic diameter less than 2.5 microns [$PM_{2.5}$] and particulate matter with an aerodynamic diameter less than 10 microns [PM_{10}])
- Sulfur dioxide (SO_2)

Standards for these six pollutants are referred to as the "National Ambient Air Quality Standards (NAAQS)" (40 CFR Part 50). Primary standards protect human health, including the health of "sensitive" populations such as children, asthmatics and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility and damage to animals, crops, vegetation and facilities. The NAAQS represents both short-term (1-, 3-, 8- or 24-hour) and long-term (quarterly or annual averages) exposure levels that are considered safe, with a reasonable margin of safety. Short-term standards address acute health effects, while long-term standards address chronic health effects (USEPA, National Ambient Air Quality Standards, http://epa.gov/air/criteria.html).

The concentration of these six pollutants, expressed in units of parts per million (ppm) or micrograms per cubic meter ($\mu g/m^3$) in air, defines the outdoor air quality at a given location. Air quality is determined by the dispersion rates of pollutants. This dispersion is a function of the temperature, inversion layers, topography, geography and prevailing meteorological conditions.

USEPA directs each state to take responsibility for compliance with the NAAQS. The state can adopt stricter standards than the NAAQS but not more lenient. In Texas, the Texas Commission on Environmental Quality (TCEQ) has accepted the NAAQS as the State standard. These standards are presented in Table 4-1.

Table 4-1 National Ambient Air Quality Standards and Standards Adopted by TCEQ

Criteria Pollutant	Standard	Primary Standard	Secondary Standard	Averaging Time
O_3	Average of the annual fourth highest daily 8-hour maximum over a three-year period is not to be above this level.	0.08 ppm	0.08 ppm	8-hour
	Average of the annual highest daily 1-hour maximum over a three-year period is not to be above this level.	0.125 ppm	0.125 ppm	1-hour
CO	Not to be exceeded more than once per year.	35 ppm	None	1-hour
	Not to be exceeded more than once per year.	9 ppm	None	8-hour
Pb	Not to exceed this level.	1.5 $\mu g/m^3$	1.5 $\mu g/m^3$	Quarterly
NO_2	Not to exceed this level.	0.053 ppm	0.053 ppm	Annual
$PM_{2.5}$	Three-year average of the annual 98th percentile for each population-oriented monitor within an area is not to be above this level.	35 $\mu g/m^3$	None	24-hour
	Three-year average of annual arithmetic mean concentrations from single or multiple community-oriented monitors is not to be above this level.	15.0 $\mu g/m^3$	15.0 $\mu g/m^3$	Annual
PM_{10}	Not to be exceeded more than once per year.	150 $\mu g/m^3$	None	24-hour
SO_2	Not to be exceeded more than once per year.	None	0.5 ppm	3-hour
	Not to be exceeded more than once per year.	0.14 ppm	None	24-hour
	Not to exceed this level.	0.03 ppm	None	Annual

Units: ppm – parts per million
$\mu g/m^3$ – micrograms per cubic meter
Source: USEPA, NAAQS, http://epa.gov/air/criteria.html; USEPA, 2006c

When criteria pollutant concentrations in an area are below the levels in Table 4-1, the area is classified as being in "attainment" for that pollutant. If the concentration of a criteria pollutant in an area is above the level in Table 4-1, the area is classified as "nonattainment" for that pollutant. An area can be in attainment for five pollutants while being in nonattainment for the remaining pollutant, or any combination thereof. An area in nonattainment status is required by federal law to develop a State Implementation Plan (SIP) to describe how the area will meet the NAAQS standards. Once approved by USEPA, the SIP is implemented, and USEPA imposes regulations on pollutant emissions as well as designating a period for the compliance actions to be completed.

Volatile organic compounds (VOCs), although not a criteria pollutant, generally are quantified along with the criteria pollutants. VOCs and NO_x are considered O_3 precursors due to the reaction of VOCs with NO_x in the presence of sunlight to form ground-level O_3. Generally, O_3 is not emitted directly and is considered a "secondary" pollutant. Therefore, it is more accurate to track the precursors to determine O_3 impacts, with VOCs replacing O_3 in typical air emissions inventories (AEIs).

Under Title III of the CAA and its amendments of 1990, USEPA is required to promulgate National Emission Standards for Hazardous Air Pollutants (NESHAPs) to regulate certain source categories that emit hazardous air pollutants (HAPs). Currently, 187 chemicals are classified as HAPs by USEPA (40 CFR Part 63.741).

San Antonio Early Action Compact

San Antonio is currently the largest corporate city in the Nation that is not designated in nonattainment for the criteria pollutants under the NAAQS. Nevertheless, during the O_3 seasons of 2000 through 2002, local air quality monitors recorded O_3 levels above the concentrations allowed under the 8-hour O_3 NAAQS. Moreover, in June 2002, area monitors recorded some of the highest 8-hour and 1-hour O_3 values on record since 1998. In December 2003, USEPA indicated its intent, barring review of compelling evidence from the State to the contrary, to designate the counties of Bexar, Comal, Guadalupe and Wilson as nonattainment of the 8-hour O_3 NAAQS. USEPA's designations became final on 15 June 2004, designating Bexar, Comal and Guadalupe Counties as nonattainment with a deferred date under the Early Action Compact (EAC). The EAC enables Bexar County to maintain its attainment status with the NAAQS for all pollutants until a specified future date, provided certain air quality parameters are maintained.

Since the USEPA guidance suggests that the boundary of the 1999 San Antonio Metropolitan Statistical Area (MSA) be considered as the boundaries for new 8-hour O_3 nonattainment areas, air quality planning has focused on Bexar, Comal and Guadalupe Counties (termed the "San Antonio EAC Region" [SAER]). Currently, the San Antonio MSA comprises Atascosa, Bandera, Bexar, Comal, Guadalupe, Kendall, Medina and Wilson Counties. The locations of these counties and the installations are shown in Figure 4-5.

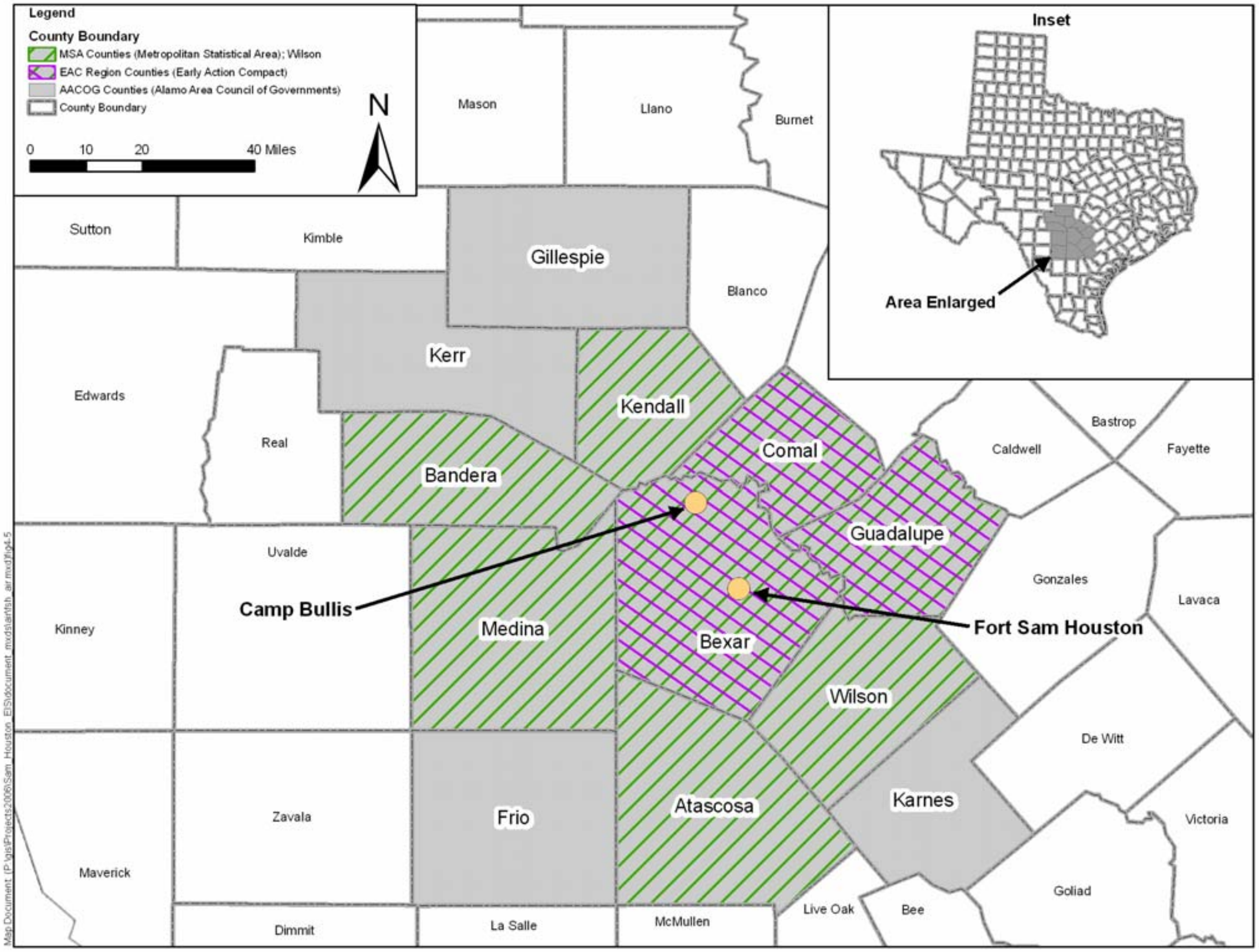


Figure 4-5 Map of San Antonio Air Quality Management Counties
Source: AACOG Counties: www.aacog.com
EAC Counties: USEPA, www.epa.gov/air/eac/areamaps.html
MSA Counties: Texas State Data Center, http://txsdc.utsa.edu/tpepp/msa03_list.php

In 1999, in response to the promulgation of the new 8-hour O_3 NAAQS, local elected officials and air quality planners in the SAER "near nonattainment" area proposed the accelerated attainment area concept to the Texas Natural Resource Conservation Commission (TNRCC [now TCEQ]) and USEPA. This concept, which San Antonio designed to voluntarily achieve the 8-hour O_3 standard, eventually developed into the Early Implementation Plan, a precursor to the EAC. Neither concept ever was endorsed by USEPA, although in 2001, USEPA proposed the O_3 Flex Program (sometimes known as O_3 Flex) to allow areas to create voluntary plans to address the 1-hour O_3 standard.

This concept of early voluntary O_3 quality plans, or EACs, was endorsed by USEPA Region 6 in June 2002, then slightly modified and made available nationally in November of that year. These plans include all the necessary elements of a comprehensive air quality plan but are tailored to local needs and driven by local decisions. An EAC is designed to develop and implement control strategies, account for growth and achieve and maintain the 8-hour O_3 standard. This approach offers a more expeditious schedule for achieving emissions reductions earlier than USEPA's expected 8-hour implementation rule making, while providing "fail-safe" provisions for the area to revert to the traditional SIP process if specific milestones are not met.

The principles of the EAC, to be executed by local, State and USEPA officials, include:

- Early planning, implementation and emissions reductions leading to expeditious attainment and maintenance of the 8-hour O_3 standard
- Local control of the measures to be employed, with broad-based public input
- State support to ensure technical integrity of the early action plan
- Formal incorporation of the early action plan into the SIP
- Deferral of the effective date of nonattainment designation and related requirements so long as all EAC terms and milestones are met
- Safeguards to return areas to traditional SIP requirements should EAC terms or milestones be unfulfilled, with appropriate credit given for emissions-reduction measures implemented

On 9 December 2002, AACOG, representing the SAER, entered into an EAC agreement with TCEQ and USEPA, making it the first area in the Nation to begin the EAC process. A final EAC was developed and submitted to TCEQ on 31 March 2004.

On 2 June 2005, USEPA issued final approval to extend the deferral of the effective date of air quality designations for EAC areas that still will be covered by the 1-hour O_3 standard as they work to meet the

8-hour standard ahead of schedule. One of these areas is the SAER, which had entered into an EAC before April 2004 when USEPA designated areas for the 8-hour O_3 NAAQS. At that time, USEPA deferred the effective date of the nonattainment designation for the areas until 30 September 2005. USEPA now has extended the deferral of the effective date for each of the EAC areas until 31 December 2006. Due to the terms of the EAC, the San Antonio area must keep certain 1-hour O_3 controls in place until they meet the more protective 8-hour O_3 standard. In exchange for a deferred effective date of their 8-hour O_3 designation, AACOG has agreed to take action to achieve clean air earlier than required under the 8-hour O_3 standard (TCEQ, Early Action Compact Plans, http://www.tceq.state.tx.us/implementation/air/sip/eac.html).

San Antonio SIP Changes

The adopted revision to the SIP consists of an 8-hour O_3 attainment demonstration for the area based on the local plan submitted to TCEQ by the SAER in March 2004 under its EAC. This revision contains results of photochemical modeling and technical documentation in support of the attainment demonstration. As a result of these analyses, and at the request of AACOG, the revision includes changes to the VOC rules for degreasing and Stage 1 vapor recovery for all gasoline dispensing operations in the SAER with a monthly throughput greater than 25,000 gallons.

Various State and federal strategies on specific sources are scheduled to be promulgated and enforced by TCEQ and USEPA by 2007. These strategies will reduce emissions in the SAER in future years. The reduction estimations listed in Table 4-2 are calculated for the SAER counties of Bexar, Comal, Guadalupe and Wilson.

Table 4-2 Federal, State and Local Emissions Reduction Measures

Federally Issued Rules	**Estimated NO_x Reduction in 2007 (tons/day)**	**Estimated VOC Reductions in 2007 (tons/day)**
Area Source Reductions: On-board Refueling Vapor Recovery	0.00	8.20
On-road Source Reductions: National Low Emission Vehicle Program Tier II Vehicle Emission Standards Federal Regulation of On-road Diesel Engines	22.39	12.43
Non-road Source Reductions: Compression-ignition Vehicles and Equipment Spark-ignition Off-road Vehicles and Equipment Tier III Heavy Diesel Equipment Lawn and Garden Equipment Recreational Marine Standards Locomotives	1.10	10.97
Total Federal Reduction (tons/day)	23.49	31.60
State-issued Rules		
Area Source Reductions: Stage I Vapor Recovery (dispensing ≥125,000 gallons gasoline per month) Texas Administrative Code (TAC) Chapter 106, *Degreasing Controls*	0.00	7.61
Point Source Reductions: Senate Bill 766 – Grandfathered Power Plants Senate Bill 7 – Grandfathered Power Plants	39.51	1.06
Total State Reduction (tons/day)	39.51	8.67
Local Control Strategies		
Energy Efficiency/Renewable Energy Projects	0.06	0.00
Transportation Emissions Reduction Measures	0.32	0.92
Transportation Demand Management	0.03	0.03
Total Local Reduction (tons/day)	0.41	0.95

Source: TCEQ, SIP Revisions: Austin, San Antonio, and Northeast Texas EACs, http://www.tceq.state.tx.us/implementation/air/sip/nov2004eac.html

4.4.2 Conformity Status

In planning projects and activities, installations must consider the impacts on air quality. Two requirements govern consideration of air quality impacts: 1) NEPA; and 2) General Conformity provisions of the CAA, §176(c). The General Conformity Rule requires federal agencies to make written conformity determinations for federal actions in or affecting NAAQS nonattainment areas or maintenance areas. The requirements of the General Conformity Rule do not apply to actions in or affecting NAAQS in-attainment areas.

Since the SIP submitted to TCEQ demonstrates attainment with the new 8-hour O_3 NAAQS, Bexar County would be classified as being in attainment with all criteria pollutants if monitoring results show compliance with the O_3 NAAQS. Nevertheless, if the EAC counties do not continue to demonstrate compliance with both the old 1-hour and new 8-hour O_3 NAAQS, they may be designated formally as being nonattainment for O_3 as early as 31 December 2006.

FSH and Camp Bullis are located in Bexar County. A conformity analysis under the General Conformity Rule is not required for this EIS. Although the procedural requirements of the General Conformity Rule are not applicable to actions in or affecting NAAQS attainment areas, conformity with SIP or the Federal Implementation Plan (FIP) in these areas still must be ensured.

4.4.3 Affected Environment

Ambient Air Quality Conditions

Climate

FSH and Camp Bullis are located on the edge of the Gulf Coastal Plain, which results in a modified subtropical climate that is predominantly continental during the winter and marine during the summer. Normal mean temperatures in the San Antonio area range from 50.7° Fahrenheit (F) in January to 84.7°F in July. The summer is hot, with daily temperatures above 90°F more than 80 percent of the time. Extremely high temperatures are rare; the highest on record is 108°F in August 1986. Mild weather prevails during much of the winter, with below-freezing temperatures occurring, on average, about 20 days each year. The record low temperature was -6°F in January 1990 (U.S. Army, 1991).

The San Antonio area is situated between a semi-arid area to the west and the coastal area of heavy precipitation to the southeast. The average rainfall of 27.54 inches is sufficient for normal production of most crops; however, rainfall is highly variable from year to year in this region. Rainfall averages approximately 28 inches annually but may range from less than 20 to 40 inches, with some years having none at all (Eckhardt, 1995a). Precipitation is fairly well distributed throughout the year; the heaviest amounts fall during May and September. From April through September, precipitation usually consists of thunderstorms, with fairly large amounts falling in short periods. Most of the winter precipitation is light rain or drizzle. Because of its proximity to the Gulf of Mexico, tropical storms bring high winds and prolonged rainfall. Thunderstorms and heavy rainfalls have occurred in all months of the year. Hail of damaging intensity is rare, but light hail frequently accompanies the springtime thunderstorms. Measurable snow falls only once every three or four years; the greatest single snowfall recorded was 13.2 inches on 12 January 1985 (U.S. Army, 1991).

Northerly winds prevail during most of the winter, while southeasterly winds from the Gulf of Mexico prevail during the summer and near the ground surface for long periods during the winter. Winds at the upper levels (1,000 meters) are primarily from the south. Rather strong northerly winds occasionally occur during the winter in connection with "northers." No tornadoes of any consequence have been recorded in the immediate area since 17 April 1988, when an estimated 10 to 12 tornadoes associated with Hurricane Gilbert (a Class 5 hurricane) struck the area (U.S. Army, 1991).

Ambient Air Quality Monitoring

Ambient air quality is measured continuously in Texas by TCEQ's ambient monitoring network through continuous ambient monitoring stations (CAMS) located throughout the state. San Antonio and the surrounding counties currently have 19 CAMS reporting real-time ambient air quality conditions. The locations of these monitoring stations are shown in Figure 4-6. Data from these monitoring stations allow TCEQ to determine compliance with the NAAQS. Most stations monitor several pollutants, including O_3, NO_x, CO and $PM_{2.5}$. Nevertheless, for the purposes of NAAQS compliance determination, only O_3 results are discussed in this EIS. Table 4-3 summarizes the San Antonio area 1-hour and 8-hour O_3 averages; included are all CAMS in the San Antonio area: CAMS 23, 58, 59, 501, 502, 503, 504, 505, 506, 622 and 678 and the preferred alternative areas.

Table 4-3 San Antonio Area Average O_3 Concentrations

1-hour Averages >125 ppb			8-hour Averages >85 ppb		
Peak Value		Annual days >125 ppb	Peak value		Annual days >85 ppb
Date	ppb		Date	ppb	
No current 2006 averages over 125			6/13/2006	93	2
No 2005 averages over 125			10/17/2005	94	5
7/19/2004	128	1	7/19/2004	101	10
No 2003 averages over 125			5/28/2003	96	11
9/12/2002	130	2	9/12/2002	111	17
No 2001 averages over 125			6/18/2001	90	1
No 2000 averages over 125			9/18/2000	93	3
No 1999 averages over 125			8/5/1999	100	11
9/4/1998	141	1	9/4/1998	110	4
No 1997 averages over 125			No 1997 averages over 85		

Units: ppb = parts per billion
Source: TCEQ, http://www.tceq.state.tx.us/nav/data/O3_data.html
Texas Commission Environmental Quality (TCEQ), One-Hour Ozone High Value Days for 1997-2006, http://www.tceq.state.tx.us/cgi-bin/compliance/monops/ozone_exceedance.
Texas Commission on Environmental Quality (TCEQ), Eight-Hour Ozone High Value Days for 1997-2006, http://www.tceq.state.tx.us/cgi-bin/compliance/monops/8hr_exceed.

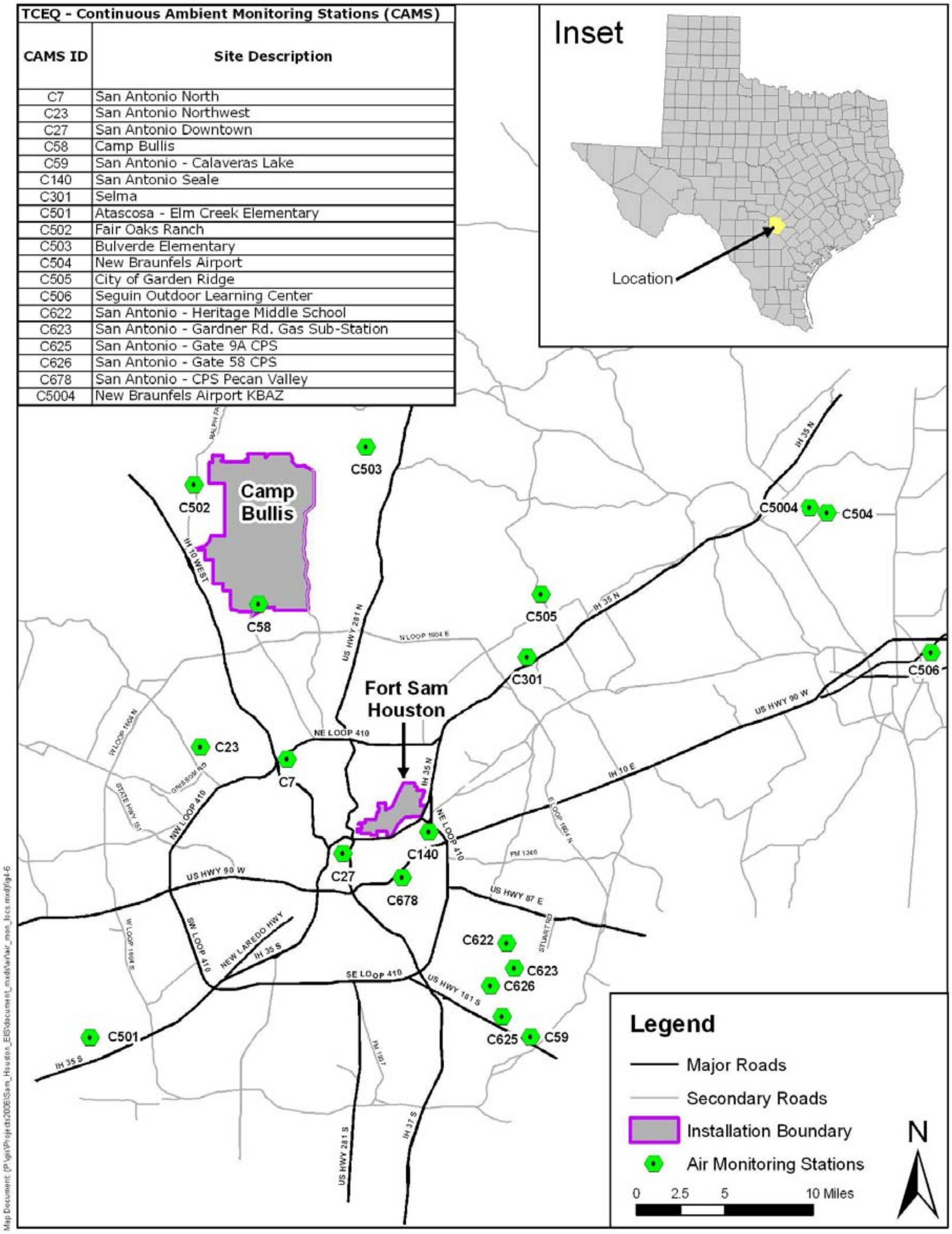


Figure 4-6 Map of San Antonio Area Continuous Ambient Air Monitoring Stations
Source: TCEQ Ambient Monitoring Network
Reference: TCEQ, www.tceq.state.tx.us/cgi-bin/compliance/monops/site_info

Air Pollutant Emissions at Fort Sam Houston and Camp Bullis

Fort Sam Houston

Stationary Sources

Table 4-4 shows the AEI data for FSH from 2005. The annual air emissions thresholds presented in Table 4-4 represent facilitywide levels. These total emissions are compared to the level, promulgated by TCEQ (State) and USEPA (federal), at which a stationary source must obtain a permit or authorization from TCEQ to install and operate a new piece of equipment.

Table 4-4 2005 FSH Actual Emissions

Emissions Source	Pollutant (tons/year)					
	PM_{10}	VOC	NO_x	SO_x	CO	Total HAPs
Boiler	1.93	1.39	20.45	0.15	21.29	2.07
Solvent Basins	0	0.06	0	0	0	0
Fuel Storage/Dispensing	0	0.60	0	0	0	0.30
Generators	0.55	0.63	7.74	0.51	1.67	0
Miscellaneous VOC	0	10.44	0	0	0	6.16
Surface Coating	0	0.16	0	0	0	0
Total	**2.48**	**13.28**	**28.19**	**0.66**	**22.96**	**8.53**
TCEQ Threshold[1]	**25**	**25**	**25**	**25**	**100**	**10**
Federal Threshold[2]	**100**	**100**	**100**	**100**	**100**	**25**

Source: FSH 2005 AEI, March 2006b.
[1] TCEQ *Permit by Rule Air Emissions Authorizations* (http://www.tceq.state.tx.us/assets/public/assistance/sblga/overview.pdf)
[2] Federal Major Source Threshold (http://www.tceq.state.tx.us/assets/public/permitting/air/Guidance/Title_V/pte.pdf)
Note: Thresholds are based on potential to emit, not actual emissions

Mobile Sources

Mobile source air emissions were calculated only for on-road vehicles. Air emissions from tactical and other off-road vehicles were not determined in this EIS. A baseline year of 2003 was selected, as this year was the most recent for which gate traffic data (vehicle counts) were available for FSH and Camp Bullis. The difference in air emissions between Baseline Year 2003 (gate count data) and Baseline Year 2005 (AEI data) would be negligible, as the mission of the installation did not change substantially during this period.

Vehicle counts were obtained from a programmatic Environmental Assessment (EA) completed in May 2004 for the access control measures at FSH and Camp Bullis (*Final Programmatic Environmental Assessment, Access Control Measures at Fort Sam Houston and Camp Bullis, Texas* [Geo-Marine Engineering and Environmental Services, Inc., 2004]). That EA also represented a vehicle count for a typical weekday passing through the installation gates. Increased vehicular traffic resulting from the preferred alternative assumed a 50 percent increase over the baseline vehicle gate counts at both FSH and Camp Bullis. A traffic increase of 50 percent was used, as opposed to 70 percent, because a disproportionate number of the increased personnel will be short-term students and trainees, as opposed to full-time installation staff. It was assumed that students and trainees will not be driving vehicles and that buses will be used to transport groups to off-installation training areas, such as Camp Bullis. Furthermore, the 50 percent increase was based on discussions with local regional planners and best assumptions indicating a historical regional growth rate of 2 percent per year for 20 years (equals 48.6 percent).

Vehicle gate count data were used as the average daily load of vehicles traveling on-installation. Vehicle model year, miles traveled and distribution of vehicle class were selected for air emissions calculations based on the assumption that each vehicle traveled 2.5 miles on-installation and 30 miles off-installation, 5 days per week, 50 weeks per year. Vehicle emissions factors for various types of vehicles were obtained from the USEPA compilation of air pollutant emissions factors (*AP-42, Fifth Edition Compilation of Air Pollutant Emission Factors*), Volume II (USEPA, 1995). Vehicle class and fuel used also were based on data provided in AP-42, Volume II. Emissions factors have been developed for eight basic vehicle classes, categorized by type of fuel burned and the respective gross vehicle weight (GVW). These eight vehicle classes and the on-road distribution used in mobile source emissions calculations are listed in Table 4-5. Vehicle class distribution was determined using AP-42, Volume II, Appendix I, by averaging the 2000 and 2010 distribution data.

Table 4-5 AP-42, Volume II, Vehicle Categories

Vehicle Class	On-road Distribution	Description
LDGV	68.9 percent	Light-duty gasoline-fueled vehicles (gasoline passenger vehicles)
LDGT1	11.4 percent	Light-duty gasoline-fueled vehicles, Type 1 (gasoline vehicles with a GVW less than 6,000 pounds)
LDGT2	8.5 percent	Light-duty gasoline-fueled vehicles, Type 1 (gasoline vehicles with a GVW between 6,001 and 8,500 pounds)
HDGV	1.5 percent	Heavy-duty gasoline-fueled vehicles (gasoline vehicles with a GVW exceeding 8,500 pounds)
LDDV	3.9 percent	Light-duty diesel-fueled vehicles (diesel passenger vehicles)
LDDT	1.9 percent	Light-duty diesel-fueled vehicles (diesel-fueled vehicles with a GVW less than 8,500 pounds)
HDDV	2.9 percent	Light-duty diesel-fueled vehicles (diesel-fueled vehicles with a GVW exceeding 8,500 pounds)
MC	1.0 percent	Motorcycles

Source: USEPA, 1995, AP-42, http://www.epa.gov/otaq/AP-42.htm

On- and off-installation vehicle emissions data are summarized in Table 4-6. Applicable vehicle emissions factors from AP-42, Volume II, are provided in Appendix B for reference, along with the vehicle emissions calculations. Appendix B also includes vehicle emissions data for each vehicle class.

Table 4-6 2003 FSH Estimated On- and Off-installation Vehicle Emissions (Baseline)

	Pollutant (tons/year)							
	VOC	CO	NO_x	PM	PM_{10}	$PM_{2.5}$	SO_x	Pb
On-installation								
Total	6.60	93.7	9.75	69.00	13.50	3.68	1.06	0.02
Off-installation								
Total	79.38	1,124.6	117.00	828.45	162.05	44.12	12.67	0.20
Total	**85.98**	**1,218.3**	**126.75**	**897.45**	**175.55**	**47.80**	**13.73**	**0.22**

Assumptions:
On-installation vehicle mileage is estimated at 2.5 miles per day, 5 days per week, 50 weeks per year
Average vehicle year model was 2000 model
Off-installation vehicle mileage is estimated at 30 miles per day, 5 days per week, 50 weeks per year
Average vehicle year model was 2000 model
PM – particulate matter

Camp Bullis

Stationary Sources

Stationary air pollutant emissions at Camp Bullis were based on the 2003 AEI and are shown in Table 4-7.

Table 4-7 2003 Camp Bullis Actual Air Emissions (Baseline)

	Pollutant (tons/year)					
Emissions Source	PM_{10}	VOC	NO_x	SO_x	CO	Total HAPs
Boiler	0.03	0.04	1.07	0.00	0.15	NC
Solvent Basins	-	0.08	-	-	-	NC
Fuel Storage/Dispensing	-	0.08	-	-	-	NC
Generators	0.05	0.05	0.67	0.04	0.14	NC
Woodworking	0.18	-	-	-	-	NC
Total	**0.25**	**0.25**	**1.74**	**0.05**	**0.29**	**NC**
TCEQ Threshold[1]	**25**	**25**	**25**	**25**	**100**	**10**
Federal Threshold[2]	**100**	**100**	**100**	**100**	**100**	**25**

Source: Dickson Consulting Group, LLC, June 2004, Camp Bullis 2003 AEI.
[1] TCEQ Permit by Rule Air Emissions Authorizations (http://www.tceq.state.tx.us/assets/public/assistance/sblga/overview.pdf)
[2] Federal Major Source Threshold (http://www.tceq.state.tx.us/assets/public/permitting/air/Guidance/Title_V/pte.pdf)
Note: Thresholds are based on potential to emit, not actual emissions

Mobile Sources

On- and off-installation vehicle emissions data are summarized in Table 4-8. Vehicle emissions factors were obtained from AP-42, Volume II. Appendix B details the process and calculations involved with vehicle emissions calculations.

Table 4-8 2003 Camp Bullis Estimated On- and Off-installation Vehicle Emissions (Baseline)

Installation	Pollutant (tons/year)							
	VOC	CO	NO_x	PM	PM_{10}	$PM_{2.5}$	SO_x	Pb
On-installation								
Total	0.07	0.93	0.10	0.70	0.14	0.04	0.01	0.0002
Off-installation								
Total	0.80	11.13	1.19	8.40	1.64	0.45	0.13	0.0019
Total	**0.87**	**12.06**	**1.29**	**9.10**	**1.78**	**0.49**	**0.14**	**0.00**

Assumptions:
On-installation vehicle mileage is estimated at 2.5 miles per day, 5 days per week, 50 weeks per year
Off-installation vehicle mileage is estimated at 30 miles per day, 5 days per week, 50 weeks per year
Average vehicle year model was 2000 model

Regional Air Pollutant Emissions Summary

Air pollutant emissions in the San Antonio area, as reported by AACOG for the year 2002, are presented in Table 4-9. Biogenic emissions sources were not included in Table 4-9 because biogenic emissions from FSH and Camp Bullis were not available. Vehicle emissions were broken out by on-road and non-road emissions sources for the San Antonio area, whereas FSH and Camp Bullis vehicle emissions data for road and non-road sources have not been determined separately.

Table 4-9 2002 San Antonio Area Emissions Summary

Emissions Source	Pollutant (tons/year)		
	VOC	NO_x	CO
Point Sources	1,952.7	29,715.0	8,048.9
Non-road Sources	145.0	159.7	1,398.0
On-road Sources	22,829.6	45,052.5	320,485.8
TOTAL	24,927.3	74,927.2	329,932.7

Reference: AACOG, www.aacog.com/naturalresources/2002_net_ei

4.4.4 Consequences

Realignment (Preferred) Alternative

Fort Sam Houston

Stationary Sources

Emissions for future development were based on current available construction data for the projects listed in Table 2-3. Each project was reviewed to obtain information for external combustion sources (boilers, furnaces and water heaters), internal combustion (emergency generators) and fuel storage tanks. If a generator was not indicated for an individual project, it was assumed that no generator would be added.

When construction data did not provide specifications for a boiler/heater, a conservative heating demand estimate was used to determine boiler/heater sizing based on facility square footage. A factor of 25 British thermal units (Btu) per sf (Btu/sf) of occupied facility space was used for the estimate. With an assumed 85 percent boiler/heater efficiency, this requires approximately 30 Btu/sf of boiler/heater capacity to heat the occupied space.

Chemical usage is expected to increase in the BAMC pathology laboratories. It is anticipated that formalin and xylene usage will increase by 25 percent. No paint booths are planned, so no increase in surface coating operations is expected. Table 2-3 identifies two vehicle maintenance shops, so solvent basin operations are expected to increase slightly as a result of the preferred alternative. Estimates of stationary source air emissions resulting from the preferred alternative are summarized in Table 4-10.

Table 4-10 FSH Estimated BRAC Action Stationary Source Emissions Increases

	Pollutant (pounds/year)					
Emissions Source	**PM_{10}**	**VOC**	**NO_x**	**SO_x**	**CO**	**Total HAPs**
Boiler	3,621.3	2,620.7	23,824.2	285. 9	40,024.7	896.9
Fuel Storage/Dispensing	0.0	1,492.1	0.0	0.0	0.0	760.1
Generators	21.2	25.4	573.3	18.8	128.8	0.4
Miscellaneous VOC		9,065.8				6,518.0
Total (pounds/year)	**3,642.4**	**13,204.0**	**24,397.5**	**304.7**	**40,153.5**	**8,175.4**
Total (tons/year)	**1.82**	**6.60**	**12.20**	**0.15**	**20.08**	**4.09**

Assumptions:
Boiler consumption would remain approximately equivalent to current consumption per Btu.
All new boilers would have low NO_x burners where available.
New generators are fueled with diesel.
Generator operational hours were estimated at 12 hours.

Mobile Sources

Future vehicle emissions estimates were based on percentage of growth, conservatively estimated at 50 percent of current vehicle traffic as a result of the preferred alternative. Estimated emissions by 2011 for on- and off-installation vehicle usage resulting from the preferred alternative are presented in Table 4-11.

Table 4-11 2010 FSH Estimated On- and Off-installation Vehicle Emissions Resulting from the Realignment (Preferred) Alternative

	Pollutant (tons/year)							
	VOC	**CO**	**NO_x**	**PM**	**PM_{10}**	**$PM_{2.5}$**	**SO_x**	**Pb**
On-installation								
Total	9.92	140.59	14.63	103.58	20.26	5.52	1.58	0.03
Off-installation								
Total	119.05	1,687.02	175.57	1,242.89	243.12	66.19	19.00	0.303
Total	**128.97**	**1,827.61**	**190.20**	**1,346.46**	**263.38**	**71.71**	**20.59**	**0.33**

Assumptions:
On-installation vehicle mileage is estimated at 2.5 miles per day, 5 days per week, 50 weeks per year
Off-installation vehicle mileage is estimated at 30 miles per day, 5 days per week, 50 weeks per year
Average vehicle year model was 2007 model

The vehicle emissions comparison between the baseline year of 2003 and the post-implementation of preferred alternative emissions of 2010 for FSH is presented in Table 4-12. The total estimated on-installation vehicle emissions for all vehicle categories were added to the off-installation vehicle emissions estimates for all vehicle categories.

Table 4-12 Vehicle Emissions Summary

	Pollutant (tons/year)							
	VOC	**CO**	**NO_x**	**PM**	**PM_{10}**	**$PM_{2.5}$**	**SO_x**	**Pb**
2003*	85.99	1,218.30	126.78	897.49	175.55	47.80	13.72	0.21
2010**	128.97	1,827.61	190.20	1,346.46	263.38	71.71	20.59	0.33
Change 2003/2010	**42.98**	**609.3**	**63.4**	**449.0**	**87.8**	**23.9**	**6.9**	**0.12**

Notes:
* 2003 from Table 4-6
** 2010 from Table 4-11

Camp Bullis

Stationary Sources

Boilers and heaters will make the greatest contribution to the overall air emissions increase as a result of the preferred alternative at Camp Bullis. A small emissions increase can be attributed to anticipated parts cleaners at the proposed vehicle maintenance facility. Stationary source air emissions estimates after all BRAC actions have concluded are summarized in Table 4-13.

Table 4-13 2010 Camp Bullis Estimated BRAC Action Air Emissions Increases

	Pollutant					
	PM_{10} (pounds/year)	**VOC (pounds/year)**	**NO_x (pounds/year)**	**SO_x (pounds/year)**	**CO (pounds/year)**	**Total HAPs (pounds/year)**
Boiler	30.8	22.3	202.6	2.4	340.3	0.00
Solvent Basins	0.00	0.10	0.00	0.00	0.00	0.00
Total (pounds/year)	**30.8**	**22.4**	**202.6**	**2.4**	**340.3**	**0.00**
Total (tons/year)	**0.02**	**0.01**	**0.10**	**0.00**	**0.17**	**0.00**

Assumptions:
Boiler consumption would remain approximately equivalent to current consumption per Btu.
All new boilers would have low NO_x burners where available.
No increase in surface coating or solvent basin operations due to BRAC actions.

Mobile Sources

Future vehicle estimates were based on percentage of growth, conservatively estimated at 50 percent of current vehicle traffic. Estimated emissions for on- and off-installation vehicle usage after implementation of the preferred alternative by 2011 are presented in Table 4-14.

Table 4-14 2010 Camp Bullis Estimated On- and Off-installation Vehicle Emissions After BRAC Action

	Pollutant (tons/year)							
	VOC	**CO**	**NO_x**	**PM**	**PM_{10}**	**$PM_{2.5}$**	**SO_x**	**Pb**
On-installation								
Total	0.10	1.40	0.15	1.08	0.21	0.06	0.02	0.00
Off-installation								
Total	1.22	16.85	1.83	12.95	2.53	0.69	0.19	0.0030
Total	**1.32**	**18.25**	**1.98**	**14.03**	**2.74**	**0.75**	**0.21**	**0.00**

Assumptions:
On-installation vehicle mileage is estimated at 2.5 miles per day, 5 days per week, 50 weeks per year
Off-installation vehicle mileage is estimated at 30 miles per day, 5 days per week, 50 weeks per year
Average vehicle year model was 2007 model

The vehicle emissions comparisons between the baseline year of 2003 and the post-implementation of preferred alternative emissions of 2010 for Camp Bullis are presented in Table 4-15. The total estimated on-installation vehicle emissions for all vehicle categories were added to the off-installation vehicle emissions estimates for all vehicles categories.

Table 4-15 Vehicle Emissions Summary

	Pollutant (tons/year)							
	VOC	**CO**	**NO_x**	**PM**	**PM_{10}**	**$PM_{2.5}$**	**SO_x**	**Pb**
2003*	0.9	12.1	1.3	9.1	1. 8	0.5	0.1	0.0
2010**	1.32	18.25	1.98	14.03	2.74	0.75	0.21	0.00
Change 2003/2010	**0.42**	**6.15**	**0.68**	**4.93**	**0.94**	**0.25**	**0.11**	**0.00**

Notes:
* 2003 from Table 4-8
** 2010 from Table 4-14

As indicated in Table 4-15, the overall impact of the preferred alternative on the air quality of San Antonio and the surrounding area is negligible. New activities at FSH and Camp Bullis resulting from the preferred alternative will be minimal, with no significant impact to the air quality in the surrounding area in general.

Minor Siting Variations

Consequences for the minor proposed siting variations would be the same as the preferred alternative.

No Action Alternative

Under the no action alternative, neither FSH nor Camp Bullis would accept the relocation of units from closing facilities. No additional construction would be completed; no additional vehicles would be used on-installation. Therefore, the air quality of the installation would change in accordance with regional changes. Regional air quality changes would be dependent on future SIP-mandated air quality improvement programs and offset by actual growth within the region.

4.5 NOISE

Section 4(b) of the Noise Control Act (NCA) of 1972 (PL 92-574) directs federal agencies to comply with applicable federal, state and local noise requirements with respect to the control and abatement of environmental noise. Congress defined environmental noise in the NCA to mean the intensity, duration and character of sounds from all sources. The City of San Antonio and the State of Texas have not enacted noise regulations or statutes.

Noise is commonly defined as any sound that is undesired or interferes with hearing or that is loud. Noise pollution is defined as "environmental pollution consisting of annoying or harmful noise." A number of sounds produced by Army installations are considered noise or noise pollution by the military community and those who live and work around installations.

4.5.1 Affected Environment

Description of Noise Sources

Noise sources common to FSH and Camp Bullis include helicopters, nontactical vehicles and routine operation of equipment and machinery (*e.g.,* generators; heating, ventilation and air conditioning; and construction equipment). The primary sources of noise associated with construction activities would be the use of heavy trucks (dump trucks and concrete mixers), bulldozers, backhoes, generators and ground compactors. These vehicles and equipment items generate noise during demolition/deconstruction, site and foundation preparation, construction and finishing work. The levels of noise generated by these vehicles and equipment during these activities are shown in Table 4-16.

Table 4-16 Peak Sound Pressure Level of Heavy Equipment

Equipment	Noise Level * (dBA)
Bulldozer	62-95
Scraper	76-98
Front Loader	77-94
Backhoe	74-92
Grader	72-92
Crane	70-94

* From a single source at a distance of 50 ft
Source: U.S. Department of Transportation (DOT) Special Report at http://www.fhwa.dot.gov/environment/noise/highway/hcn06.htm
dBA = "A" weighting

There would be a slight increase in overall noise levels at the preferred alternative site from construction activity and the slight increase in vehicle traffic. Descriptions of these sources and other noise sources that are specific to each installation are provided below.

- **FSH:** Sources of noise at FSH are automobiles and helicopter Life Flight operations. The Life Flight operations using the BAMC helipad have neither established routes into/out of the helipad nor altitude restrictions, but the general directions of the Life Flight routes are to the northeast, southeast and southwest (Figure 4-7). Helicopters involved with Life Flight operations include the Bell 206, Bell 412 and Black Hawk Utility Helicopter (UH-60).

- **Camp Bullis:** The major sources of noise at Camp Bullis include small arms ranges, the use of explosive simulators in training areas and ranges, the use of explosives during quarrying and training exercises and aircraft noise. Noise sources are interspersed throughout the installation.

Noise Descriptors

The day-night level (DNL) is the primary descriptor for military noise, except for small arms. DNL combines five major factors of noise annoyance into a single index: loudness, duration, number of occurrences, time of day and nature of the disturbance. The DNL is the time-weighted energy average sound level occurring over a 24-hour period with a 10-decibel (dB) penalty added to the nighttime levels between 10 p.m. and 7 a.m. Sound is the variation of the air pressure about a mean atmospheric pressure of 1.47 pounds per square inch (psi). Sound pressure levels are expressed as dBs.

Humans hear higher-pitched sounds more easily than lower ones of the same magnitude. A standard weighting curve, labeled the “A” weighting, is applied to measured sound levels to compensate for the different perceptions of loudness. Decibel values for this weighting are expressed as dBA (“A”-weighted decibels).

Previous Noise Analyses

Existing noise data that are relevant to this EIS include an analysis of helicopter annoyance flight path corridors at FSH and an analysis of aircraft engine simulation and pyrotechnics noise associated with the medical training facility. These data are summarized below:

- **FSH:** The maximum noise levels of the UH-60 and “slant” distances of 200, 500 and 1,000 feet are 91, 83 and 76 dBA, respectively. The slant distance is defined as the hypotenuse of the triangle represented by the altitude of the aircraft and the distance between the receiver and the aircraft’s ground track distance (Enclosure 5, Appendix C). The low number of aircraft operations is not sufficient to generate “A”-weighted DNL contours.
- **Camp Bullis:** Noise sources that will be associated with this facility include a high-velocity fan that is used to simulate the sound of an aircraft engine and blank ammunition, smoke grenades, flares and pyrotechnics associated with the craftsman’s leader’s course that will be conducted at this facility. Approximately 30 craftsman’s courses are held each year. The average amount of blanks, smoke grenades, flares and simulators used for these courses is listed below (Morgan, 2006).

M4 5.56-millimeter (mm) blank ammunition	31,320 rounds/class average
7.62-mm blank ammunition	8,400 rounds/class average
Smoke, hand grenade, purple	2.4 rounds/class average
Ground burst simulator (GBS)	3 rounds/class average
M115A2 Flare, trip, Cyalume	10 rounds/class average

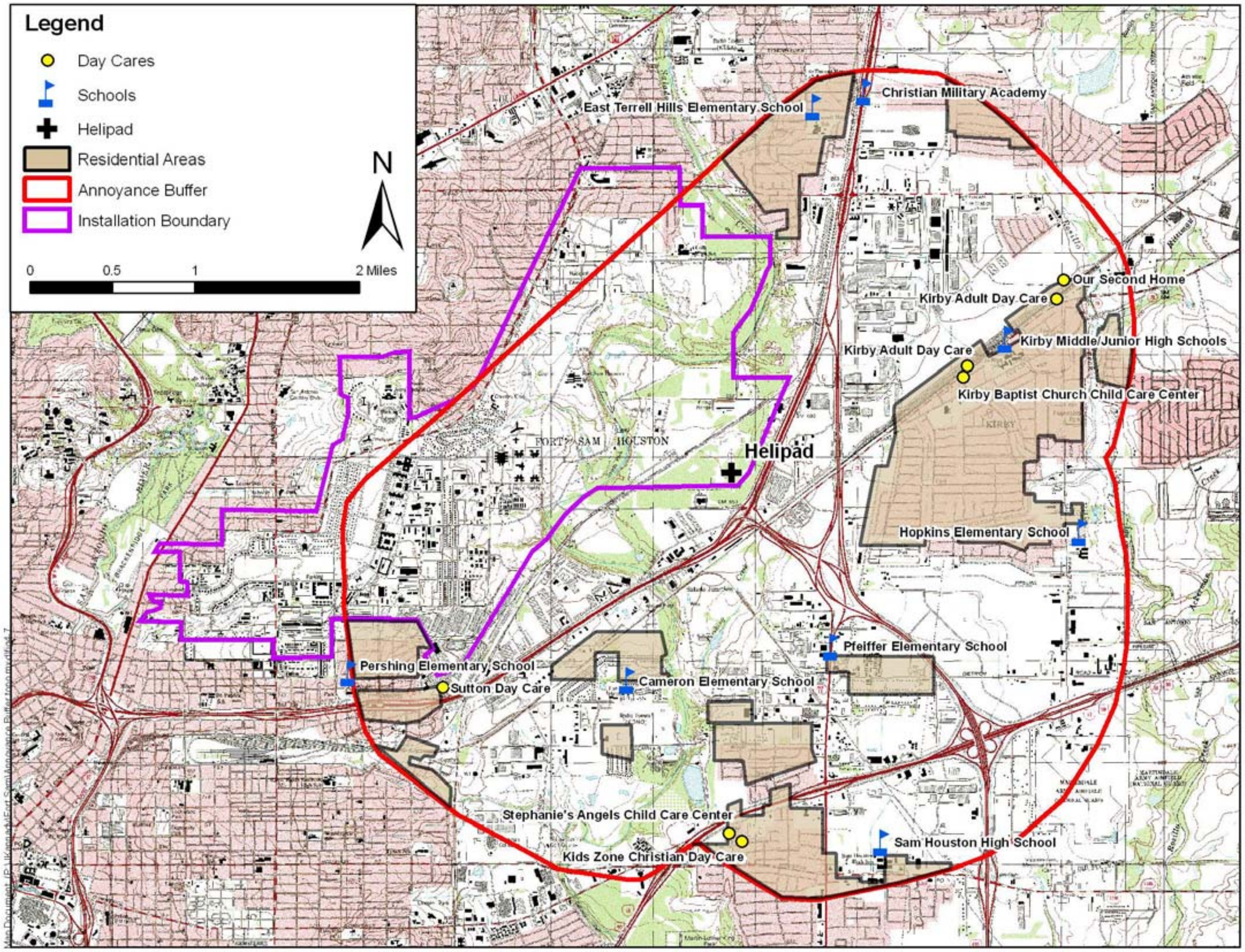


Figure 4-7 FSH Annoyance Buffer Area Map
Source: USACHPPM, 2006 (Appendix C)

4.5.2 Consequences

Realignment (Preferred) Alternative

Noise impacts would be considered significant if there were expected long-term increases in the number of people highly annoyed by the noise environment or unacceptable increases[6] to the noise environment for sensitive receptors. A sensitive receptor is defined as any person or group of persons in an environment where low noise levels are expected, such as schools, day care centers, hospitals and nursing homes. The City of San Antonio Municipal Code defines noise-sensitive uses to include these noise-sensitive receptors:

- Residences
- Religious institutions
- Libraries
- Museums
- Concert halls
- Bank shells
- Auditoriums
- Research facilities
- Other land uses that require a quiet environment to function effectively

Construction Noise

The primary sources of noise associated with construction activities under the preferred alternative would be the use of heavy trucks (dump trucks and concrete mixers), bulldozers, backhoes, generators and ground compactors. These vehicles and equipment items generate noise levels of 80 to 85 dBA. Noise-sensitive areas at FSH include BAMC and the three schools in the FSH Independent School District (ISD). The ISD schools include the Robert G. Cole Junior/Senior High School, the FSH Elementary School and an alternative education school. Noise effects to occupants of these facilities would not be expected due to the noise level reduction in aircraft noise of 20 dB normally provided by permanently constructed buildings.

There are no noise-sensitive uses at Camp Bullis. Construction noise would be managed as an occupational health matter under Occupational Safety and Health Administration (OSHA) regulations at 29 CFR 1926.

[6] An unaccepted increase is determined loosely based on an increase of noise complaints received by the installation.

Operational Noise

FSH MEDEVACS. Figure 4-7 shows the annoyance buffer for MEDEVAC flight operations. As a result of the preferred alternative, an increase in MEDEVAC flight operations will occur due to the movement of all trauma medical operations for WHMC to BAMC. MEDEVAC flights to FSH will increase from an average of one per day to two per day. The effect on environmental noise from this increase in operations is expected to be negligible due to the limited time these flights are in the annoyance buffer and on the helipad southeast of BAMC and due to the routing over major transportation corridors of IH-35 and IH-40 to the south, east and southeast of FSH. The annoyance buffer is near the departure centerline of Runway 12R and the final approach course of Runway 30L for SA IAP. Jet aircraft ascend to an altitude of 3,000 feet above mean sea level (amsl) above FSH (Stonewall Jackson Field, which is north of Pershing Field at FSH), then turn left or right for their destination. Aircraft approaching Runway 30L begin their descent at an altitude of 2,600 feet amsl (National Geodetic Vertical Datum [NGVD]) near a point above the rail line to the north of Pershing Field.

Existing noise-sensitive uses within the annoyance buffer are shown in Figure 4-7. The non-residential noise-sensitive uses are listed below.

East Terrell Hills Elementary School
Christian Military Academy
Hopkins Elementary School
Pfeiffer Elementary School
Cameron Elementary School
Pershing Elementary School
Kirby Middle/Junior High Schools
Sam Houston High School
Kirby Baptist Church Child Care Center
Kirby Adult Day Care (two locations)
Our Second Home
Sutton Day Care
Stephanie's Angels Child Care Center
Kid's Zone Christian Day Care

Camp Bullis. A sound system with outside speakers is used to provide exercise inputs at the medical training facility. Sounds from these speakers cannot be heard beyond 100 meters. The medical trainers have direct control over the exercise speaker volume. Several generators may be in use at any time during field medical training activities. Generator noise for the adjacent Deployable Medical Systems Equipment for Training (DMSET) facility was evaluated in the *Environmental Assessment on Proposed U.S. Army Medical Department Center and School Training Parks at Camp Bullis* (USACE, 1995), which included an Environmental Acoustics Assessment (Appendix C). A maximum 24-hour DNL contour calculated for 100-kilowatt (kW) generators showed a 55-dB DNL contour extending less than 2,300 feet from DMSET. This sound contour is approximately 1,500 feet within the west boundary of Camp Bullis (USACE, 1995). Sound levels from the use of generators at the medical training facility would not be expected to exceed the levels generated at DMSET.

The craftsman's course also would generate noise from the use of blank ammunition, smoke grenades, flares and pyrotechnics. GBSs would generate the loudest noise of these materials. In December 1998, Camp Bullis measured GBS at distances of 500 to 1,200 meters from simulator explosions at a point far inside the installation boundary. Mean "A"-weighted peak noise levels were 84.8 dB (USACHPPM, 1999b).

The BN interrogation training range would not produce noise from pyrotechnics or other sources. All interrogation training activities would occur indoors. Noise levels near the medical training facility may increase to a minor degree from generator and GBS usage. There would be no effects beyond the local vicinity.

Minor Siting Variations

Minor siting variations described in Section 3.4 would have the same impacts as the preferred alternative.

No Action Alternative

Under the no action alternative, conditions affecting noise at FSH and Camp Bullis would remain the same and there would be no significant impacts.

4.6 GEOLOGY AND SOILS

4.6.1 Geology and Soils

Fort Sam Houston

Figure 4-8 shows that the lithologic units underlying FSH are mapped as the Cretaceous Navarro Group and Marlbrook Marl undifferentiated, overlain with Quaternary terrace deposits. The upper part of the Navarro Group is mostly medium gray to bluish gray clay, silty and in parts sandy, which increases downward. This portion is calcareous and glauconitic, with calcareous concretions common. Marine fossils are scarce. The lower part is light to medium gray sand, silty, clayey and weakly coherent. Marine fossils are abundant locally. The Navarro Group is bedded indistinctly to thinly and has a thickness of 500 to 775 feet. Marlbrook Marl is medium bluish gray to yellowish gray marl, slightly glauconitic in the upper part, and highly plastic when wet. Marine fossils are scarce. It has a thickness of 150 to 450 feet and thins eastward. The Quaternary terrace deposits consist of gravel, sand and silt up to approximately 45 feet thick. As shown in Figure 4-8, the patient care, medical and other RDTE; medical training; and HQ and administrative support subareas are underlain by Quaternary terrace deposits. The low terrace deposits along the Salado Creek floodplain consist of recent alluvium. No borrow pits or quarries are in operation at FSH.

Figure 4-9 shows that land surface at FSH is moderately rolling. Ground surface elevations are level in the eastern portion of the installation at the patient care, medical and other RDTE subarea under the preferred alternative, ranging from approximately 625 feet amsl in the Salado Creek floodplain to 650 feet amsl near the eastern edge of the installation. Ground surface elevations range to over 750 amsl in two subareas of the preferred alternative: the medical training subarea and the HQ and administration subarea.

Figure 4-10 shows the soil types within the six soil series mapped at FSH by the NRCS. Table 4-17 shows the approximate percentage of land area covered by each of the soil series identified at FSH.

Table 4-17 FSH Soil Series and Percent Land Area Covered

Soil Series/Soil Types	Acreage	Percentage of Area
Houston Black/HuB, HuC	1,657	52.6
Lewisville/LvA, LvB	728	23.0
Tarrant/Tb	33	1.0
Frio/Fr	182	5.8
Trinity and Frio/Tf	137	4.4
Venus/VcA, VcB	413	13.2
Total	**3,150***	**100**

Source: FSH, 2001
* Includes the Veterans Administration Cemetery land

The eastern portion of FSH beneath the patient care, medical and other RDTE subarea primarily consists of very dark grayish brown to brown silty clay Lewisville series soils that overlie stream terrace deposits with smaller areas of dark gray to black, calcareous clay, and gravelly clay of the Houston Black series soils. The medical training subarea is underlain primarily with Houston Black series soils with smaller areas of Lewisville series soils. The HQ and administrative support subarea is underlain with Houston Black series soils. Venus series soils consisting of clayey loam are located near Salado Creek. Other soil types locally present at FSH near Salado Creek include the Tarrant series, Frio series and the Trinity and Frio series soils. These soil types are generally clays, gravelly clays or cobbly clays.

Based on the predominantly clay soil types present beneath the subarea FSH, infiltration is generally poor, and runoff can be fairly rapid over areas exhibiting 1 percent or greater slope. As a result, moderate to severe erosion potential exists on non-vegetated areas.

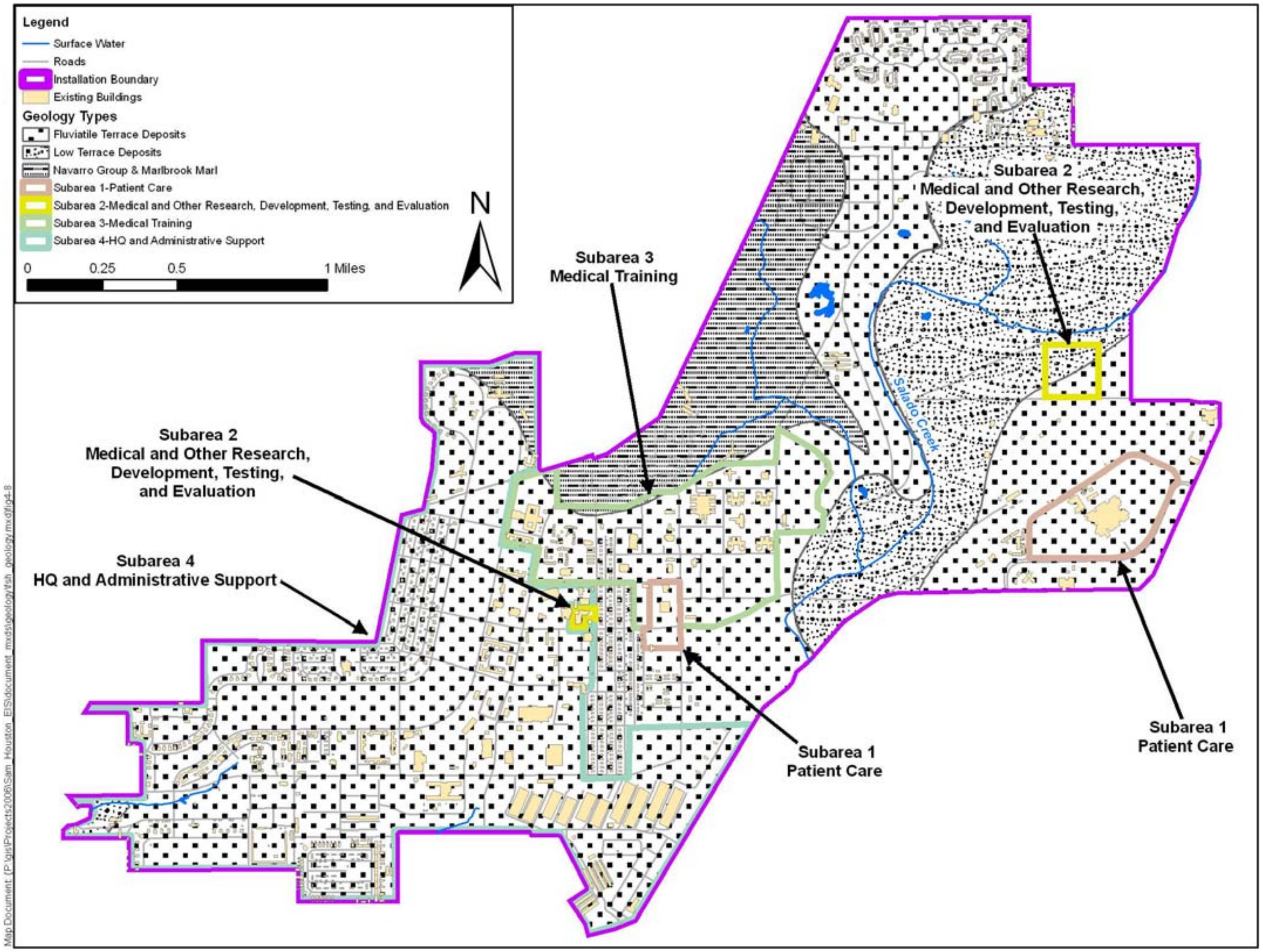


Figure 4-8 Map of Lithologic Units Underlying FSH
Source: Modified from U.S. Army, 1991

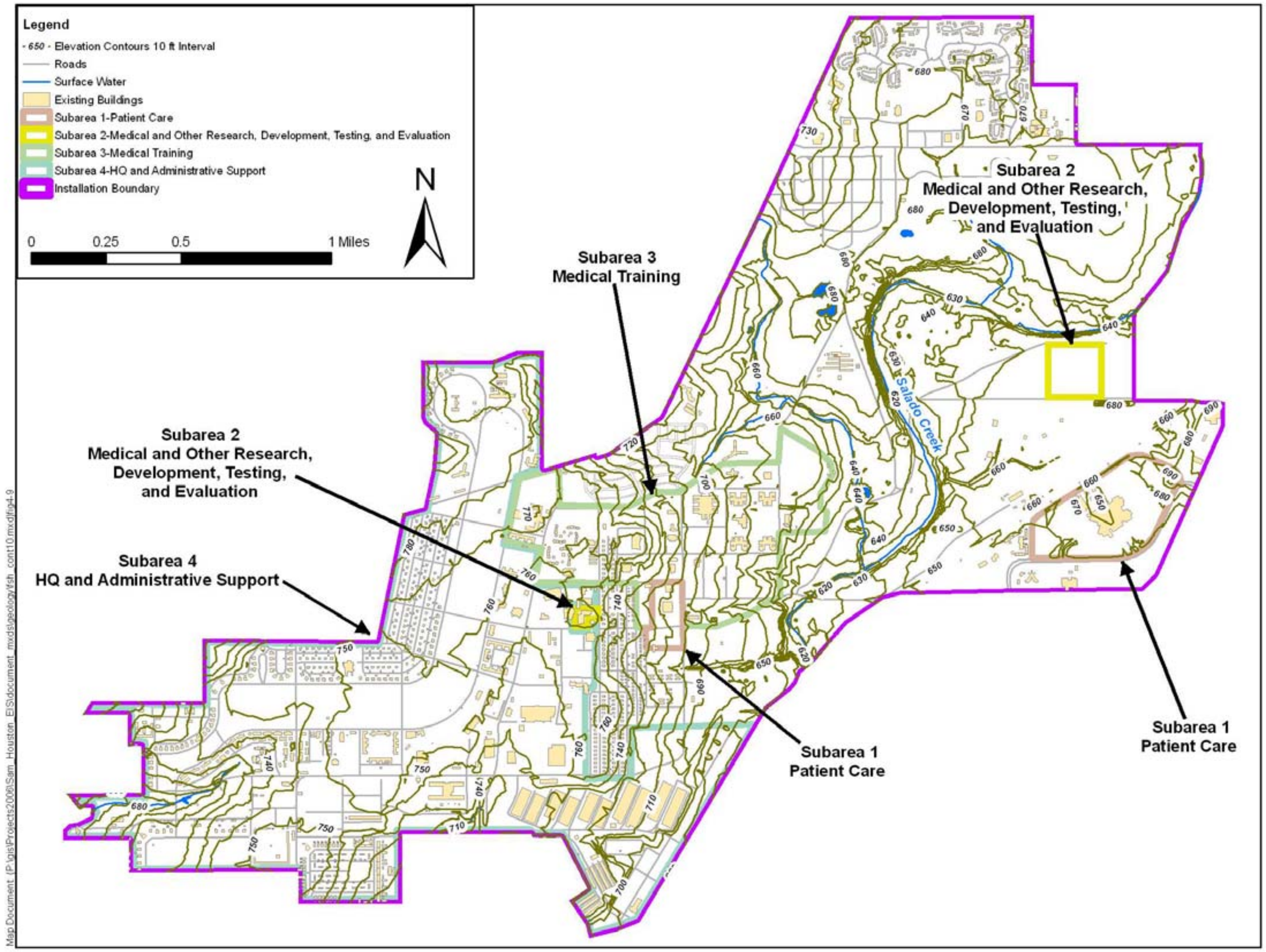
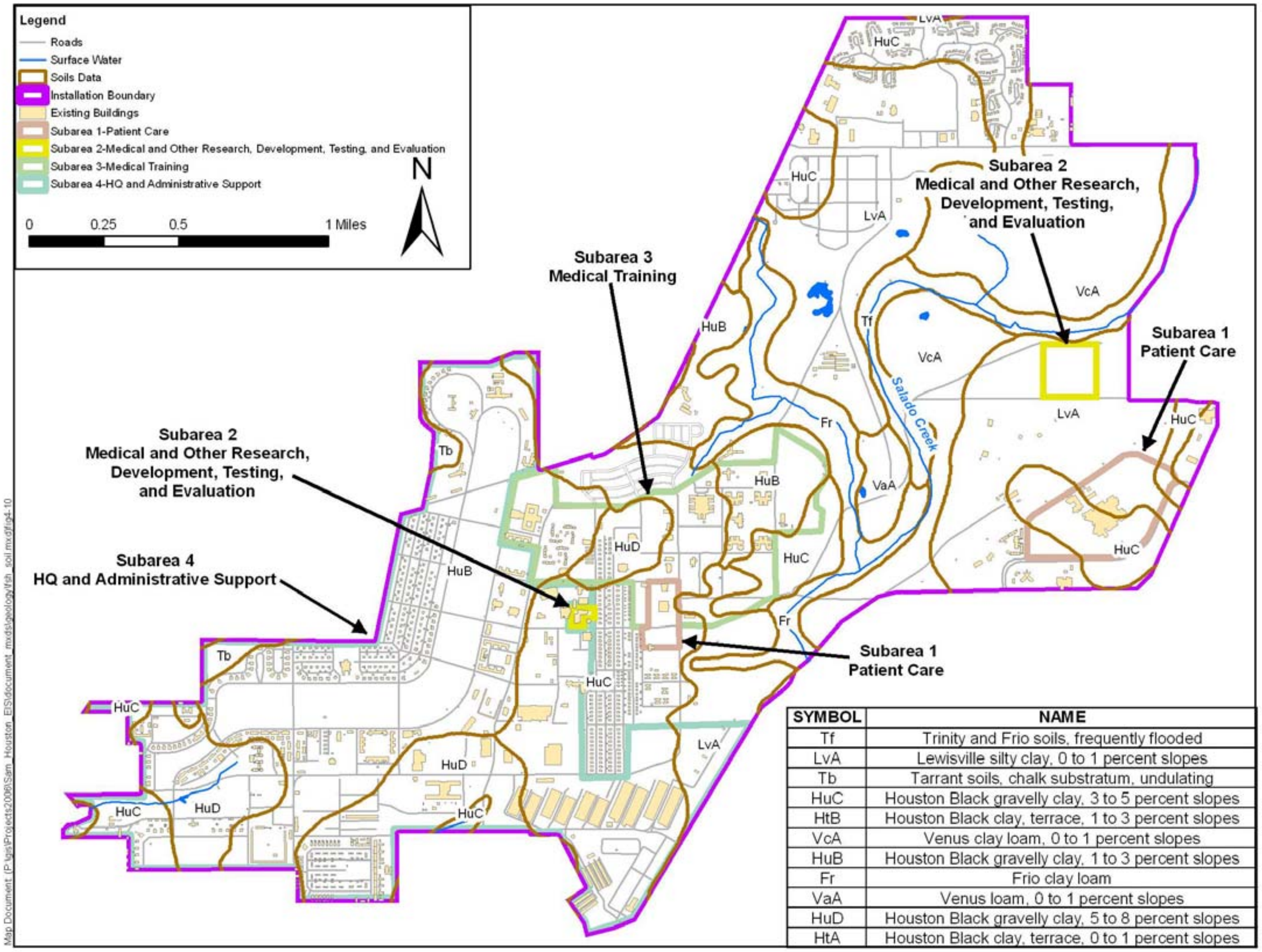


Figure 4-9 Surface Elevation Contour Map of FSH
Source: FSH GIS Department, 2006



SYMBOL	NAME
Tf	Trinity and Frio soils, frequently flooded
LvA	Lewisville silty clay, 0 to 1 percent slopes
Tb	Tarrant soils, chalk substratum, undulating
HuC	Houston Black gravelly clay, 3 to 5 percent slopes
HtB	Houston Black clay, terrace, 1 to 3 percent slopes
VcA	Venus clay loam, 0 to 1 percent slopes
HuB	Houston Black gravelly clay, 1 to 3 percent slopes
Fr	Frio clay loam
VaA	Venus loam, 0 to 1 percent slopes
HuD	Houston Black gravelly clay, 5 to 8 percent slopes
HtA	Houston Black clay, terrace, 0 to 1 percent slopes

Figure 4-10 Soils Map of FSH
Source: FSH GIS Department, 2006

Both the Houston Black series and Lewisville series soils underlying the majority of the installation exhibit a high corrosivity potential and a high shrink-swell potential.

Camp Bullis

Figure 4-11 shows that Camp Bullis is underlain primarily by formations of the upper and lower members of the Glen Rose Limestone (FSH, 2001). The upper member of the Glen Rose Limestone, which consists of beds of moderately resistant and massive chalky limestone (mudstone) alternating with beds of less resistant, marly (loose and crumbly) limestone, covers approximately 74 percent of Camp Bullis. The lower member of the Glen Rose Limestone covers 14 percent at the northern edge of the training site. Overlying a small portion of the Glen Rose at the southern edge of Camp Bullis is the Kainer Formation of the Edwards Group (U.S. Army, 2001b). Bedrock beneath the proposed medical training facility and the BN interrogation training range at Camp Bullis is mapped as the upper member of the Glen Rose Limestone.

The Camp Bullis landform is a typical representative of karst geology. Karst geology is defined as an aggregate of characteristic landforms (sinkholes and springs) and subsurface features (caves) produced primarily by the dissolution of soluble rocks (Soil Science Society of America [SSSA], 2005). At Camp Bullis, caves are located throughout the installation but are found predominately in the Lower Glen Rose Formation and Kainer Formation of the Edwards Group. As shown in Figure 4-11, one karst feature (Sharron Spring) has been identified near the western edge of the proposed medical training facility.

Figure 4-12 shows that Camp Bullis topography consists of numerous hills and valleys that are drained by intermittent streams that flow east and south. Salado Creek and Lewis Creek are the major drainages that direct surface water runoff from Camp Bullis (U.S. Geological Survey [USGS], 1992). Faulting and erosional differences between the stratigraphic units of the Glen Rose Limestone have resulted in the formation of a terrace type of topography. King Ridge (elevation 1,515 feet amsl), Otis Ridge (elevation 1,480 feet amsl), and High Hill (elevation 1,490 feet amsl) are the most prominent landforms on Camp Bullis. The ground surface slopes from north to south-southeast at the proposed medical training facility, with elevations ranging from approximately 1,250 to approximately 1,110 feet amsl.

Figure 4-13 shows that the predominant soils on Camp Bullis are the Tarrant (Tr) and Bracket (BrG) series. These thin clay soils formed in weathered limestone bedrock. The Tarrant series occurs on gently undulating, 1 to 5 percent slopes, and consists of stony soils of limestone prairies. The Bracket series is on steeper slopes (12 to 30 percent) and is predominantly clay and loam.

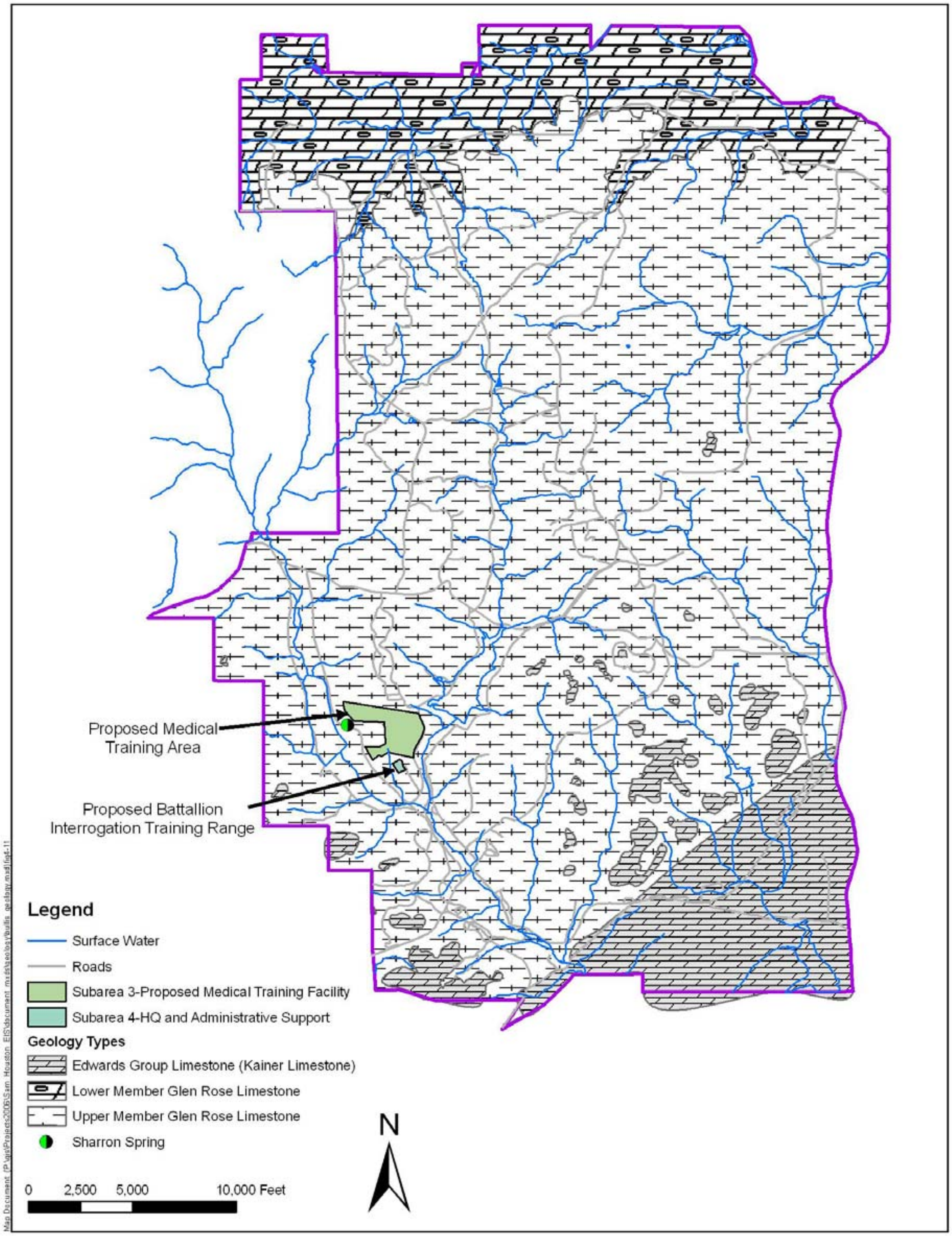


Figure 4-11 Map of Lithologic Units Underlying Camp Bullis
Source: Modified from FSH, 2001

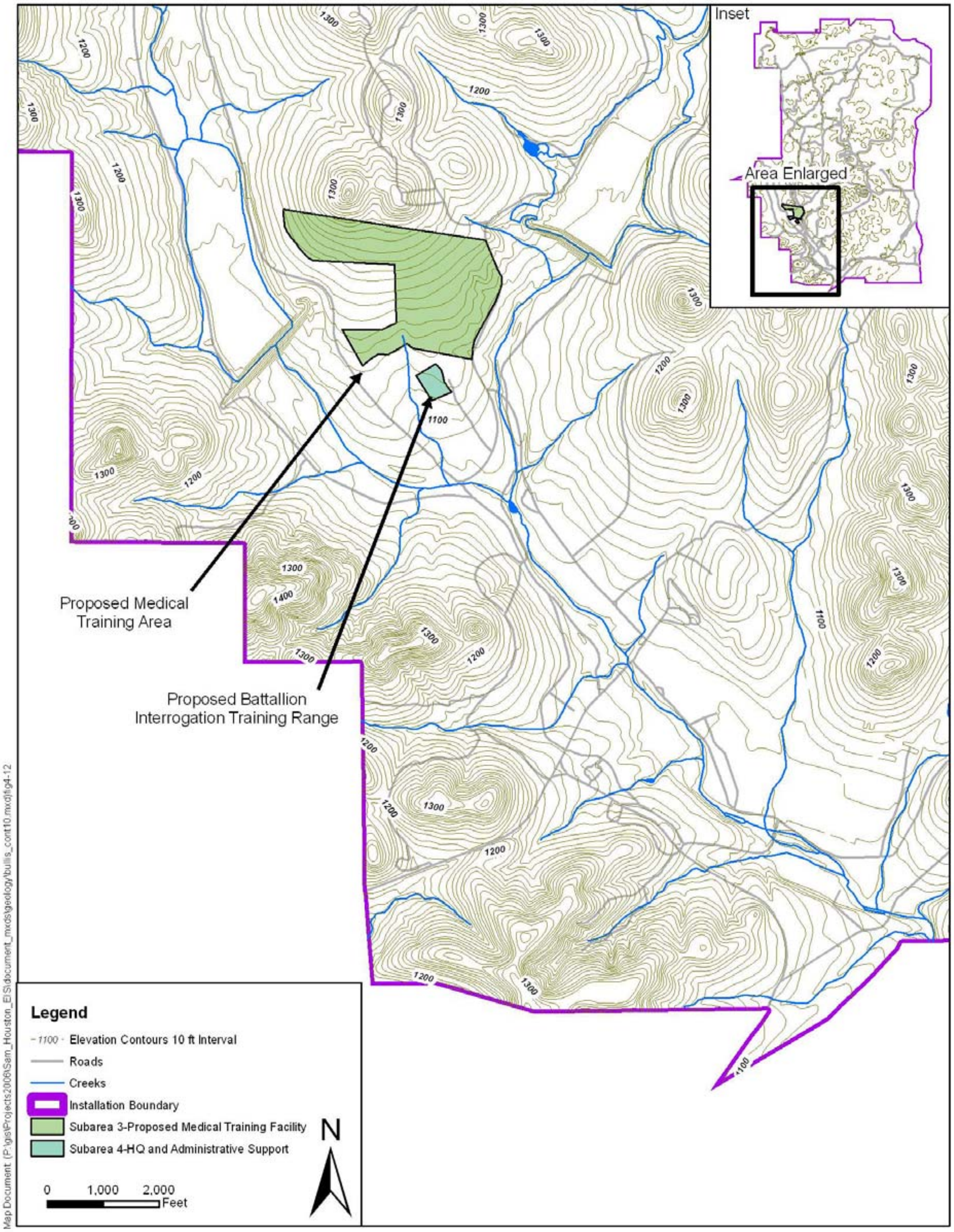


Figure 4-12 Surface Elevation Contour Map of Southwest Portion of Camp Bullis
Source: FSH GIS Department, 2006

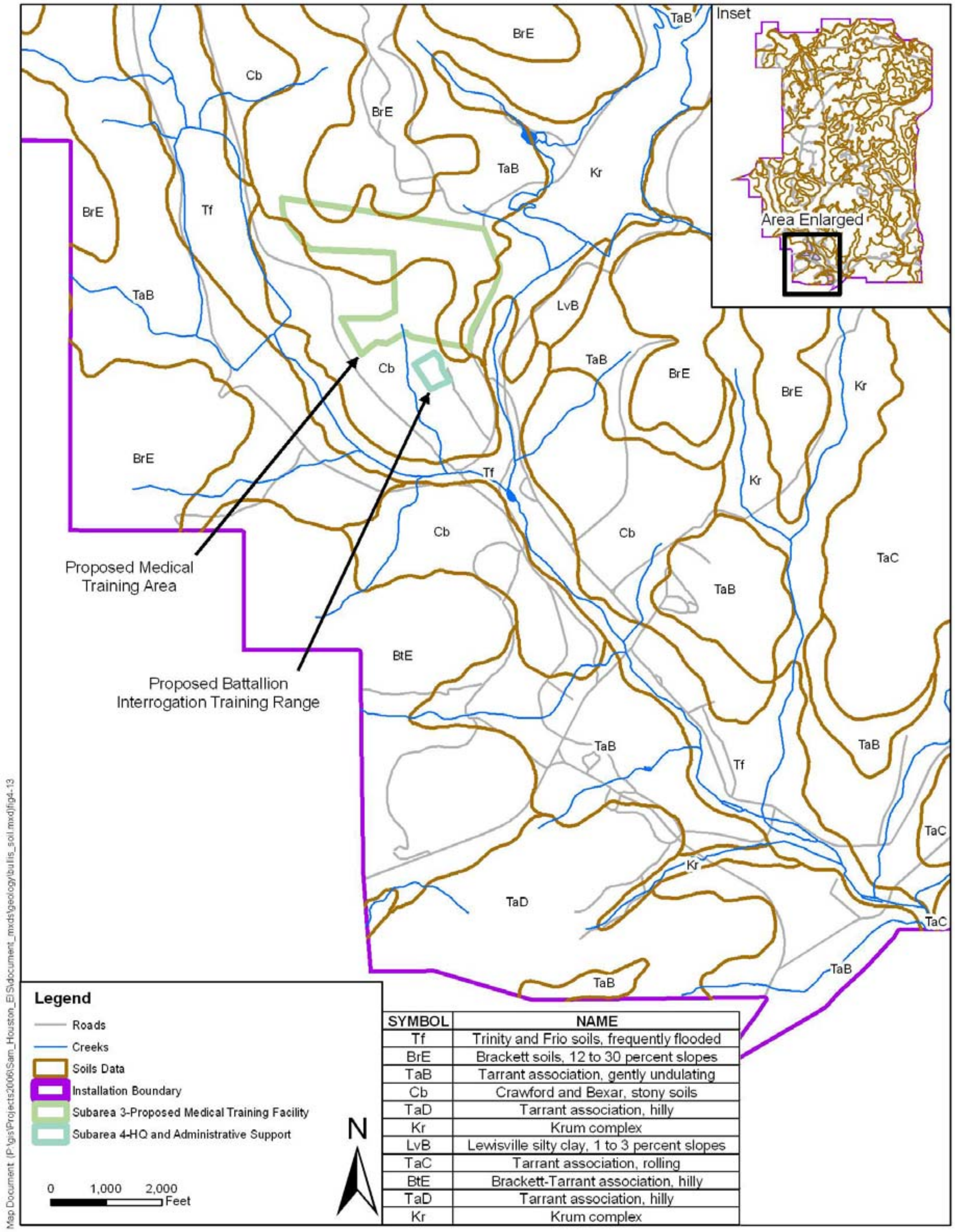


Figure 4-13 Soils Map of Southwest Portion of Camp Bullis
Source: FSH GIS Department, 2006

Other soil series on Camp Bullis include Crawford and Bexar (Cb), Krum (Kr), and Lewisville (Lv). Two soil complexes occur on Camp Bullis – the Crawford and Bexar and the Trinity and Frio (Tf) – where each individual soil series so intermixed with the other that mapping at the scale used precludes separating into discrete units. The Trinity and Frio soils are clay and clay loam and occur in the floodplains of small and large drainages. They are flooded at least once per year and, on Camp Bullis, are found in the Salado Creek drainage. Trinity is the only hydric soil found on Camp Bullis (NRCS, 1995).

Soil units mapped beneath the proposed medical training facility primarily consist of Tarrant series and the Crawford and Bexar series. A small area of Bracket series underlies the northwest portion of the proposed facility, and a small area of Krum series soils underlies the eastern portion of the proposed facility. Soils underlying the proposed BN interrogation training range consist of the Crawford and Bexar series.

The Tarrant and Bracket series soils are well drained, but both have high erosion potential, while the Krum and Crawford series soils have only a slight to moderate erosion potential (Taylor *et al.,* 1991).

Soils mapped beneath the proposed medical training facility and the BN interrogation training range exhibit a high corrosivity potential and a high shrink-swell potential.

4.6.2 Environmental Consequences

Realignment (Preferred) Alternative

Geology: The preferred alternative would have no significant impacts on the geology of FSH or Camp Bullis. No borrow pits or quarries are in operation at FSH; however, several at Camp Bullis are used to obtain sand and gravel for construction and routine maintenance. Nonetheless, the quantity of materials mined from these areas does not significantly deplete the geologic resources. Erosion and sediment control, grading and reseeding land when disturbed would prevent long-term impacts from construction.

To protect Sharron Spring and other karst features at Camp Bullis, an undeveloped area (buffer) around the spring has been established. The purpose of the buffers is to prevent contaminated surface water from entering the karst feature (U.S. Army, 2006). This buffer would have minimal effect on the training activities at the proposed medical training facility and would prevent negative impact on the spring due to the training activities.

Topography: The preferred alternative would have no significant impacts on the topography of FSH or Camp Bullis.

Soils: The preferred alternative would have no significant impacts on the soils of FSH or Camp Bullis. Nevertheless, upon completion of construction activities, impervious surfaces at FSH will increase, which may result in increased runoff and erosion of remaining soils. During construction activities, erosion of exposed soils can be controlled through engineering measures. Grading and reseeding land after construction is completed will reduce and control erosion at FSH and Camp Bullis further. In addition, regular maintenance of established vegetation will control potential erosion in vegetated training areas at Camp Bullis.

Foundation and utility construction would use established engineering BMPs to prevent potential significant impacts from highly corrosive and high shrink-swell soils.

Minor Siting Variations

Minor siting variations would result in the same conditions affecting the geology and soil as described in the preferred alternative, and there would be no significant impacts.

No Action Alternative

Under the no action alternative, conditions affecting the geology and soil at FSH and Camp Bullis would remain the same, and there would be no significant impacts.

4.7 WATER RESOURCES

This section summarizes the water resources in the vicinity of FSH and Camp Bullis. The surface water ROI for FSH includes Salado Creek, the San Antonio River (via the Alamo Ditch) and a portion of the City of San Antonio storm drainage system (Figure 4-14). The surface water ROI for Camp Bullis water resources includes Salado Creek (Figure 4-15).

4.7.1 Affected Environment

Surface Water

Fort Sam Houston

FSH is drained primarily by Salado Creek, which flows from north to south through the eastern portion of the installation. The headwaters of Salado Creek are located in the northwestern part of the Camp Bullis Military Reservation area and Camp Stanley in extreme north-central Bexar County. Salado Creek runs north to south for 35 miles along the north and east side of the City of San Antonio through SA IAP and FSH. The Salado Creek watershed encompasses 218 square miles (TNRCC, 2001b). The stream is

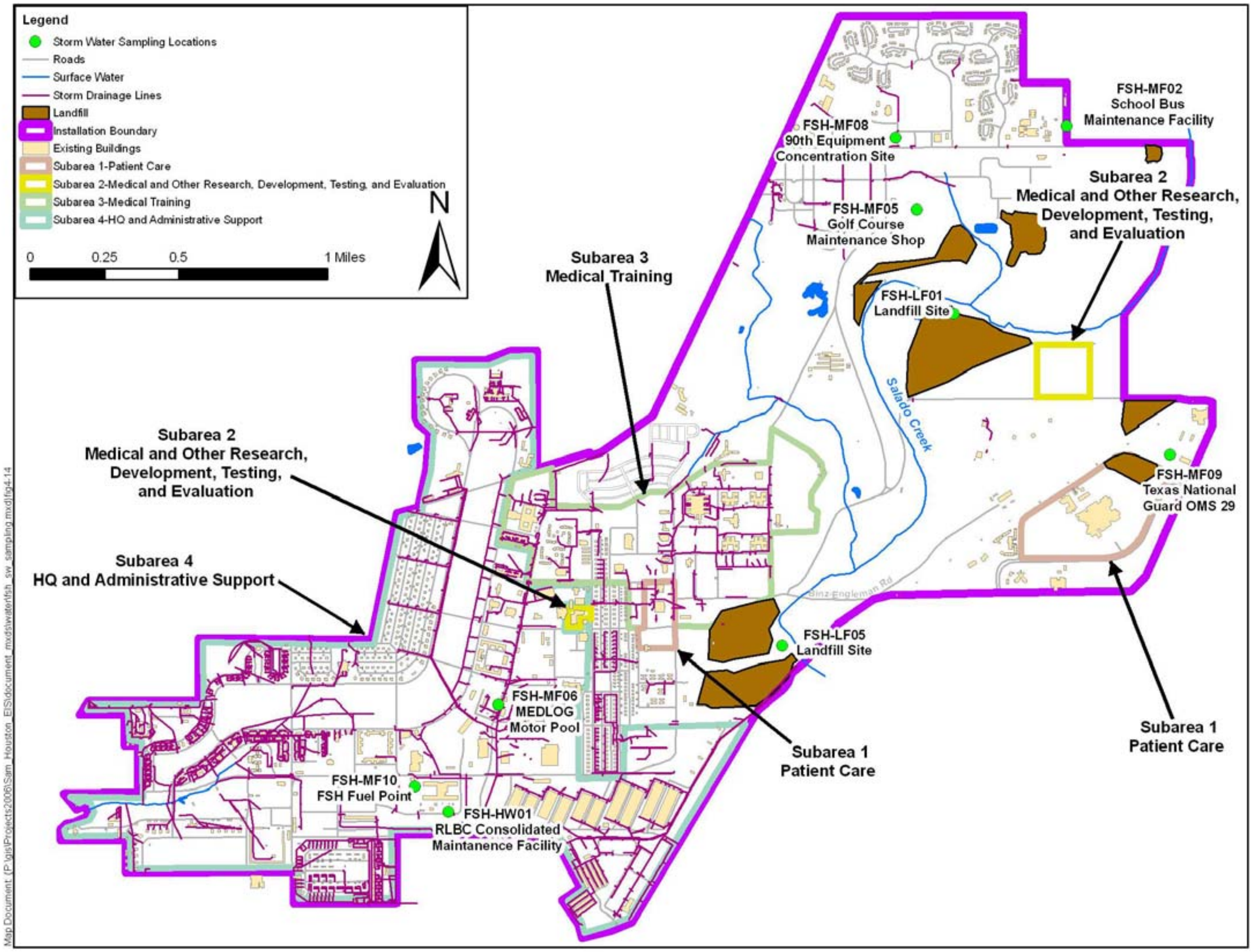


Figure 4-14 Stormwater Sampling Locations at FSH
Source: Stormwater Pollution Prevention Plan for FSH, Texas. Pacific Environmental Services, Inc., September 2005

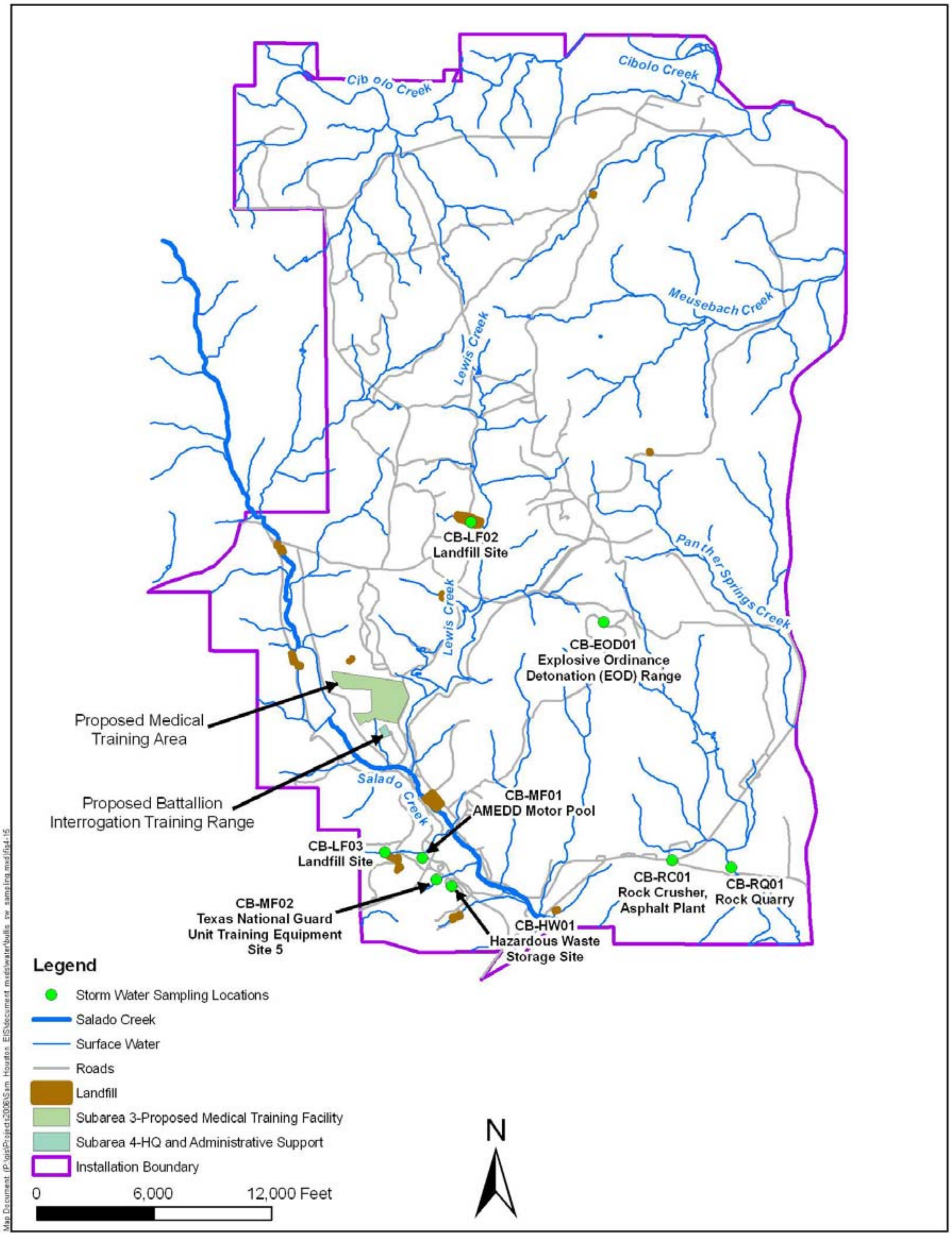


Figure 4-15 Stormwater Sampling Locations at Camp Bullis
Source: Stormwater Pollution Prevention Plan for Camp Bullis Training Site, Texas. U.S. Army Center for Health Promotion and Preventive Medicine. September 2005

intermittent, derives principally from precipitation in the area and is recharged by springs in the artesian zone of the Edwards the Aquifer near Loop 410 to the north of FSH. A small tributary of the San Antonio River, known as Alamo Ditch, drains the western part of FSH. The southern and central portions of the installation are drained by the City of San Antonio's municipal separate stormwater sewer system (MS4), which discharges to Salado Creek. Figure 4-14 shows major and minor creeks at FSH.

The segment of Salado Creek that courses through FSH is identified as Segment 1910 in the Texas Surface Water Quality Standards (TSWQS). The uses designated for Salado Creek by TCEQ are Contact Recreation, High Aquatic Life, Public Water Supply and Aquifer Protection (TNRCC, 2001b). Salado Creek was included in the TCEQ, 2004, Texas 303(d) list for the State of Texas based on an assessment of water quality data. Section 303(d) of the CWA requires all states to identify waters that do not meet, or are not expected to meet, applicable water quality standards. The water quality criteria not being met within Salado Creek are elevated bacteria levels (fecal coliforms) and impaired fish community (TCEQ, 2005). For each listed water body that does not meet the standard, states must develop a total maximum daily load (TMDL) for each pollutant that has been identified as contributing to the impairment of water quality in that body. TCEQ is responsible for ensuring that TMDLs are developed for impaired surface waters in Texas. The TMDL water quality status for Salado Creek currently is rated by TCEQ as a Category 5a: "the water body does not meet applicable water quality standards or is threatened for one or more designated uses by one or more pollutants and additional data and information will be collected before a TMDL is scheduled." A TMDL project for Salado Creek that addresses the high bacteria levels and causes of the impaired fish communities has been initiated by TCEQ and is underway (TCEQ, 2005). Evidence currently suggests that neither FSH nor Camp Bullis is directly responsible for the stream impairment.

The watershed within FSH is partially developed. Runoff from this watershed is carried into the Salado Creek drainage system and the San Antonio River via the Alamo Ditch. The stream is intermittent and derives principally from precipitation in the area. Impervious surfaces, such as pavement and facilities, accumulate dust, debris and soil from atmospheric fallout, automobile traffic and other land-disturbing activities. The amount of impervious surface is a direct measure of the degree of development, and it affects both water quality and recharge of groundwater. Areas with more impervious or nonporous surfaces generate more runoff, which can contaminate and warm stream waters and increase flow volumes and velocities that can degrade stream channels and banks. These land use changes generally impact the fish and wildlife that inhabit streams. In general, the impact on streams increases as the percentage of impervious surface in a watershed increases (Natural Resources Defense Council [NRDC], 1999, Chapter 2). Precipitation via runoff washes these particles into the collection systems to the Salado Creek drainage systems and, ultimately, into the San Antonio River.

The stormwater runoff within FSH has caused erosion in some areas, such as the point where Binz-Engleman Road crosses Salado Creek (Figure 4-14). Erosion further downstream also has caused undercutting of the bridge pylons under IH-35. Sedimentation is noticeable throughout the Salado Creek drainage system within the FSH property limits.

As impervious surface area increases, BMPs will need to be revised to address increased stormwater runoff. The total amount of impervious land area at FSH is approximately 20 percent; the amount of pervious land area is approximately 80 percent. Table 4-18 breaks down the current percent pervious and impervious land area per subarea.

Table 4-18 FSH Existing Conditions Subarea Percent Pervious and Impervious Land Area Totals

Subarea Number	Subarea Name	Percent Impervious Area	Percent Pervious Area
1a	Patient Care	26	74
1b	Patient Care	44	56
2a	Medical and Other RDTE	22	78
2b	Medical and Other RDTE	0	100
3	Medical Training	22	78
4	HQ and Administrative Support	33	67
5	Remaining Areas	12	88

FSH has implemented BMPs as part of the requirements of the National Pollutant Discharge Elimination System (NPDES) permit. BMPs are defined as physical, structural and/or managerial practices that, when used singly or in combination, prevent or reduce pollution of water. These BMPs are delineated in the Stormwater Pollution Prevention Plan (SWPPP) of June 1999 (updated September 2005) and cover the industrial sources listed in Table 4-19. The SWPPP also includes proposed BMPs for each industrial site and scheduled implementation dates (Pacific Environmental Services, Inc., [PES] 2005).

The SWPPP was prepared in accordance with the Texas Pollutant Discharge Elimination System (TPDES) and the Final NPDES General Permit for Stormwater Discharge Associated with Industrial Activities promulgated by USEPA. The current FSH NPDES permit number, TXR05M458, was issued by USEPA on 29 May 2002 and expires on 20 August 2006. Nine activities at FSH have been identified in the SWPPP as “industrial activities” subject to the requirements of the NPDES Stormwater Multisector

General Permit (MSGP). These industrial activities are subject to Sectors L, N and P of the MSGP. Table 4-19 summarizes each industrial activity and its MSGP sector. Those activities include maintenance facilities; a fueling facility; a recycling facility; and several closed landfills, which are considered one industrial activity for the SWPPP (PES, 2005). As stated previously, the southern and central portions of the installation discharge into the City of San Antonio's MS4 stormwater sewer system. FSH is required by TCEQ to make its SWPPP available to the municipal operator of the system upon request. At this time, no specific requirements are put forth in the City of San Antonio SWPPP concerning FSH (PES, 2005).

Table 4-19 FSH Industrial Activity and Related MSGP Sector

Name of Activity	Site Identification	MSGP Sector
School Bus Maintenance Facility	FSH-MF02	Sector P: Land Transportation
Directorate of Logistics (DOL) Consolidated Maintenance Facility	FSH-HW01	Sector P: Land Transportation
FSH Fuel Point	FSH-MF10	Sector P: Land Transportation
Golf Course Maintenance Shop	FSH-MF05	Sector P: Land Transportation
Landfill Sites	FSH-LF01 (2 & 3) FSH-LF05 (6 & 7)	Sector L: Landfills and Land Application Sites
Medical Logistics (MEDLOG) Motor Pool	FSH-MF06	Sector P: Land Transportation
90th Equipment Concentration Site	FSH-MF08	Sector P: Land Transportation
Texas National Guard OMS 29	FSH-MF09	Sector P: Land Transportation
DRMO	FSH-MF11	Sector N: Scrap and Waste Recycling Facilities

Eight former landfill sites are located along Salado Creek, six of which are within the Salado Creek floodplain. Landfills along Salado Creek have not received refuse since the mid-1970s. Sampling of Salado Creek found no correlation between the contaminants detected at the landfill locations and contaminant concentrations in Salado Creek. Elevated levels of chemical oxygen demand (COD) show a mixed relationship between landfill locations and water quality. Other sources of potential surface water contamination exist on FSH, including runoff from irrigation on the golf course and other landscaped areas and non-point sources originating on FSH that could impact water quality in Salado Creek (USACE, 2002).

FSH has implemented a program in which stormwater runoff samples are collected quarterly at designated locations along Salado Creek as part of the MSGP monitoring compliance requirements. Figure 4-14 shows stormwater sampling locations for FSH. Results for the four quarters of 2004 and

2005 were reviewed as part of the baseline analysis. Most evaluated constituents were below the benchmark value established by the FSH stormwater discharge permit, except COD, iron and total suspended solids (TSS). Site LFO5 consistently exceeded the benchmark values of Sector L of the TCEQ stormwater discharge permit for iron and TSS of 1 and 100 milligrams per liter (mg/L), respectively. This monitoring point is downstream of the location of storm sewer discharges to Salado Creek from the medical training subarea. Site LFO3 exceeded the benchmark value of Sector L of the TCEQ stormwater discharge permit for TSS of 100 mg/L once during the fourth quarter of 2004. Site MF11 exceeded the benchmark value of Sector N of the TCEQ stormwater discharge permit for COD of 120 mg/L once during the fourth quarter of 2005. Additionally, the benchmark value for silver is 0.0318 mg/L, but the minimum detection limit for the method used by the laboratory to measure silver is 0.05 mg/L.

As specified by the NPDES Stormwater MSGP, additional annual sampling is required at each industrial site for numeric effluent limitations of the 12 Texas heavy metals: arsenic, barium, cadmium, chromium, copper, lead, manganese, mercury, nickel, selenium, silver and zinc. All metals concentrations were below the maximum contaminant level (MCL) established by the FSH stormwater discharge permit for the period evaluated.

Camp Bullis

Camp Bullis is drained primarily by Salado Creek. Additional smaller creeks and springs also drain Camp Bullis: Panther Springs, Cibolo Creek, Lewis Creek and Meusebach Creek. The creeks are intermittent, fed primarily by precipitation from storms and exist as dry streambeds the remainder of the year. Stormwater runoff at Camp Bullis flows overland as sheet flow, is collected by natural channels and streams and eventually drains into the San Antonio River. In addition, springs along Panther Springs Creek and Lewis Creek periodically produce surface flow for several hundred feet before disappearing into fractures, caves and sinkholes in the streambeds (U.S. Army, 2005). Figure 4-15 shows major and minor creeks at Camp Bullis.

Salado Creek is near the west edge of the installation and drains southeast. Runoff from the preferred alternative sites of the medical training facility and BN interrogation training range flows southward into an unnamed drainage that heads northeast to Salado Creek (USGS, 1992). Camp Bullis has two large SARA flood control structures. SARA Structure No. 1 is located on Salado Creek; SARA Structure No. 2 is located on Lewis Creek, a tributary to Salado Creek (USACE, 1995). These structures are not designed to impound large quantities of water permanently; however, they allow stormwater runoff to flow downstream at a controlled rate.

The segment of Salado Creek that runs through Camp Bullis is identified as Segment 1910 in the TSWQS. The uses designated for Salado Creek by TCEQ are Contact Recreation, High Aquatic Life, Public Water Supply and Aquifer Protection (TNRCC, 2001b). The segment of Salado Creek that flows adjacent to the preferred alternative sites is not noted as impaired in the 2004 Texas 303(d) list.

An SWPPP was prepared in accordance with the NPDES General Permit for Stormwater Discharge Associated with Industrial Activities promulgated by USEPA. Seven activities at Camp Bullis have been identified in the SWPPP as "industrial activities" subject to the requirements of the NPDES Stormwater MSGP No. TXR050000 relating to stormwater discharge associated with industrial activity. The FSH permit under which Camp Bullis is covered is TXR05M458. These industrial activities are subject to Sectors D, J, K, L and P of the MSGP. Table 4-20 summarizes each industrial activity and its MSGP sector. Those activities include vehicle maintenance facilities, a rock quarry, a rock crusher/asphalt plant, a hazardous waste storage site, an explosives ordnance detonation range and several closed landfills (landfills are considered one industrial activity for this SWPPP) (U.S. Army, 2005).

All of these sites are located on tributaries that empty into Salado Creek downstream of the medical training facility and the BN interrogation training range.

Table 4-20 Camp Bullis Industrial Activity and Related MSGP Sector

Name of Activity	Site Identification	MSGP Sector
AMEDD Motor Pool	CB-MF01	Sector P: Land Transportation
Explosive Ordnance Detonation Range	CB-EOD01	Sector K: Hazardous Waste Treatment Storage or Disposal Facilities
Hazardous Waste Storage Site	CB-HWO1	Sector K: Hazardous Waste Treatment Storage or Disposal Facilities
Landfill Sites	CB-LF02 CB-LF03	Sector L: Landfills and Land Application Sites
Rock Quarry	CB-RQ01	Sector J: Mineral Mining and Dressing
Rock Crusher/Asphalt Plant	CB-RC01	Sector D: Asphalt Paving and Roofing Materials Manufacturers
Texas National Guard Unit Training Equipment Site 5	CB-MF02	Sector P: Land Transportation

Floodplains

Floodplains, as defined in EO 11988 on *Floodplain Management*, are "lowlands and relatively flat areas adjoining inland or coastal waters including flood-prone areas of offshore islands, including at a minimum, that area subject to a 1 percent or greater chance of flooding in any given year" (*i.e.*, that area that would be inundated by a 100-year flood). Floodplains often are classified as 10-, 25-, 50- or 100-year floodplains, according to the average interval between major floods.

Fort Sam Houston

FSH has major flooding, on average once every three to four years, that inundates a large portion of the training area in the eastern section of FSH along Salado Creek. The western, southern and central portions of FSH do not experience similar flooding; however, some localized flooding has occurred just off-installation on the western arm at the end of the drainage channel (USACE, 2002).

In 1987, a study was performed to determine Salado Creek flood levels in the area of the proposed BAMC site and its access road. Flood level elevations were established for the 100- and 500-year flood under both projected 1990 and 2000 conditions. The results showed that the channel and underdeveloped floodplain of the overbanks are adequate to pass the 100-year flood safely with one notable exception. The area between Binz-Engleman Road and W.W. White Road would be subject to inundation from a flood as small as a two-year flood; during such an event, each crossing would be under 8 to 10 feet of water. During the 10-, 25- and 50-year floods, the crossing would be under 15 to 18 feet, 10 to 22 feet and 22 to 23 feet of water, respectively (USACE, 1996). If the area between Binz-Engleman and W.W. White Roads were to become inaccessible, the bridge connecting Nursery Road and W.W. White Road maintains the access between the firehouse and the BAMC complex.

West of the creek, 100- and 500-year floods would inundate portions of the golf course as well as the area near the helipad approach to the east bank of the creek. The helipad approach and the Naval and Marine Corps Reserve Center also could suffer some low-level flooding as a result of a 500-year flood (USACE, 1996). Figure 4-16 shows areas prone to flooding at FSH.

Camp Bullis

The cantonment area is adjacent to the Salado Creek floodplain. The drainage for Salado Creek above the cantonment area is approximately 12,350 acres. To reduce severity of downstream flooding, two water retention dams were installed on Camp Bullis. These flood control structures and other natural drainages provide adequate storage and stormwater retention and seepage to substantially reduce flooding at the installation (U.S. Army, 2005b). Flooding is seldom a problem on Camp Bullis; however, low water crossings occasionally are inundated during storms. Figure 4-17 shows the water drainage and 100-year floodplain at Camp Bullis.

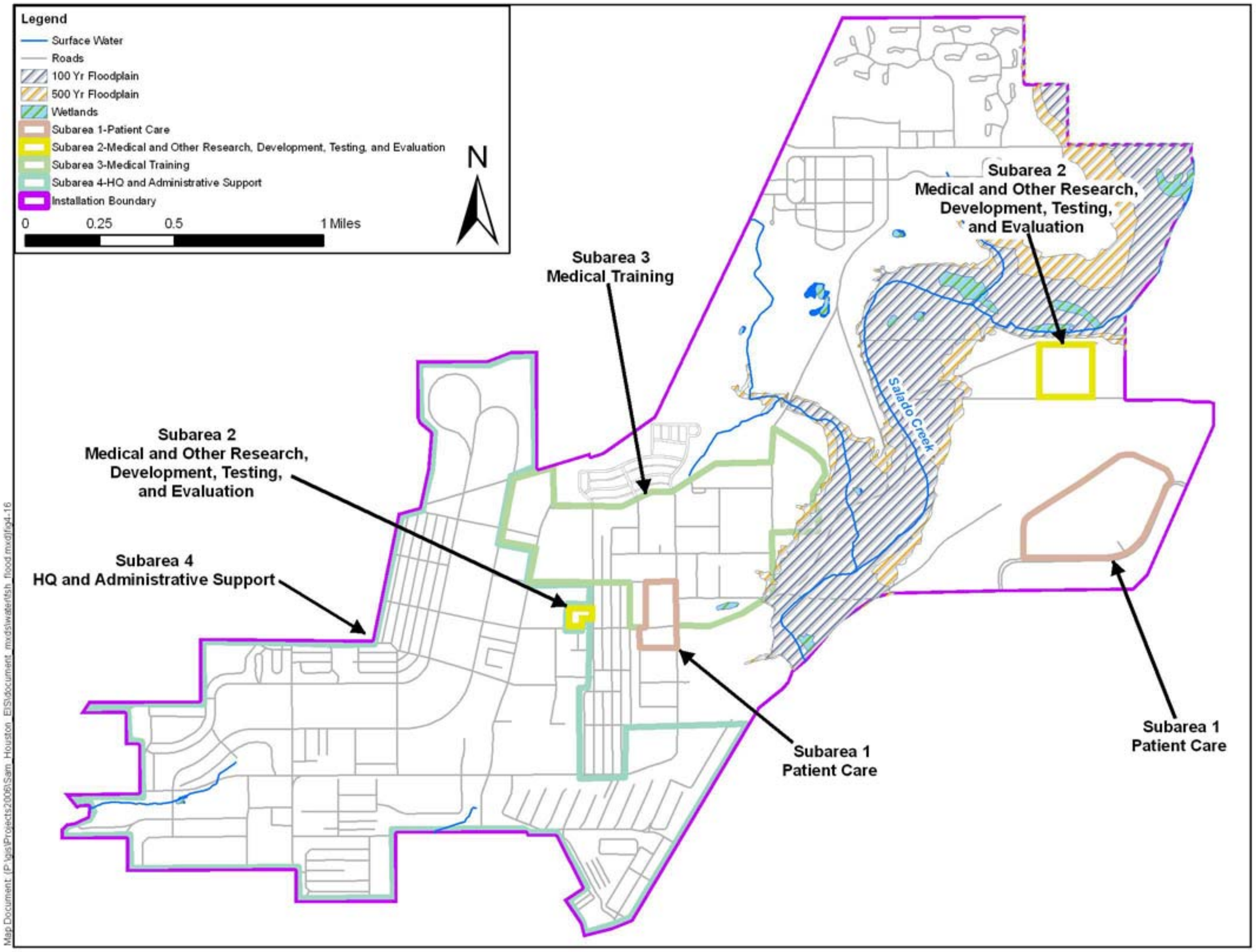


Figure 4-16 FSH Floodplain Map
Source: FEMA Q3 Data, 1996

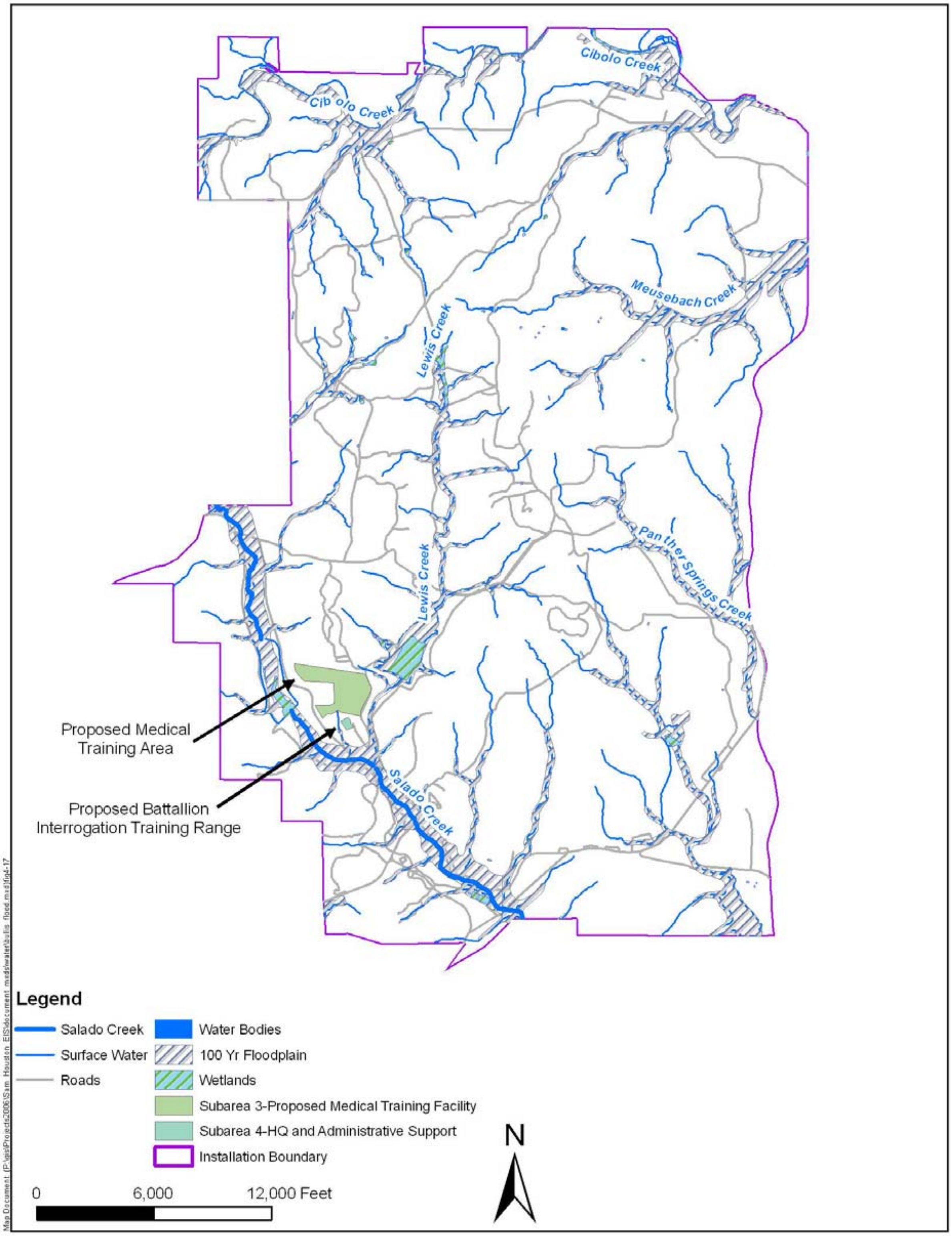


Figure 4-17 Camp Bullis Floodplain Map
Source: FEMA Q3 Data, 1996

Hydrogeology/Groundwater

Fort Sam Houston

FSH is located above the Edwards Underground Reservoir, or the Edwards Aquifer. FSH obtains its drinking water from five wells. The wells extend into the Edwards Aquifer to depths of 728 to 1,106 feet below ground surface (bgs) (USACE, 2001b). The Edwards Aquifer extends along the Balcones Fault Zone from Kinney County through Uvalde, Medina, Bexar and Comal Counties and ends in Hays County. The Edwards Aquifer covers an area of approximately 4,700 square miles, is approximately 180 miles long from west to east and ranges from 5 to 40 miles wide north to south. Figure 4-18 shows the location of the Edwards Aquifer (DoD, 2005b). Seventeen cities with a total of approximately 1.5 million people are dependent upon the aquifer for their water supply. San Antonio is the largest city in the United States that obtains its water supply from a sole source aquifer (the Edwards Aquifer) (USACE, 2001b).

The Edwards Aquifer is one of the most permeable and productive carbonate aquifers in the United States. Its major natural springs are Comal and San Marcos Springs, approximately 30 miles and 45 miles northeast of FSH, respectively. San Antonio Springs and San Pedro Springs are south-southwest of FSH and are dry when the water level in the aquifer is low (DoD, 2005b).

Zones of the Edwards Aquifer

The Edwards Aquifer consists of four zones: the contributing zone or the catchment zone, the recharge zone, the artesian zone and the transition zone. Surface water in the contributing zone has the potential to flow into the Edwards Aquifer or neighboring Trinity Aquifer. Within the recharge zone, the majority of the surface water flows into the Edwards Aquifer, resulting in an ecologically sensitive area. The recharge rate is highly variable and averages approximately 640,000 acre-feet annually. The transition zone is the area between the recharge zone and the artesian zone that has characteristics of both zones. Figure 4-18 shows three zones within the aquifer. The transition zone is too small to be shown in the figure. Several rivers drain into the Edwards Plateau and lose much of their flow to the Edwards Aquifer as they pass over the recharge zone. Flow from these rivers accounts for approximately 85 percent of the Edwards Aquifer recharge. Surface water reservoirs such as Medina Lake also contribute large volumes of water to the aquifer. Other forms of recharge come directly from precipitation on the outcrop and flow over the Balcones Fault Zone. FSH is above the artesian zone of the aquifer and is where the groundwater sits both above the Glen Rose Formation and below the confining layer of the Del Rio clay layer.

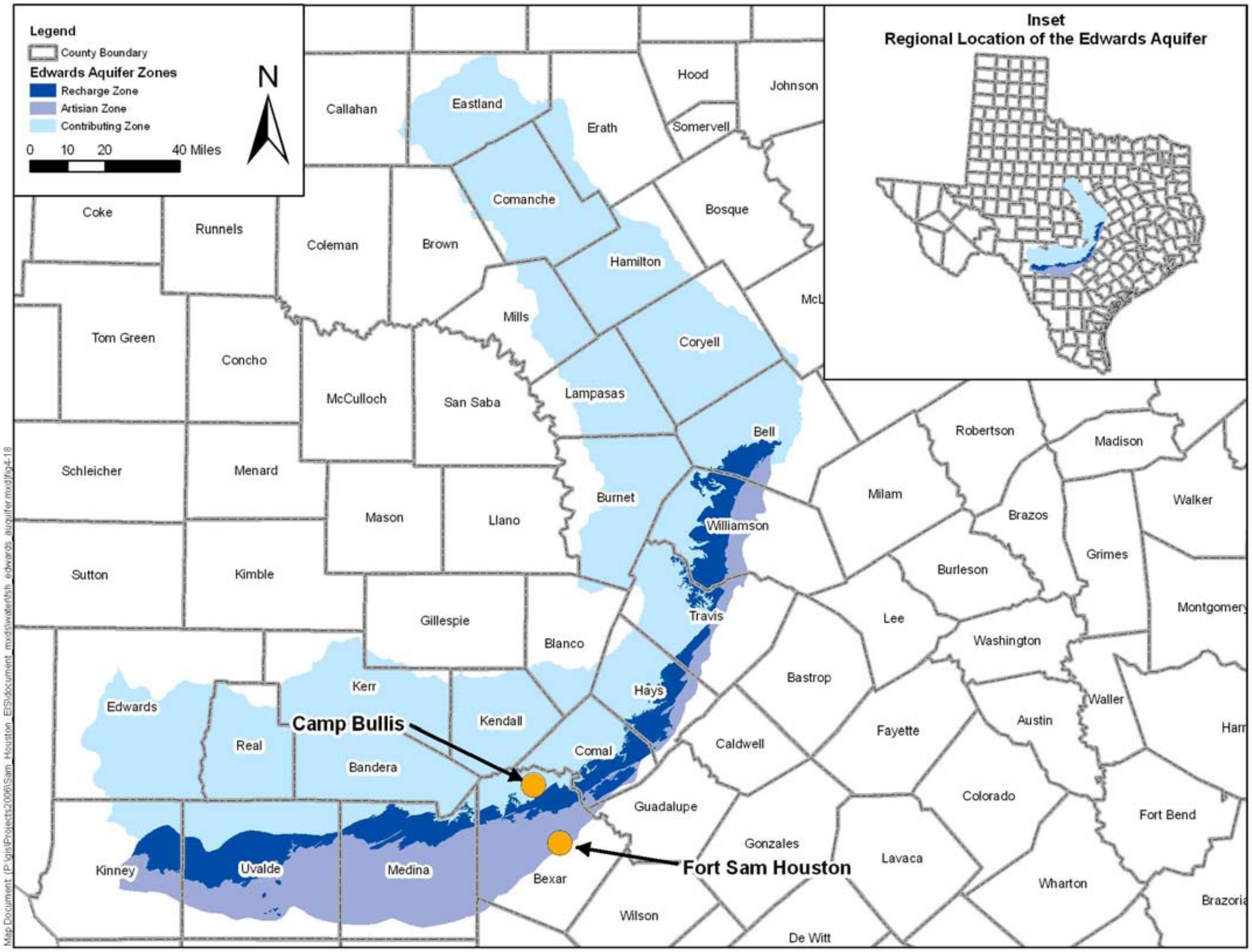


Figure 4-18 Edwards Aquifer Zones and Location
Source: Texas Water Development Board GIS Data, http://www.twdb.state.tx.us/mapping/gisdata.asp.

Hydrology of the Edwards Aquifer

Within the Edwards Aquifer, water flows from higher elevations in the west toward lower discharge areas in the east. Numerous faults within the aquifer make it difficult for water in different units to mix. The faults, along with variations in porosity and permeability of the limestone, control the movement of the water within the aquifer. Although water easily enters the recharge zone, subsurface drainage is typically inadequate during large rain events, and the area is prone to high flooding.

Water pollution problems have been experienced in the Edwards Aquifer. Instances of groundwater contamination, resulting in cessation of use of some water wells, have occurred and are concentrated in Bexar County. The Edwards Aquifer was found the most vulnerable aquifer in Texas (Texas Water Commission [TWC], 1989). In addition, natural degradation within the aquifer, known as the “bad water line,” occurs in an area along the southern and eastern edges of the freshwater zone. The rock is denser and less permeable, which decreases the movement of the water. Within this area where the water is in contact with the limestone for longer periods, mineral solids from the surrounding rock are dissolved. The concentration of total dissolved solids (TDS) reaches 1,000 ppm, and the water is considered saline and non-potable. The aquifer is bordered on the north by the northern limit of the formations in the recharge area of the faulted outcrop, on the west and east by groundwater divides and on the south by the saline-water zone.

It is estimated that water in the Edwards Aquifer (25 to 55 million acre-feet) is sufficient to supply the region for 200 to 300 years with no additional recharge. However, only 5 to 10 percent of the flow in springs and in the artesian zone is retrievable (USACE, 1996). The aquifer has both confined and unconfined conditions that affect flow of the springs. Comal and San Marcos Springs (located northeast of FSH) both flow under artesian or confined conditions.

Estimated water yield values[7] for the Edwards Aquifer are:

- Transmissivity in the confined region is approximately 1 million to 2 million square feet per day.

[7] There are three terms used to describe water yield in aquifers:

- The transmissivity is the volumetric flow rate through a unit width of aquifer under a unit gradient and is constant in a confined aquifer that is homogeneous and of uniform thickness.
- The specific yield of an unconfined aquifer is the volume of water that a unit volume of aquifer releases from storage under a unit decline in hydraulic head.
- The storativity of a confined aquifer is the volume of water that an aquifer releases from storage per aquifer unit surface area per unit of decline in the component of hydraulic head normal to the surface.

- The specific yield of the unconfined section of the Edwards Aquifer is estimated to range from 5 to 20 percent.
- The storativity of the confined area of the Edwards Aquifer is estimated to range from 0.0001 to 0.00001 (unitless), depending on the porosity and thickness of the aquifer. Under water table conditions, the coefficient of storativity is equal to the specific yield if gravity drainage is complete.

The catchment zone allows precipitation and surface runoff to infiltrate into the unconfined areas of the Edwards Aquifer. The discharge that does not recharge the aquifer will become surface water in streams. The Edwards Plateau is an unconfined aquifer with moderate permeability and large infiltration capacity that is separated hydrologically from the Edwards Aquifer. The headwaters of streams that provide recharge to the Edwards Aquifer occur in valleys incised within these limestone-capped uplands.

The recharge zone of the Edwards Aquifer occurs along the Balcones Fault Zone. Water movement along the faults in this area has enlarged openings at various depths. The net result has been the enhancement of a zone of high infiltration rates within the Balcones Fault Zone, allowing extensive recharge of the exposed unconfined Edwards Aquifer. The aquifer is unconfined within the Balcones Fault Zone, and surface water from the catchment zone flows over the permeable units of the recharge zone and infiltrates into the Edwards Aquifer.

Water for FSH is obtained from the Edwards Aquifer within the artesian zone of the aquifer. Groundwater in this zone is under pressure, and water levels in monitoring wells can rise several hundred feet above the top of the aquifer. There is little recharge within this zone. Flow rates within the artesian zone average more than 1 mile per year in the area between San Antonio and San Marcos (DoD, 2005b).

Military Water Draw and Conservation Activities

Total water withdrawal from the Edwards Aquifer is limited to 450,000 acre-feet per year until 31 December 2007, and it will be reduced to 400,000 acre-feet per year thereafter (USACE, 2001b). FSH currently draws less than 1 percent of the total withdrawal from the Edwards Aquifer (2,402 acre-feet in 2003). The total DoD withdrawal ranges from approximately 2 to 3 percent for all activities from multiple installations that use the Edwards Aquifer. The DoD withdrawal cap currently is set at 10,515 acre-feet per year by the DoD 1999 Biological Opinion (BO) given by the U.S. Fish and Wildlife Service (USFWS, 1999).

The 1999 BO (USFWS, 1999) recommends the water allocations for the DoD installations dependent on the Edwards Aquifer. The BO was developed by USFWS and originally was written to be active from

1999 until 2003, but was extended to 31 December 2006. The recommended DoD water allocation presented in the 1999 BO was based on the required minimum flow for Comal and San Marcos Springs that USFWS believed would not jeopardize or take threatened or endangered species (the Fountain darter, Texas blind salamander, San Marcos salamander, San Marcos gambusia and Texas wild rice). There is a hydrologic correlation between overall Edwards Aquifer levels and spring flows at these locations that could result in a decrease in flow of the springs if too much water is pumped from the Edwards Aquifer. This might result in a “taking” of the threatened or endangered species depending on the spring flows. The pumping limit of 10,515 acre-feet per year, as presented in the 1999 BO, was adopted by the DoD installations that were withdrawing water from the Edwards Aquifer. These DoD installations in turn established pumping limits for each installation to collectively remain at or below the USFWS-recommended limit. Table 4-21 shows the water allocations for each DoD installation that withdraws water from the Edwards Aquifer. Currently, the collective total water withdrawal for these DoD installations remains under the USFWS-recommended pumping limit of 10,515 acre-feet per year. For example, in 2005, the military installations’ combined totals were approximately 67.7 percent of this limit of 10,515 acre-feet per year. This amount of 10,515 acre-feet per year represents about 2.1 percent of Edwards Aquifer pumping. The other entities that pump the remaining 97.9 percent of the Edwards Aquifer withdrawals are in the process of negotiating a Habitat Conservation Plan (HCP) with USFWS under Section 10 of the ESA.

Table 4-21 Annual Water Allocations by Installations in Non-drought Conditions

Base	Percent of DoD Total	USFWS Cap (acre-feet per year)
FSH	30	3,163
Kelly*	29	3,013
Lackland	30	3,198
Randolph	11	1,141
Total	100	10,515

* Prior to the closure of Kelly AFB, the military water allocation was 2.63 percent of the overall withdrawal from the Edwards Aquifer. When Kelly AFB closed, only a portion of the Kelly AFB property was realigned to Lackland AFB, and only 30 percent of Kelly AFB’s withdrawal allocation (or 8.6 percent of the DoD allocation) was transferred to Lackland AFB. Therefore, the DoD draw from the Edwards Aquifer currently constitutes only 2.1 percent of the overall withdrawal from the aquifer, rather than 2.63 percent.

The Edwards Aquifer Authority (EAA) was created in 1993 by State of Texas legislation. It was created to issue and manage permits for limiting withdrawal of water from the Edwards Aquifer. Although EAA does not regulate the DoD installations’ water withdrawal from the Edwards Aquifer, it recognized the

USFWS-recommended DoD pumping limit of 10,515 acre-feet per year when it established other pumping limit permits for entities under its jurisdiction.

In September 2005, the Military Water Working Group (representatives of FSH and Lackland and Randolph AFBs) submitted a Biological Assessment (BA) to USFWS as part of Section 7 of the ESA consultations to renew the 1999 BO. The BA and supplemental documents analyze increased pumping from BRAC and discretionary moves at the military facilities. The BA and supplemental documents also assess three species that were not mentioned in the 1999 BO (the Peck's Cave amphipod, Comal Springs dryopid beetle and Comal Springs riffle beetle). A new BO is anticipated to be issued by USFWS in late 2006.

On 16 July 2006, USFWS proposed (59 FR 58982) critical habitat for several endangered species (Peck's Cave amphipod, Comal Springs dryopid beetle and Comal Springs riffle beetle) at Comal Springs and Hueco Springs in Comal County, and Fern Bank Springs and San Marcos Springs in Hays County (Federal Register [FR]: 17 July 2006, Vol. 71, No. 136, *Proposed Rules*, pp. 40587 to 40621). While this proposal is not expected to be finalized before this EIS is finalized, effects from Edwards Aquifer water withdrawals on the Hueco and Fernbank Springs will be considered in the ongoing consultation with USFWS.

FSH also has implemented several conservation efforts to reduce the water drawn from the Edwards Aquifer. These efforts include a water use reduction program when Well J-17 and Comal and San Marcos Springs are at certain levels. Table 4-22 provides actual water consumption numbers for FSH since 1994, before and after water conservation activities had begun at FSH. Table 4-23 describes the different stages of the Water Use Reduction Program of the Drought Management Plan at FSH developed by USFWS in 1999.

Table 4-22 Water Consumption at FSH Before and After Water Conservation Activities Implemented

Year	**1994**	**1995**	**1996**	**1997**	**1998***	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Acre-feet	3,523.1	3,670.5	3,589.3	2,788.9	2,918.7	2,449.2	2,576.3	2,002.9	1,902.0	2,402.5	2,003.9	1,547.5

* Year water conservation activities started

Table 4-23 Water Use Reduction Program at FSH

Stage	Triggers			Maximum Allowable Usage	
	FSH Well J-17	Comal Spring	San Marcos Spring	Multiplier	Monthly Withdrawal
I	5 days where level = 657.5 feet	5 days at or below 250	3 days at or below 80 cfs	1.7	Base usage
II	5 days where level = 647.0 feet	5 days at or below 200 cfs	Any Stage I trigger, plus 3 days at or below 80 cfs	1.6	Base usage
III	5 days where level = 642.0 feet	5 days at or below 180 cfs	Any Stage II trigger, plus 3 days at or below 80 cfs	1.4	Base usage
IV	5 days where level = 640.5 feet	5 days at or below 160 cfs	Any Stage III trigger, plus 3 days at or below 80 cfs	1.3	Base usage
V	3 days where level = 637.0 feet	3 days at or below 100 cfs	Any Stage IV trigger, plus 3 days at or below 80 cfs	1.185	Base usage

Notes:
cfs = cubic feet per second
Data from: (USACE, 2001b)
Maximum Allowable Usage is defined as the amount of underground water that a person is allowed to withdraw or supply.

Other conservation efforts put in place by FSH since 1998 include measures to decrease water use and raise community awareness. These activities include:

- Water Distribution System Upgrade and Modification Program, which implemented system leak testing, repairs and replacements of leaking lines and installation of water-saving fixtures.
- Irrigation and Landscaping Policy, which involved planting native, drought-resistant vegetation; limiting water for existing vegetation; developing a Landscape Master Plan; and implementing a computer-controlled irrigation system on both golf courses.
- The elimination of organized car washes and the implementation of car washing policies restricting the operation to a hand-held trigger hose only.
- Reuse water was used for irrigating the golf course and other landscaped areas and for the fire training area.
- Leaking swimming pools were closed and demolished.
- Recycled water is used in chiller and boiler systems in seven facilities across the installation (USACE, 2001c).

Recycled water use at FSH was 238 acre-feet in 2001, 392 acre-feet in 2002, 500 acre-feet in 2003, 425 acre-feet in 2004, and 606 acre-feet in 2005 (DoD, 2006).

Camp Bullis

The oldest formations containing groundwater under Camp Bullis are the Travis Peak Formation and Glen Rose Formation. Collectively, these formations make up the Trinity Group, which has been divided into three water bearing units (WBUs) based on hydraulic continuity:

- The upper member of the Glen Rose Formation (also known as the Glen Rose Aquifer) makes up the upper member of the Trinity Group Aquifer.
- The lower member of the Glen Rose Formation is part of the middle member of the Trinity Group Aquifer.
- The rest of the middle and lower members of the Trinity Group Aquifer represent the Travis Peak Formation (Texas Department of Water Resources [TDWR], 1983).

The Edwards Aquifer contains rock younger than the Trinity Group and is restricted to the southeast corner and northern edge of Camp Bullis.

Groundwater movement in the Trinity and Edwards Aquifers is extremely variable due to the physical characteristics of the rock. Limestone and cemented sandstone depend on secondary porosity in the form of solution channels, fractures and faults to transmit groundwater. Water production in these rock types can be erratic, resulting in unpredictable yields at different well locations.

The Edwards Limestone and Glen Rose Formation both outcrop in Camp Bullis. As a result, portions of Camp Bullis recharge both aquifers. The Glen Rose Formation derives its recharge from direct precipitation on the outcrop and streams flowing across the outcrop. The northern portion and southeast corner of the installation provide recharge to the Edwards Aquifer. Stream flow in Salado Creek crosses the Edwards Limestone in the south-central portion of Camp Bullis, providing recharge to the Edwards Aquifer. Cibolo Creek at the north end of the facility also recharges the Edwards Aquifer. Camp Bullis obtains its water from wells installed in the upper Trinity Aquifer located north of the Edwards Aquifer (U.S. Army, 2006).

4.7.2 Consequences

Realignment (Preferred) Alternative

Fort Sam Houston

Based on the data presented in Section 3.0 of this EIS, the increase in impervious land area due to the proposed construction activities at FSH was evaluated. Table 4-24 presents the percent pervious and impervious land area per subarea. Figure 4-19 shows the pervious and impervious land area per subarea.

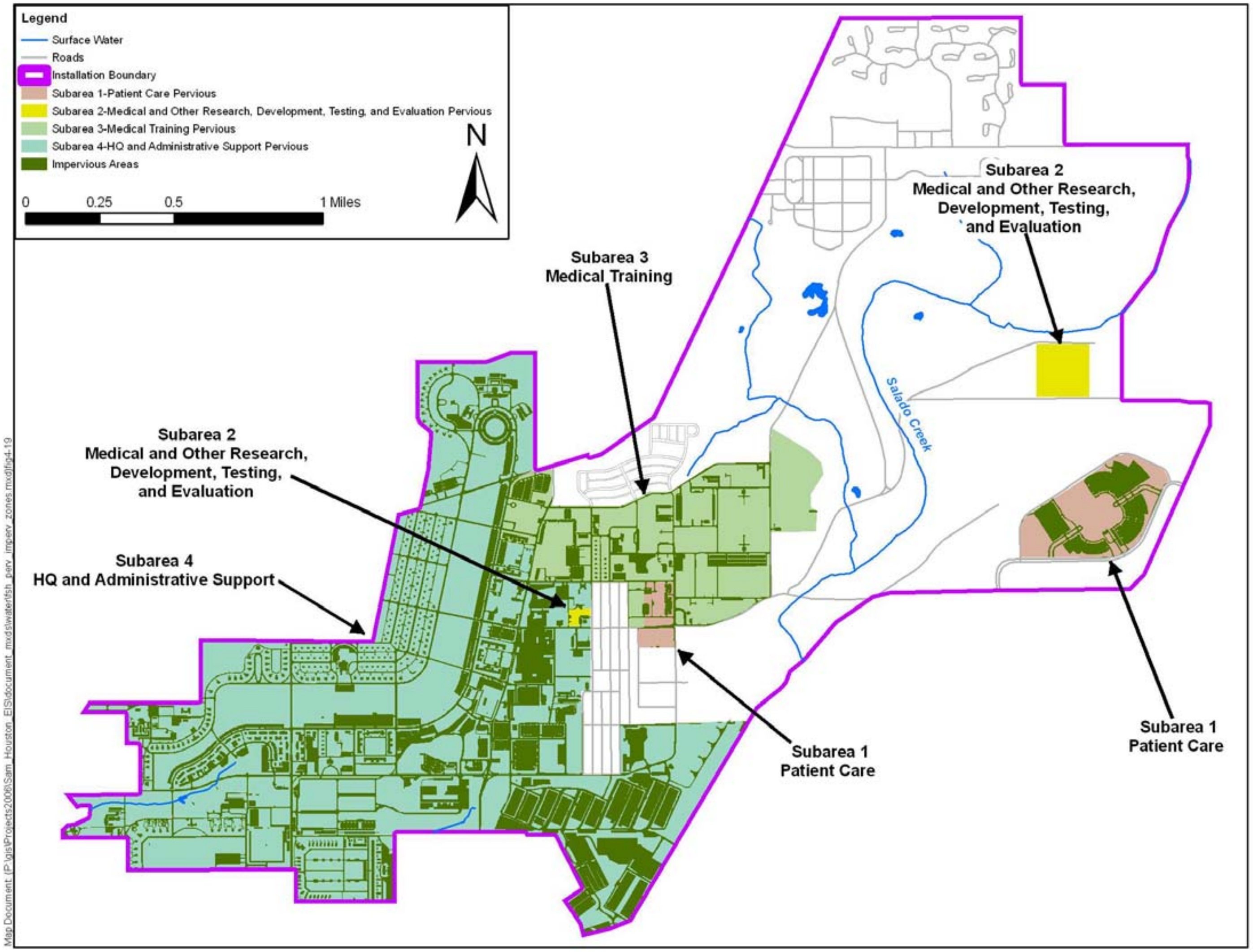


Figure 4-19 FSH Impervious and Pervious Areas

The total amount of impervious land area currently at FSH is approximately 20 percent; the amount of pervious land area is currently approximately 80 percent. Under the preferred alternative, the total amount of impervious land area at FSH would increase to approximately 31 percent, while the amount of pervious land area would be reduced to approximately 69 percent as a result of proposed actions. Table 4-24 breaks down the percent pervious and impervious land area per subarea.

Table 4-24 FSH Preferred Alternative Future Conditions Subarea Percent Pervious and Impervious Land Area Totals

Subarea Number	Subarea Name	Percent Impervious Area	Percent Pervious Area	Preferred Alternative Percent Increase in Impervious Area
1a	Patient Care	39	61	13
1b	Patient Care	46	54	12
2a	Medical and Other RDTE	39	61	17
2b	Medical and Other RDTE	24	76	24
3	Medical Training	33	67	11
4	HQ and Administrative Support	35	65	2
5	Remaining Areas	12	88	0

As the impervious area increases, an increase in peak flows will intensify erosion and sedimentation throughout and downstream of FSH. Further evaluation will be necessary to quantify the impact of the proposed site growth. Further project-specific environmental analysis would be required for the siting and design of the bridge in a floodplain and addressed in a Finding of No Practicable Alternative (FONPA) to meet the requirements of EO 11990.

Potentially one of the most significant environmental consequences for the preferred alternative activities at FSH are related to groundwater water supply withdrawal. The personnel increase due to the preferred alternative is expected to be 10,152 people (Section 2.0) and would impact the aquifer directly by requiring an increased draw on the Edwards Aquifer. Water allocations of 50 gallons per day (gpd) are allotted to 8-hour shift employees and 150 gpd for 24-hour employees and students (Joint Defense Air Force [JDAAF], 1987). This equates to an increase in water demand for personnel of 0.92 million gallons per day (MGD), or 2.80 acre-feet per day. In addition to increased water demand from personnel increases, the construction of new facilities also will require an increase in water usage during construction and post-construction activities. Once the new facilities are in place, water usage requirements will decrease to a demand based on personnel use. Withdrawal from the Edwards Aquifer after the preferred alternative has been implemented must remain below the cap of 9,467 acre-feet per day through 2007 and 8,406 acre-feet after 2007 for DoD facilities dependent on the Edwards Aquifer in the

San Antonio area (that includes FSH, Lackland AFB and Randolph AFB). The allocations for DoD are based on a total allocation from the Edwards Aquifer from the entire San Antonio area equaling 450,000 acre-feet per year through 2007 and 400,000 acre-feet per year after 2007.

The increased draw from the Edwards Aquifer would be for potable water use. The use of recycled water at FSH would have no significant impact to the Edwards Aquifer (Sections 4.12.1 and 4.12.2). The primary consequence of the preferred alternative activities on the Edwards Aquifer could result in more quickly reaching the FSH portion of the DoD allocation limit. Because a water allocation cap is in place for DoD activities, mitigation should not be required for the preferred alternative as long as the BRAC activities do not increase the water usage requirements beyond the Edwards Aquifer DoD allocation cap. The water withdrawal allocations for the San Antonio area for the Edwards Aquifer should allow the aquifer to recharge each year to compensate for water withdrawn. If water demand increases beyond the allowable withdrawal allocation, the resulting impacts could lower the potentiometric head of the aquifer, increase the drawdown (cone of depression) of pumping wells and decrease water availability and the flow of the aquifer. Reducing the potentiometric head of the aquifer would reduce flow from springs in the area.

It is anticipated that the current DoD water allocation cap will be protective of the Edwards Aquifer resource (DoD, 2005b). Because the increase in water use at FSH is not expected to result in exceedance of the DoD cap, this alternative is not expected to impact the resource significantly.

The preferred alternative would not add potential new sources of pollutants to Salado Creek. BMPs such as construction of new and or upgrade of existing detention ponds would reduce effects from the increase in impervious surfaces. Therefore, no significant impact to surface water quality is expected by implementing the preferred alternative.

Camp Bullis

The preferred alternative is expected to cause minimal impact on Salado Creek during storms due to the large amount of impervious surface area compared to the pervious surface area.

The environmental consequences on the groundwater resources from implementing the preferred alternative at Camp Bullis are related primarily to the expected increase in personnel. The expected increase in personnel at Camp Bullis is 1,200 people. The increase of personnel would result from the transfer of the Army Reserve Center and the National Guard (Section 2.0). Personnel increases directly impact the aquifer by increasing water usage, which would require an increased water withdrawal of the

Trinity Aquifer. Water allocations of 50 gpd are allotted to 8-hour shift employees and 150 gpd for 24-hour employees and students. This indicates that the water demand for personnel at Camp Bullis will increase from 0.11 to 0.13 MGD, or by 22.1 acre-feet per year. In addition to personnel water usage requirements, construction activities will require a temporary increase in water consumption. Construction activities are expected to be short term and to be completed prior to personnel additions.

The impacts of an increased draw on the Trinity Aquifer are not known. Changes at Camp Bullis are on a smaller scale than those of FSH and should not result in significant impacts on the Trinity Aquifer. If water demand increases beyond the recharge ability of the aquifer, the resulting impacts could lower the potentiometric head of the aquifer and decrease water availability and the flow of the aquifer. Reducing the potentiometric head of the aquifer would reduce flow from springs in the area. Nonetheless, the total volume of water that will be withdrawn from the Trinity Aquifer is relatively small and should have a minimal impact on the aquifer (EAA, 2006). The preferred alternative would not involve pumping from the Edwards Aquifer. The large open space at Camp Bullis protects or buffers the aquifer from adverse impacts from surrounding private development. Locating the Camp Bullis BRAC facilities near the cantonment area would allow the "buffering" of the aquifer to continue.

Minor Siting Variations

Minor siting variations described in Section 3.4 would have the same impacts to both FSH and Camp Bullis as the preferred alternative.

No Action Alternative

Fort Sam Houston

With the no action alternative, personnel numbers on the installation would remain similar. Therefore, the water demand would remain at similar levels and may decrease as conservation activities and use of reclaimed water increase.

Camp Bullis

With the no action alternative, activities and personnel at Camp Bullis should remain similar to current conditions and result in similar water usage requirements for the Trinity Aquifer. There would be no adverse effects to the Edwards Aquifer. The open space "buffering" of the aquifer would not be changed.

4.8 BIOLOGICAL RESOURCES

4.8.1 Affected Environment

Fort Sam Houston

FSH is located in an urban setting, and much of the land has been developed for military purposes. Approximately 30 percent of FSH is not developed along the floodplain of Salado Creek.

Camp Bullis

Camp Bullis is located in a residential/rural environment. The majority of the land is undeveloped.

Vegetation

The preferred alternative at FSH and Camp Bullis is situated in Bexar and Comal Counties, respectively, which lie within two of the Level IV ecoregions of Texas (the Northern Blackland Prairies [Ecoregion 32a] and the Balcones Canyonlands [Ecoregion 30c]). Each ecoregion is described below (Griffith *et al.,* 2004).

The rolling to nearly level plains of the Northern Blackland Prairie ecoregion are underlain by interbedded chalks, marls, limestones and shales of Cretaceous age. Soils are mostly fine-textured, dark, calcareous and productive vertisols. Historical vegetation was dominated by little bluestem, big bluestem, yellow Indiangrass and tall dropseed. In lowlands and more mesic sites, such as on some of the clayey vertisol soils in the higher precipitation areas to the northeast, dominant grasses were eastern gamagrass and switchgrass. Also in the northeast, over loamy alfisols, were grass communities dominated by Silveanus dropseed, Mead's sedge, bluestems and long-spike tridens. Common forbs included asters, prairie bluet, prairie clovers and black-eyed Susan. Stream bottoms often were wooded with bur oak, Shumard's oak, sugar hackberry, elm, ash, eastern cottonwood and pecan. Most of the prairie has been converted to cropland, non-native pasture and expanding urban uses around Dallas, Waco, Austin and San Antonio.

The Balcones Canyonlands ecoregion forms the southeastern boundary of the Edwards Plateau (Ecoregion 30). The Edwards Plateau was uplifted during the Miocene epoch at the Balcones Fault Zone, separating central Texas from the coastal plain. The Balcones Canyonlands are dissected highly through the erosion and solution of springs, streams and rivers working both above and below ground; percolation through the porous limestone contributes to the recharge of the Edwards Aquifer. High-gradient streams originating from springs in steep-sided canyons supply water for development on the Texas Blackland

Prairies (Ecoregion 32) at the eastern base of the escarpment. Ecoregion 30c supports several endemic plants and has a higher representation of deciduous woodland than elsewhere on the Edwards Plateau (Ecoregion 30), with escarpment black cherry, Texas mountain laurel, madrone, Lacey oak, bigtooth maple and Carolina basswood. Some relics of eastern swamp communities, such as bald cypress, American sycamore and black willow, occur along major stream courses. It is likely that these trees have persisted as relics of moister, cooler climates following the Pleistocene glacial epoch. Toward the west, the vegetation changes gradually as the climate becomes more arid. Plateau live oak woodland eventually is restricted to north- and east-facing slopes and floodplains, and dry slopes are covered with open shrublands of juniper, sumac, sotol, acacia, honey mesquite and ceniza.

Fort Sam Houston

The vegetation at FSH is dominated primarily by maintained grasslands with some undeveloped areas with vegetation typical of the urbanized, anthropomorphically altered Blackland Prairies.

Camp Bullis

Vegetation on Camp Bullis is typical for the Edwards Plateau area of Texas. This vegetation was studied on Camp Bullis in 1994, 1995 and 1996 and consists of over 500 species (U.S. Army, 2001b). These studies found five distinct plant communities: woodland plant communities of intermittent streams and adjacent floodplains, wetland plant communities, grassland savanna plant communities, upland wood plant communities and plant succession on disturbed ground. According to the INRMP, 61 percent of the installation consists of woodland plant communities, 31 percent of grassland savanna, 6.5 percent of disturbed grassland communities and the remainder of developed/urban areas (U.S. Army, 2001b).

Wildlife

Fort Sam Houston

Wildlife at FSH can be divided into species tolerant of urbanized areas and those that occur in the floodplain of Salado Creek. Salado Creek supports a diverse bird fauna, including nesting, migrating and wintering species. Common species observed during winter months include the white-winged dove (*Zenaida asiatica*) and northern cardinal (*Cardinalis cardinalis*). A large number of waterfowl and other waterbirds are expected to use the Salado Creek floodplain throughout the year. Mammals such as beaver (*Castor canadensis*), armadillo (*Dasypus novemcinctus*) and opossum (*Didelphis virginiana*) inhabit the bottomlands of Salado Creek (U.S. Army, 2001b). Fish species in the creek include bluegill (*Lepomis macrochirus*), largemouth bass (*Micropterus salmoides*) and Rio Grande perch (*Cichlasoma* *cyanoguttatum*) (U.S. Army, 1991). Species found in the urbanized setting of the installation include fox squirrel (*Sciurus niger*), house sparrow (*Passer domesticus*), grackle (*Quiscalus* spp.) and American robin (*Turdus migratorius*) (U.S. Army, 2001b). No species listed in the DoD BO (Section 4.7.1) have been observed at FSH.

Camp Bullis

Various studies have indicated that Camp Bullis contains at least 57 mammal species, 157 bird species, 92 species of reptiles and amphibians and 14 species of fish (U.S. Army, 2001b). A full listing of these species is detailed in the 2001 INRMP. No species noted in the DoD BO (Section 4.7.1) have been observed at Camp Bullis.

Sensitive Species

According to USFWS, 19 species protected under the ESA potentially occur or imminently are affected by actions in Bexar County, and 10 species potentially occur or imminently are affected by actions in Comal County. Critical habitat in Bexar County (1,063 acres in 22 units) for the nine federally endangered karst/invertebrate species was designated in April 2003 (50 CFR 17). Neither FSH nor Camp Bullis contains federally designated critical habitat for these invertebrate species. Additionally, the Texas Parks and Wildlife Department (TPWD) has listed 18 species in Bexar County and 11 species in Comal County as State threatened or endangered.

Table D-1 in Appendix D presents the habitat requirements for State and federally listed threatened and endangered species occurring or potentially occurring in Bexar and Comal Counties, as well as whether those habitats occur or potentially may occur at Camp Bullis and FSH. According to USFWS records, several threatened and endangered bird species could use portions of the installations during annual migration, including the whooping crane and arctic peregrine falcon. Two species listed as threatened by TPWD (the widemouth blindcat and the toothless blindcat) may be present near FSH (U.S. Army, 2001b). Camp Bullis contains habitat and current populations of five federally endangered species (golden-cheeked warbler [GCW], black-capped vireo [BCV], Madla’s Cave meshweaver and two unnamed beetles [*Rhadine exilis* and *R. ewersi*]), as well as two State threatened species, the Cascade Caverns salamander (*Eurycea latitans*) and the Comal blind salamander (*Eurycea tridentifera*).

Camp Bullis annually monitors for GCW and BCV because these are listed endangered species (U.S. Army, 2005a). Table 4-25 indicates the estimated population of GCW and the number of territories of BCV from 1991 to 2005. Figure 4-20 shows the habitats for both species and the proposed alternative site location.

Table 4-25 Summary of GCW and BCV Indicators at Camp Bullis

Year	GCW Estimated Population	BCV Territories
1991	184	11-13
1992	158	9-11
1993	126	12
1994	130	10-11
1995	nda	7-9
1996	nda	6-8
1997	nda	12-17
1998	155	13
1999	317	9-11
2000	249	10
2001	672	7
2002	750	18
2003	551	28
2004	673	23
2005	485	13

nda = no data available

As of 2006, 23 caves on Camp Bullis have been identified as containing endangered species. Fifteen karst features contained two species of ground beetle listed as federally endangered species (*Rhadine exilis* and *R. infernalis ewersi*). All the federally listed cave-dwelling species identified by USFWS are threatened by urban expansion onto karst features of San Antonio and communities surrounding Camp Bullis and into the recharge areas associated with the Glen Rose and Edwards Aquifers (U.S. Army, 2005b).

Wetlands

Activities that result in dredging and/or filling of jurisdictional waters of the United States are regulated under Section 404 of the CWA and by EO 11990, *Protection of Wetlands*. USACE has established Nationwide Permits (NWPs) to efficiently authorize common activities that do not impact waters of the United States significantly. The NWPs were modified and reissued by USACE in the FR on 18 March 2002. USACE has the responsibility to authorize permitting under an NWP or to require an Individual Permit (IP). Non-jurisdictional wetlands on federal properties also are protected under EO 11990.

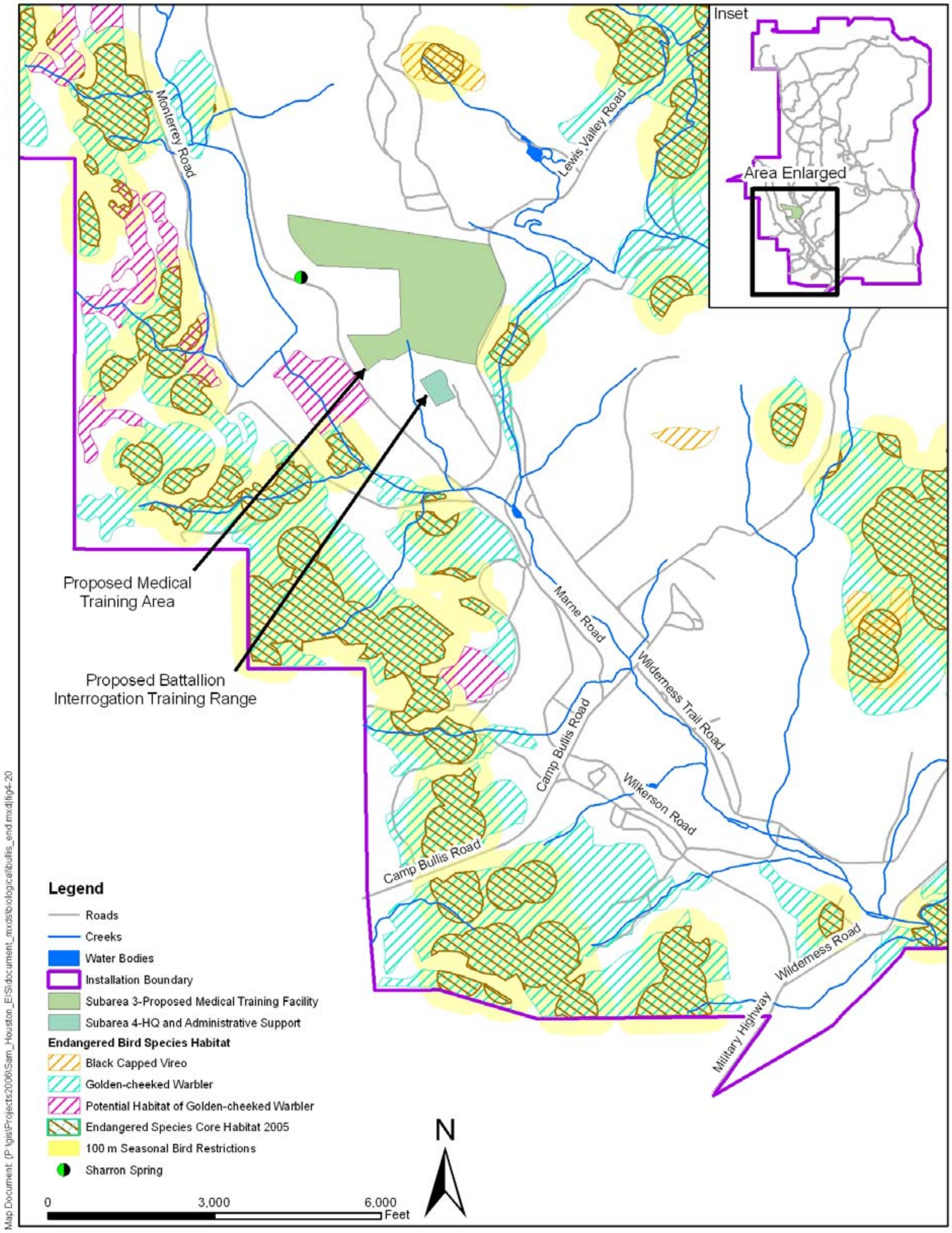


Figure 4-20 GCW and BCV Habitat near the Preferred Alternative Location on Camp Bullis (Core and Non-core)
Source: FSH GIS Department, 2004a

Federal agencies are directed to take all practical measures to avoid or minimize impacts to wetlands. Impacts to wetlands should be avoided unless there is no practicable alternative to avoid or minimize impacts to these waters. If affected, the wetlands should be mitigated to prevent a net loss of the functions and values provided by the impacted wetlands.

Fort Sam Houston

A wetlands inventory of FSH was conducted in 1999 by USFWS (U.S. Army, 2001b). This inventory identified 22 acres of wetlands (less than 1 percent of the land area of the installation). These wetlands were defined using the USFWS official wetland classification system (Cowardian *et al.*, 1979). These wetlands consisted of 82 percent palustrine forested (PFO) wetlands and 18 percent palustrine unconsolidated bottom (PUB) (U.S. Army, 2001b). Figure 4-16 shows wetlands mapped at FSH.

Camp Bullis

A wetlands inventory of Camp Bullis also was conducted by USFWS in 1999 (U.S. Army, 2001a). This inventory identified 88 acres of wetlands in the installation. These wetlands were classified as 40 percent palustrine emergent wetlands (PEW), 25 percent palustrine unconsolidated shores (PUS), 20 percent PUB, 10 percent palustrine forested wetlands (PFW), 5 percent palustrine scrub/shrub (PSS) and 42 acres of lacustrine unconsolidated shores (LUS). Wetlands near the proposed alternative location are shown in Figure 4-16.

Management Plans

FSH and Camp Bullis natural resources are managed under an overarching INRMP. Additional management plans for Camp Bullis exist due to the presence of federally protected species and unique ecological areas. The INRMP for FSH and Camp Bullis describes the existing environment, natural resources management goals and project objectives for the five-year period from 2000 to 2005. The INRMP is the baseline document for natural resources management and is supplemented through additional management plans on a five-year revision cycle. The Endangered Species Management Plan (ESMP) is a tool to reduce the effects to federally protected species and their habitats located on Camp Bullis (Thompson and Schlatter, 2005). This plan is written for the period for Fiscal Year (FY) 2005 through FY 2009. Table D-1 in Appendix D describes the objectives of the ESMP and the actions proposed and undertaken to meet those objectives.

Karst Management Plan

A Karst Management Plan (KMP) was developed in 2002 to assist Camp Bullis in managing the protection of karst species by protecting the unique ecological zones containing and adjacent to karst features on the installation. The KMP identified 37 biologically significant caves within the Camp Bullis karst management areas. Sharron Spring is the only karst feature within approximately 1,000 feet of the preferred alternative location (Figure 4-11).

Biological Opinion

The GCW and BCV at Camp Bullis are managed and studied under the terms of the 28 July 2005 10-year Programmatic BO from USFWS (2005). Under the BO, USFWS requested the following reasonable and prudent measures necessary and appropriate to minimize incidental destruction of GCW and BCV:

1. Minimize harassment and harm of GCW or BCV during activities associated with implementing the projects
2. Minimize effects of temporary losses and degradation of habitat of GCW and BCV and, to the greatest extent practicable, restore habitat to pre-project conditions

The following terms and conditions were requested by USFWS to implement Reasonable and Prudent Measure No. 1:

A. To the greatest extent practicable, conduct authorized activities within GCW or BCV habitat and the 100-meter buffer area between 15 August and 28 February. This is the non-nesting period for GCW and BCV, and potential significant impacts would be minimized and avoided.

B. To the greatest extent practicable, minimize authorized activities within core GCW habitat and adjacent riparian areas or within known nesting territories of BCV during the nesting and post-fledging season (1 March to 14 August).

C. Inform personnel involved in an authorized activity covered by this programmatic opinion of the terms and conditions of this BO before implementation of the authorized activity.

D. Allow GCW or BCV encountered during authorized activities to move away from activities on their own. Capture and relocation of trapped or injured birds can be attempted only by personnel with current USFWS recovery permits pursuant to Section 10(a)1(A) of the Act.

E. To the greatest extent practicable, restrict movement of heavy equipment between a project site and established roadways to minimize habitat disturbance.

F. Conduct BCV and GCW surveys annually to facilitate planning that will avoid and minimize significant impacts caused by routine operations.

The following terms and conditions were requested by USFWS to implement Reasonable and Prudent Measure No. 2:

A. Designate known occupied habitat of federally listed species as "Environmentally Sensitive Areas," and personnel shall, to the greatest extent practicable, avoid such areas.

B. After completion of activities covered by this programmatic opinion that result in habitat alteration, remove temporary fill; construction or other debris; and, wherever feasible, disturbed areas, to pre-project conditions.

C. Ensure compliance with reporting requirements to assist in management decisions that will avoid and minimize impacts on GCW, BCV and their associated habitats.

4.8.2 Consequences

Realignment (Preferred) Alternative

Fort Sam Houston

Implementing the preferred alternative would not result in significant impacts on biological resources within or adjacent to FSH. Under the preferred alternative, only one facility (approximately 260,000 sf) location is within an undeveloped/urbanized portion of the installation. The Tri-Service Research facility is planned for construction north of W.W. White Road on Pershing Field. This location is not within unique or special habitats (*i.e.,* wetlands or other aquatic features) and previously has been disturbed through past actions. Vegetation and wildlife are those species that have adapted to open spaces within low-density urban environments after past human activities. All other construction activities would occur within developed/urbanized portions of the installation; therefore, there would be no substantial effects on biological resources on the installation posed by the preferred alternative. Furthermore, as discussed in Section 4.7, the biological resources in San Marcos and Carmel Spring would not be affected significantly.

Camp Bullis

The location for the preferred alternative is adjacent to one managed karst feature (Sharron Spring). Activities associated with the preferred alternative would avoid effects on this feature through ongoing karst management and protection activities as described in the KMP and ESMP, thereby ensuring that there would be no significant impacts to potential populations of federally protected karst species. Sharron Spring is upstream from the preferred alternative location and would not be expected to receive runoff from the site, thereby reducing the potential effects from anthropomorphic activities.

Implementing the preferred alternative would not result in significant effects on biological resources at Camp Bullis. Under the preferred alternative, approximately 125 acres would be used for the construction of and operational activities at the medical training facility, and 5 acres would be used for the construction of the BN interrogation training range. The preferred alternative location is next to the cantonment area of Camp Bullis, which is developed and contains associated infrastructure for facilities. This alternative would construct facilities and additional infrastructure on the majority of the acreage, thereby removing a small percentage (less than 1 percent of the land area) of disturbed grassland/oak savanna acreage on the installation. Existing wildlife would be anticipated to relocate to other adjacent areas within the installation.

Federally protected species protection and management at Camp Bullis were authorized by USFWS under the 2005 BO. All actions undertaken through the preferred alternative would comply with this BO, thereby reducing the need for further Section 7 consultation between FSH and USFWS. Furthermore, the preferred alternative does not contain and is not adjacent to habitat for any federally endangered GCW or BCV habitats (Figure 4-21). Implementing the preferred alternative would not increase training activities outside those limits described in the Camp Bullis Mission Update EA (U.S. Army, 2006). The medical training facility also will be used for the craftsman's course by USAF. Noise generated by this course would be produced by blank ammunition, flares and pyrotechnics. The frequency and magnitude of this training are expected to be considerably less than those occurring at the small arms ranges, which have a localized noise contour. The operational noise from this new facility is expected to be fairly localized and would not increase noise levels for the whole installation. This localized peak would not create substantial effects to sensitive avian species, since frequency and magnitude research has indicated limited noise-related effects on the GCW and BCV outside sensitive activity periods (*i.e.,* breeding season). BCV are highly dependent on vocal communication, particularly during the courtship and early nesting season. During the breeding season, male BCV sing persistently well into the heat of the day, the intensity of their singing seeming to increase after singing by other local species has waned. This species' songs with alternating phrases are typical of those of many other vireo species, but they are unusual in being derived from a large syllable repertoire, an order of magnitude greater than that of other vireos (Grzybowski, 1995). BCV vocalizations are within the 2- to 6-kilohertz (KHz) range (Robbins *et al.,* 1983), and its hearing is assumed to be predominately within this range. The projected noise levels associated with construction and operational activities at the habitat are anticipated to be below 1 KHz and reasonably can be expected to be below the hearing threshold of the species. Therefore, training noise is not expected to interfere with the courtship process, territorial establishment or reproductive success of BCV that could occur at Camp Bullis. No mitigations are needed for biological resources.

Minor Siting Variations

Minor siting variations have been proposed for FSH; however, none of these variations would alter the overall construction and operational activities of the preferred alternative substantially. Therefore, there would be no substantial effects on biological resources on the installation. No minor siting variations have been proposed for medical training at Camp Bullis; therefore, there would be no additional effects to biological resources different from the current condition.

No Action Alternative

Fort Sam Houston

Under the no action alternative, FSH would not carry out the preferred alternative. There would be no effects on biological resources different from the current condition.

Camp Bullis

Under the no action alternative, Camp Bullis would not accept the relocation of units and would not construct the medical training facility. There would be no effects on biological resources different from the current condition.

4.9 CULTURAL RESOURCES

4.9.1 Affected Environment

The affected environment for cultural resources at FSH and Camp Bullis includes all areas to be affected by new construction, demolition/deconstruction or adaptive reuse of facilities and structures or areas affected by increased training activities or use from the preferred alternative.

Prehistoric and Historic Background

The human occupation of central Texas includes three prehistoric periods: Paleoindian (9500 Before Christ [B.C.]), Archaic (6,000 B.C. to 700 *Anno Domini* [A.D.]) and Late Prehistoric (700 to 1,600 A.D.). The Paleoindian period began toward the end of the last Ice Age, when roving bands of hunters crossed a land bridge exposed by lowered sea levels between what is now Siberia and Alaska. The Paleoindian hunters pursued large mammals such as mammoths, mastodons and large bison forms that are now all extinct, but also exploited smaller game and gathered resources. Paleoindian bands roamed over very large territories and used extremely high-quality toolstone to produce distinctive fluted points, blades and other tools. No Paleoindian sites have been documented at FSH, but 12 sites at Camp Bullis include

Paleoindian or possible Paleoindian components. Seven of those sites are represented by Late Paleoindian components.

The Archaic period is represented by many known archaeological sites in central Texas. Central Texas still was occupied by bands that wandered over fairly large territories and exploited seasonally available animal and plant resources. The stone tools of this period are different from the preceding Paleoindian period and reflect greater emphasis on gathered resources. Large burned-rock middens appear at this time and mark locations where bands repeatedly visited over a long period to gather and cook wild plant tubers. Cemeteries also appear at this time and include individuals buried with grave goods. Numerous Archaic period sites have been identified at Camp Bullis, while a single site with Archaic components has been found at FSH. No burned rock middens have been identified at FSH, and only 13 sites with burned rock middens (including those without diagnostics and Late Prehistoric occupations) have been identified at Camp Bullis. The Archaic sites at Camp Bullis tend to be campsites, lithic procurement sites or lithic scatters.

The introduction of pottery marks the beginning of the Late Prehistoric period at about 700 A.D. New types of stone tools also were introduced during this period, including small projectile points used to tip arrows. Bison hunting was important during this period in central Texas, while the more sedentary Caddoans occupied eastern Texas. A single site with a Late Prehistoric component has been found at FSH. Late Prehistoric sites in the form of quarry sites, camps and lithic scatters have been found at Camp Bullis. A single cave site at Camp Bullis has been noted as containing a possible Caddo component, but no definite Caddoan presence has been found at that facility.

The Historic period in central Texas began with Spanish expeditions into the area in the 17th century, although a permanent Spanish presence in the form of missions was not established there until the mid-18th century. The siege and subsequent capture of the Alamo by the Mexican army in nearby San Antonio in 1836 was a critical catalyst in the struggle for independence for Texas. Texas joined the Union in 1845, and a military installation was established near what is now FSH during the Mexican War of 1846 to 1848. The initial elements of FSH were established on a 92-acre tract donated by the City of San Antonio in the early 1870s. The facility was named "Fort Sam Houston" in 1890 and became HQ for the Fifth Military District in 1899. The facility was expanded during World War I and again during World War II. The Medical Field Service School and the ISR were established on the installation after World War II.

The historical use of what is now Camp Bullis appears to date to the late 19th century, when a number of small farms and ranches were established in the area. Camp Bullis was created as an adjunct facility to FSH in 1906 for heavy weapons training. It was used as a training facility during World War I and World War II and continues to serve as a sub-installation of FSH.

Status of Cultural Resource Inventories and 106 Consultations

Cultural resource inventories that have been conducted at FSH and Camp Bullis include architectural surveys and evaluation, archaeological survey and evaluation studies, Cold War era resource evaluation and landscape studies. The results of the resource inventories are available in the *Fort Sam Houston and Camp Bullis Historic Properties Component* (FSH HPC, 2006) of the Integrated Cultural Resources Management Plans for Fort Sam Houston and Camp Bullis (Peter *et al.,* 2001a, 2001b) and *Preliminary Evaluation of Cold War Era Resources at Fort Sam Houston* (Prior and Adams, 2006), and the specific inventories will not be reproduced in this document.

The HPC was developed to enable FSH to comply with Section 106 of the NHPA on a programmatic, rather than a case-by-case, basis under the Army Alternate Procedures (AAPs). The AAP was adopted under Section 800.14 of the Advisory Council on Historic Preservation (Council) regulations under 36 CFR Part 800 and published in the FR at Vol. 69, No. 74, p. 2057. The HPC for FSH was certified by the Advisory Council on 1 March 2006. The HPC serves as the Section 106 compliance agreement for a five-year period. The Section 106 compliance responsibilities would be met through internal installation implementation of the HPC. The HPC for FSH has established a series of standard operating procedures (SOPs) that will guide the treatment of cultural resources on the study project.

Architectural surveys of FSH have revealed 1,377 facilities and structures on the installation. Five of these facilities are listed individually on the NRHP, and 746 are considered to be contributing structures to National Register districts or eligible for listing on the NRHP. The remaining 626 facilities and structures have been determined to be ineligible for the NRHP or are less than 50 years old. A study of Cold War resources on the installation revealed that none are present that are potentially eligible for the NRHP. There is an ongoing program to consider the eligibility of facilities and structures as they meet the minimum 50-year-old threshold required for NRHP eligibility. The five facilities that currently are listed on the NRHP include the Quadrangle (Facility 16), Clock Tower (Facility 40), Pershing House (Quarters 6), Gift Chapel (Facility 2200), and Old Brook Army Medical Center (Facility 1000), as shown in Figure 4-3.

An NHLD (Figure 4-3) that includes all of the individually listed facilities, as well as 103 facilities that have been defined as contributing elements of the NHLD, has been identified. The Quadrangle, Staff Post, Infantry Post and Artillery Post are National Register Historic Landmark Districts in their own right, and all are included in the NHLD. A National Historical Conservation District encompasses the New Post portion of FSH, which includes a portion of the installation that was developed beginning in the 1930s.

The majority of the undisturbed lands at FSH have been surveyed for archaeological resources. Twelve archaeological sites have been identified on the facility, and none have been determined to be eligible for listing on the NRHP. All areas of FSH except the Salado Creek floodplain appear to be low-probability areas for the occurrence of prehistoric archaeological sites. Intact historic archaeological deposits may be possible in the older, developed portions of the installation, and no surveys have been conducted to date to search for those resources.

There are a total of 364 facilities and structures at Camp Bullis. These include landscape features such as wells, roads and culverts, as well as facilities, hutments and other structures. A total of 89 facilities and structures and 37 landscape features are more than 50 years old, and 81 of all types have been found to require further study to determine whether they are eligible for the NRHP.

Historic landscape studies conducted at FSH identified 10 historic landscape features on the facility:

- Quadrangle (1876 to 1946)
- Staff Post (1881 to 1946)
- Infantry Post (1885 to 1946)
- Cavalry/Artillery Post (1906 to 1946)
- Channel Pastures (1875 to 1946)
- New Post (1926 to 1946)
- Gorgas Circle (1930s to 1946)
- Depot (1917 to 1946)
- NCO Housing (1930s to 1946)
- Golf Course (1930s to 1946)

All of the landscape features except the Infantry Post are considered eligible for the NRHP. Furthermore, the entire installation has been surveyed and documented sites have been evaluated for NRHP eligibility, with the result of the evaluations pending.

Archaeological surveys have been completed on 100 percent of the 23,032 acres of maneuver areas at Camp Bullis. According to the 2001 ICRMP for FSH and Camp Bullis, those surveys have identified 287 archaeological sites, 221 of which have been determined to be ineligible for the NRHP. Thirty-five of the Camp Bullis sites have been determined to be eligible for the NRHP or require additional consideration. The eligibility status of 31 sites is unknown. A reassessment is underway for some of the archaeological sites. Unmarked cemeteries and individual graves may be present, awaiting discovery. A recent survey completed on a 20-acre parcel of Pershing Field (preferred alternative location of the Tri-Services Research center) is included in Appendix E. The results of the survey did not indicate significant findings.

A formal cultural landscape study has not been conducted for Camp Bullis.

Native American Resources

Traditional Cultural Properties (TCPs) may be embodied in a broad range of cultural and natural areas. These may include archaeological sites, ceremonial areas, places or natural areas. TCPs are subject to the same regulations as other types of cultural properties, and the level of protection afforded by NRHP eligibility or listing may be extended to TCPs. Native American groups that might have TCPs at FSH or Camp Bullis include the Tonkawa, the Lipan Apache, the Mescalero Apache, the Coahuiltecan, the Wichita, the Comanche, the Kiowa/Kiowa Apache and the Caddo. No TCPs have been identified at FSH or Camp Bullis. Following EO 13175, all consultation with Native American groups is to be done on a Nation-to-Nation basis.

4.9.2 Consequences

The cultural resource impacts of the proposed project may be direct, indirect or cumulative. Impacts also may be positive or negative, depending on the effects on the cultural resources. Examples of positive effects may be adaptive reuse of a property following FSH SOPs to prolong the use life of a structure, or finding a new use for a facility structure without alterations that would ensure its proper maintenance. The FSH ICRMP lists examples of significant impacts as:

- Physical destruction or damage to all or part of the property
- Alteration of the property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation and provision of handicap access, that is not consistent with the Secretary's Standards for the Treatment of Historic Properties (36 CFR Part 68) and the IDG (FSH Pamphlet [PAM] 210-20-3)
- Removal of the property from its historic location
- Change of the character of the property's use or physical features within the property's setting that contribute to its historic significance

- Introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features
- Neglect of an architectural property that causes its deterioration (except where such neglect and deterioration are recognized qualities of a property or religious and cultural significance to an Indian tribe)
- Transfer, lease or sale of the property out of federal ownership or control without adequate and legally enforceable restrictions of conditions to ensure long-term preservation of the property's significance

Significant impacts to archaeological sites generally are caused by physical damage to the sites that destroys the contexts within those sites that contain the information defining the sites' scientific significance.

Realignment (Preferred) Alternative

The preferred alternative consists of several projects that will be undertaken at FSH and Camp Bullis to accommodate the expanded installation mission. There are no known significant archaeological resources present at the FSH and Camp Bullis preferred alternative locations. There are no known archaeological sites for the project locations at FSH shown in Figures 3-1, 3-2 and 3-3. No archaeological sites have been identified within the medical training facility site or the northern portion of Black Jack Village, which is the preferred alternative location for the BN interrogation training range.

The largest area of planned ground disturbance under the preferred alternative at FSH is within Pershing Field. That area has been surveyed completely (Appendix E), and no significant archaeological resources have been found.

There is always potential for ground-disturbing activities to encounter unrecorded cultural sites. In the event of an inadvertent discovery of Native American remains, funerary objects, sacred objects or objects of cultural patrimony, HPC SOP 11 (*Consultation for Inadvertent Discoveries*) would be followed.

Projects in Visual Zones 1 to 3 and part of Visual Zone 5 (Figure 4-4) require historic review and approval.[8] The preferred alternative at FSH includes several projects that will involve alteration or

[8] Army property under FSH control has been divided into seven Visual Zones (VZs). The VZs were developed during a Visual Enhancement Study and are based largely on historical development of common design elements and/or current uses at FSH. VZ1 encompasses the entire NHLD. VZ2 includes all those areas in the New Post building programs as well as those immediately adjacent. VZ3 includes the Harris Heights and Watkins Terrace neighborhoods and the west portion of the METC campus. VZ4 includes training brigade troop housing and support areas from several different uncoordinated building programs. VZ5 includes the supply warehouse area south of Wilson Street, and open space areas south of Binz-Engleman Avenue and between BAMC and W.W. White Road. VZ6 encompasses the BAMC subarea. VZ7 includes the FSH National Cemetery, the FSH Golf Course and open space and recreation areas along Salado Creek and north of W.W. White Road.

demolition/deconstruction of existing structures or new construction. Table 4-26 lists the proposed alteration/renovation projects that will affect existing facilities and structures by project number, the nature of the impact and the historic status of each facility and structure. Table 4-27 lists construction projects that will affect existing facilities and structures. Table 4-28 lists new construction that will not affect existing facilities or structures. Figures 4-21 through 4-23 show the locations of these facilities. Any project action that will affect facilities and structures that either are listed on or are eligible to be listed on the NRHP would not constitute significant impacts if SOPs established in the HPC are followed. Significant impacts would be mitigated by following pertinent SOPs in the HPC.

Table 4-26 Proposed Alteration/Renovation Projects Under the Preferred Alternative that Involve Existing Facilities or Structures

Project #	Facility #	Historic Status	Action	National Historic Landmark District	Visual Zone
64210	3611	Not Eligible	Alteration/Construction	No	VZ 6
64292	2630	Not Eligible	Renovation	New Post	VZ 2
64184	1279	Not Eligible	Alteration/Construction	No	VZ 3
64188	1111	Not Eligible	Demolition/Deconstruction	No	VZ 5
64188	1105	No Information	Demolition/Deconstruction	No	VZ 5
64189	1240	Not Eligible	Alteration/Construction	No	VZ 5
64189	1278	Not Eligible	Alteration/Construction	No	VZ 5
64212	2266	Eligible	Alteration/Construction	New Post	VZ 2
64216	2000	Listed/Contributing	Alteration/Construction	Artillery/Cavalry Post	VZ 1
64216	2001	Listed/Contributing	Alteration/Construction	Artillery/Cavalry Post	VZ 1
64216	2263	Eligible	Alteration/Construction	New Post	VZ 2
64218	2264	Eligible	Alteration	New Post	VZ 2
64580/64220	4170	No Information	Alteration	No	VZ 5
64182	2270	Listed/Contributing	Renovation	Artillery/Cavalry Post	VZ 1
65310	258	Listed/Contributing	Construction	Channel Pastures	VZ 1
64179	3600 (1)	Not Eligible	Alteration/Demolition/ Deconstruction/ Construction	No	VZ 6
64180	3600 (2)	Not Eligible	Alteration/Demolition/ Deconstruction/ Construction	No	VZ 6
64181	3600 (3)	Not Eligible	Alteration/Demolition/ Deconstruction/ Construction	No	VZ 6

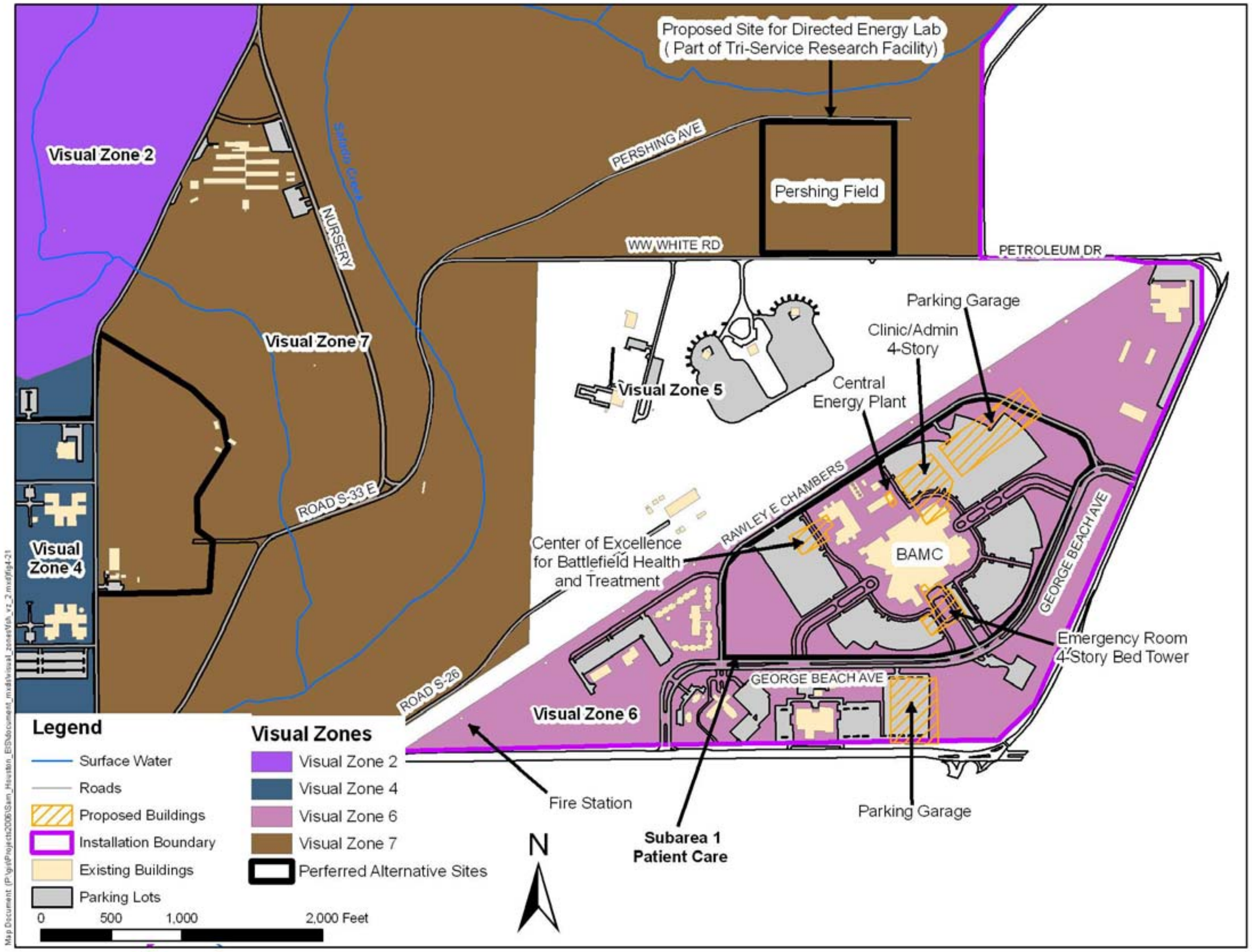


Figure 4-21 Visual Zone Map of Patient Care and Medical and Non-medical RDTE Subareas
Source: FSH PAM 210-20-3

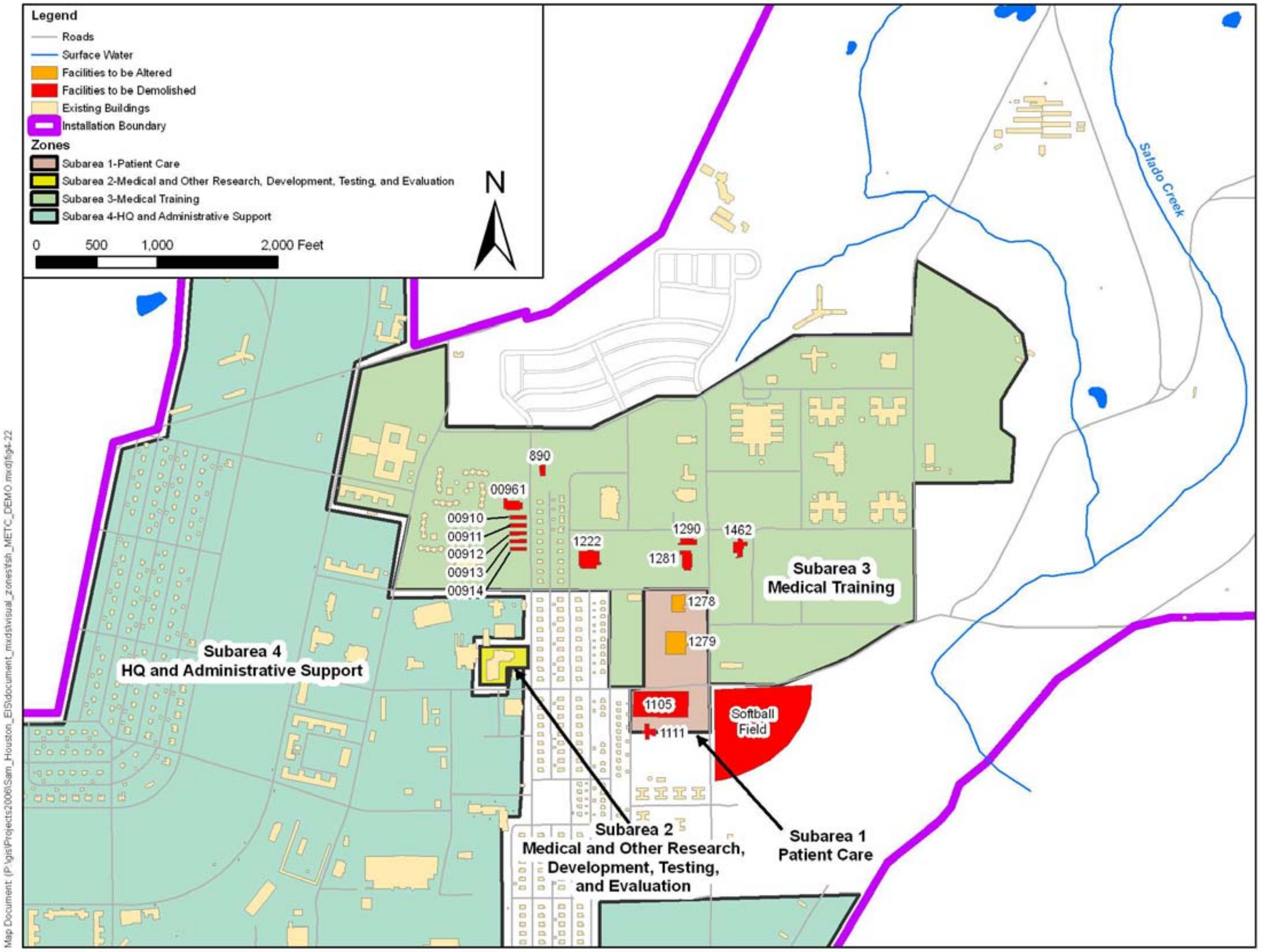


Figure 4-22 Facilities to be Deconstructed/Demolished Under the Preferred Alternative
Source: FSH PAM 210-20-3

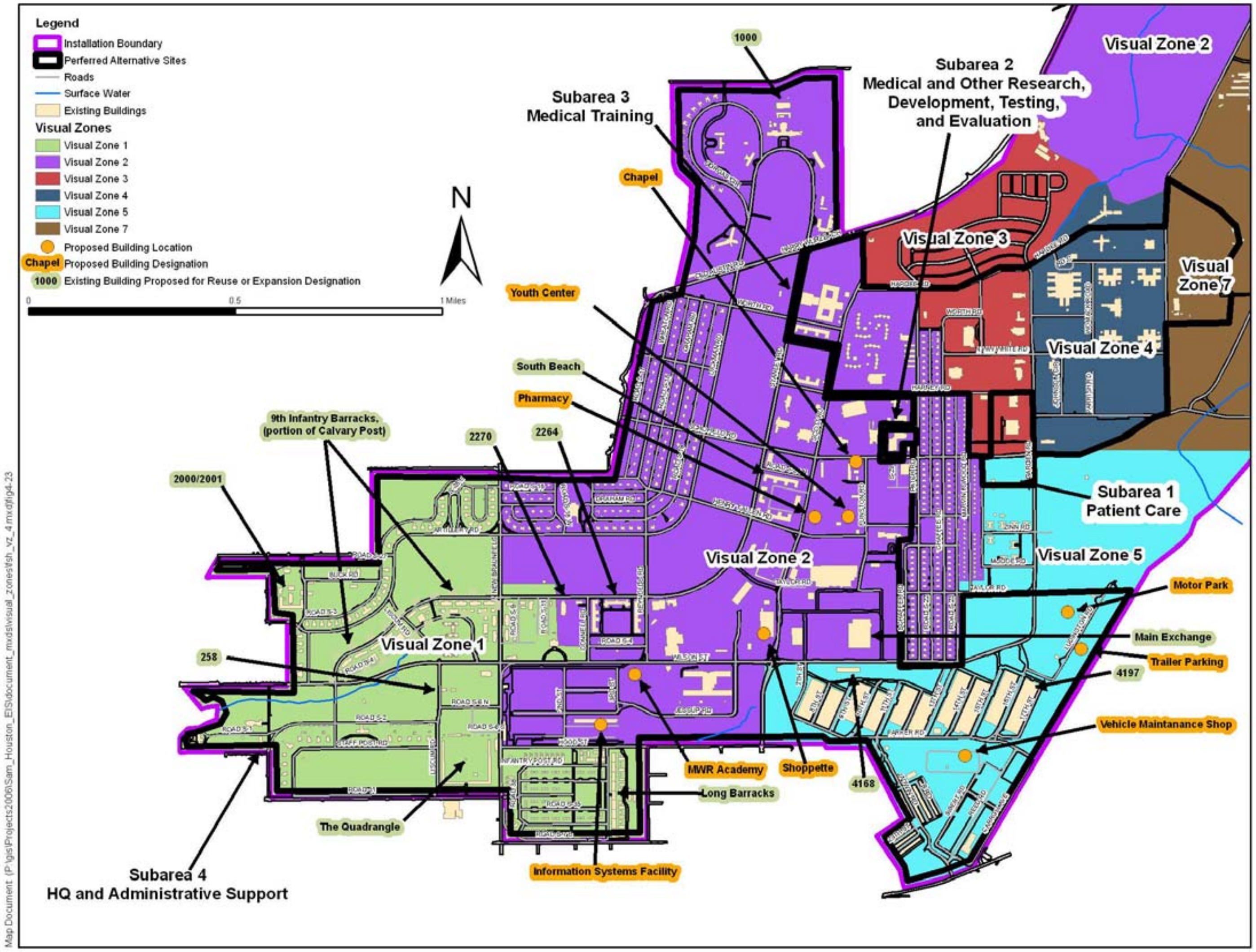


Figure 4-23 Visual Zone Map of HQ and Administrative Support Subarea
Source: FSH PAM 210-20-3

Table 4-27 List of Projects Under the Preferred Alternative that Involve Demolition/Deconstruction of Entire Facilities or Structures

Project #	Facility #	Historic Status	Visual Zone	National Historic Landmark District
64192	1222	Listed/Contributing	VZ 3	No
64192	1281	Listed/Contributing	VZ 3	No
64192	1290	Not Eligible	VZ 3	No
64200	1462	Not Eligible	VZ 4	No
64200	B1462	Not Eligible	VZ 4	No
64200	1470	No Information	VZ 4	No
64200	1463	Not Eligible	VZ 4	No
64201	3850	No Information	VZ 4	No
64206	890	Not Eligible	VZ 3	No
64206	910	Not Eligible	VZ 2	No
64206	911	Not Eligible	VZ 2	No
64206	912	Not Eligible	VZ 2	No
64206	913	Not Eligible	VZ 2	No
64206	914	Not Eligible	VZ 2	No
64206	961	Not Eligible	VZ 2	No
64209	2010	Listed/Contributing	VZ 1	Yes*
64216	2007	Listed/Contributing	VZ 1	Yes*
64216	2008	Listed/Contributing	VZ 1	Yes*
65543	4190	Eligible	VZ 2	No

* These buildings are in the Artillery/Cavalry Post Historic District.

Table 4-28 New Construction Under the Preferred Alternative that Will Not Require Demolition/Deconstruction

Project #	Facility	Mission Subarea	National Historic District	Visual Zone
64202	Student Dormitories 2, Phase 1	Medical Care	No	VZ 4
64211	Student Dormitories 3, Phase 1	Medical Care	No	VZ 4
64205	Medical Training Facility 2	Medical Care	No	VZ 2 – VZ 4
64207	Medical Training Facility 3	Medical Care	No	VZ 2 – VZ 4
64208	Medical Training Facility 4	Medical Care	No	VZ 2 – VZ 4
64185	Tri-Service Research Facility	Pershing Field	No	VZ 7
64290	Tractor Trailer Parking	HQ and Administrative Support	No	VZ 5
64221	MWR Academy	HQ and Administrative Support	No	VZ 2
64194	Chapel Facility	HQ and Administrative Support	No	VZ 2
64191	Enlisted Unaccompanied Personnel Housing	Medical Care	Artillery/Cavalry Post	VZ 1
64174	Youth Center	HQ and Administrative Support	No	VZ 2
64215	Shoppette with Gas and Car Wash	HQ and Administrative Support	New Post	VZ 2
64746	Main Exchange Addition	HQ and Administrative Support	No	VZ 2
64214	Fire Station I Company	HQ and Administrative Support	No	VZ 6
45151	Vehicle Maintenance Shop 470th MI	HQ and Administrative Support	No	VZ 5
66063	BDE Complex	HQ and Administrative Support	No Location Given	
12253	JOC – Fifth USA	HQ and Administrative Support Subarea	No	VZ 5 (Adjacent to VZ 2)
66029	470th MI BDE Complex	HQ and Administrative Support Subarea	No Location Specified	

Portable, relocatable buildings may be used adjacent to the Quadrangle within the NHLD on a temporary basis. Temporary use of portable buildings in this setting may not be considered a significant impact unless they remain in place for five or more years.

The HPC establishes a series of SOPs that must be followed on projects that involve eligible or listed properties and projects that take place within the installation. Those SOPs define the entire process that may be triggered by such a project, and include (but are not limited to) assessing significant impacts, reviewing alternatives, resolving significant impacts, obtaining technical assistance and dealing with TCPs or emergency or late discoveries. Those SOPs would inform and guide needed additional evaluation and mitigation of significant impacts that could occur due to the preferred alternative.

The IDG requirements for alteration and construction projects would be followed. Appendix D of the IDG contains detailed design review requirements, including a historic review procedure for projects in Visual Zones 1 to 3 and that part of VZ 5 adjacent to VZ 2.

Rehabilitation projects involving Facilities 258, 2000, 2001, 2263, 2264 and 2266 would be designed to prevent:

- Conflict with the existing architectural character
- A facility larger or taller than existing historic structures
- A color or material that conflicts visually with the predominant historic materials used in the area
- Demolition/deconstruction of the historic fabric of existing structures or landscape features that are defining elements within the NHLD
- Destruction of the spatial relationship between or among historic facilities designed as a grouping

Rehabilitation work would be designed in accordance with the Secretary of Interior Standards for Historic Preservation to:

- Enhance and protect historic qualities
- Provide necessary modern conveniences as unobtrusively as possible
- Scale new facilities down as to minimize their visual impact
- Landscape parking areas and modern mechanical equipment so as to screen them from view

Demolition/deconstruction projects within the NHLD include Buildings 2007, 2008 and 2010.

Planned undertakings within the NHLD, including the demolition of existing buildings and construction of new buildings, will be reviewed using the IDG historic review requirements and the SOPs in the HPC. If demolition cannot be avoided, the determination of harm to the NHLD and required mitigations would be determined per the HPC SOPs.

Minor Siting Variations

The facilities listed in Table 4-29 would be reviewed in accordance with the IDG Design Review Guidelines, except for the additional dormitory space siting. Their locations are shown in Figure 3-5.

Table 4-29 Location Summary for Minor Siting Variations

Facility	Mission Subarea	National Historic District	Visual Zone
Perimeter Parking and Walking Spaces	Medical Training	No	VZ 2 – VZ 4
Additional Dormitory Space	Medical Training	No	VZ 5
Additional Portable Relocatables	HQ and Administrative Support	The Quadrangle	VZ 1
Temporary Motor Pool Space	HQ and Administrative Support	No	VZ 5*

* VZ 5 location adjacent to VZ 2

Minor siting variations will not have significant impacts on historic districts, facilities and structures if appropriate SOPs in the HPC are followed.

No Action Alternative

Implementing the no action alternative would not result in ground disturbances, alteration or demolition/deconstruction of facilities and structures or new construction. No cultural resources listed on or eligible for listing on the NRHP would be affected under the no action alternative.

4.10 SOCIOECONOMICS

Socioeconomic analyses generally include detailed investigations of the prevailing population, income, employment and housing conditions of a community or area of interest. The socioeconomic conditions of an ROI could be affected by changes in the rate of population growth, changes in the demographic characteristics of an ROI or changes in employment within the ROI caused by the implementation of the proposed action. In addition to these characteristics, populations of special concern, addressed by EO 12898 (*Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations*, February 1994) are identified and analyzed for environmental justice impacts. Also, two other populations, limited English profient populations and risks to children, are addressed per the guidance of EO 13166 (*Improving Access to Services for Persons with Limited English Proficiency [LEP]*) and EO 13045 (*Protection of Children from Environmental Health Risks and Safety Risks*).

According to the CEQ (1997), a minority population can be described as being composed of the following population groups: American Indian or Alaskan Native, Asian or Pacific Islander, Black, not of Hispanic origin or Hispanic and exceeding 50 percent of the population in an area, or the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population. Race and ethnicity are separate categories of minority populations. A minority population can be defined by race, by ethnicity or by a combination of the two distinct classifications.

Race as defined by the U.S. Census Bureau (USCB, 2001) includes:

- White – A person having origins in any of the original peoples of Europe, the Middle East or North Africa
- Black or African American – A person having origins in any of the Black racial groups of Africa
- American Indian or Alaska Native – A person having origins in any of the original peoples of North and South America (including Central America) and who maintain tribal affiliation or community attachment
- Asian – A person having origins in any of the original peoples of the Far East, Southeast Asia or the Indian subcontinent including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan or the Philippine Islands
- Native Hawaiian and Other Pacific Islanders – A person having origins in any of the original peoples of Hawaii, Guam, Samoa or other Pacific Islands

USCB defines ethnicity as either being of Hispanic origin or not being of Hispanic origin. Hispanic origin is defined as "a person of Cuban, Mexican, Puerto Rican, South or Central America, or other Spanish culture or origin regardless of race (USCB, 2001).

A minority population can be defined in multiple ways; for example, a population under consideration may be composed demographically of 45 percent Black, 6 percent Asian, 40 percent White and 9 percent all other races or combination of races. A minority population also can be defined through ethnicity where the population under consideration is composed demographically of 80 percent White, 10 percent Black and 10 percent all other races or combination of races but has an ethnic composition of 98 percent Hispanic origin and 2 percent of the population not of Hispanic origin. Race and ethnicity each total a population of 100 percent.

Each year USCB defines the national poverty thresholds, which are measured in terms of household income dependent upon the number of persons within the household. Individuals falling below the poverty threshold ($17,603 for a household of four in 2000) are considered low-income individuals. USCB census tracts where at least 20 percent of the residents are considered poor are known as poverty areas (USCB, 1995). When the percentage of residents considered poor is greater than 40 percent, the census tract becomes an extreme poverty area.

4.10.1 Affected Environment

The FSH ROI for the socioeconomics analysis was a comparison of the San Antonio MSA (Atascosa, Bandera, Bexar, Comal, Guadalupe, Kendall, Medina and Wilson Counties); Bexar County; and USCB Census Tract[9] 1201, block group[10] 1 (FSH). Additionally, the census tracts[11] and block groups[12] outside FSH were evaluated based on 2000 USCB data (Figures 4-24 and 4-25). Between 1990 and 2000, the census tract containing FSH changed from USCB Census Tract 120185 in the 1990 Census to USCB Census Tract 120100 in the 2000 Census; however, these two tracts are directly comparable since they contain only FSH. All data are derived from the 1990 and 2000 Census of Population and Housing and the most recent local area personal income data (1990 to 2000) from the Bureau of Economic Analysis (BEA).

Similarly, the Camp Bullis ROI includes the San Antonio MSA; Bexar County; and USCB Census Tract 191600, block group 1, which contains Camp Bullis, and adjacent census tracts[13] and block groups[14] (Figures 4-26 and 4-27).

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[9] According to USCB (1994), "Census tracts are small, relatively permanent geographic entities within counties (or the statistical equivalent of counties) delineated by a committee of local data users."

[10] According to USCB (1994), "Census blocks, the smallest geographic area for which the Bureau of Census collects and tabulates decennial census data, are formed by streets, roads, railroads, streams and other bodies of water, other visible physical and cultural features, and the legal boundaries shown on Census Bureau maps."

[11] USCB 2000 census tracts immediately outside FSH include 111000, 120200, 120400, 120501, 120600, 130700 and 130800.

[12] USCB 2000 census block groups immediately outside FSH include block groups 1, 3 and 4 in Census Tract 111000; block groups 1 to 6 in Census Tract 120200; block groups 1 to 3 in Census Tract 120400; block groups 3 and 6 to 8 in Census Tract 120501; block group 1 in Census Tract 120600; block groups 1, 4 and 5 in Census Tract 130700; and block group 9 in Census Tract 130800.

[13] USCB 2000 census tracts immediately outside Camp Bullis include 191804, 191805, 191803, 182101 and 310700.

[14] USCB 2000 census block groups immediately outside Camp Bullis include block groups 1 and 2 in Census Tract 191804, block group 2 in Census Tract 191805, block groups 1 to 3 in Census Tract 191803, block group 1 in Census Tract 182101 and block group 2 in Census Tract 310700.

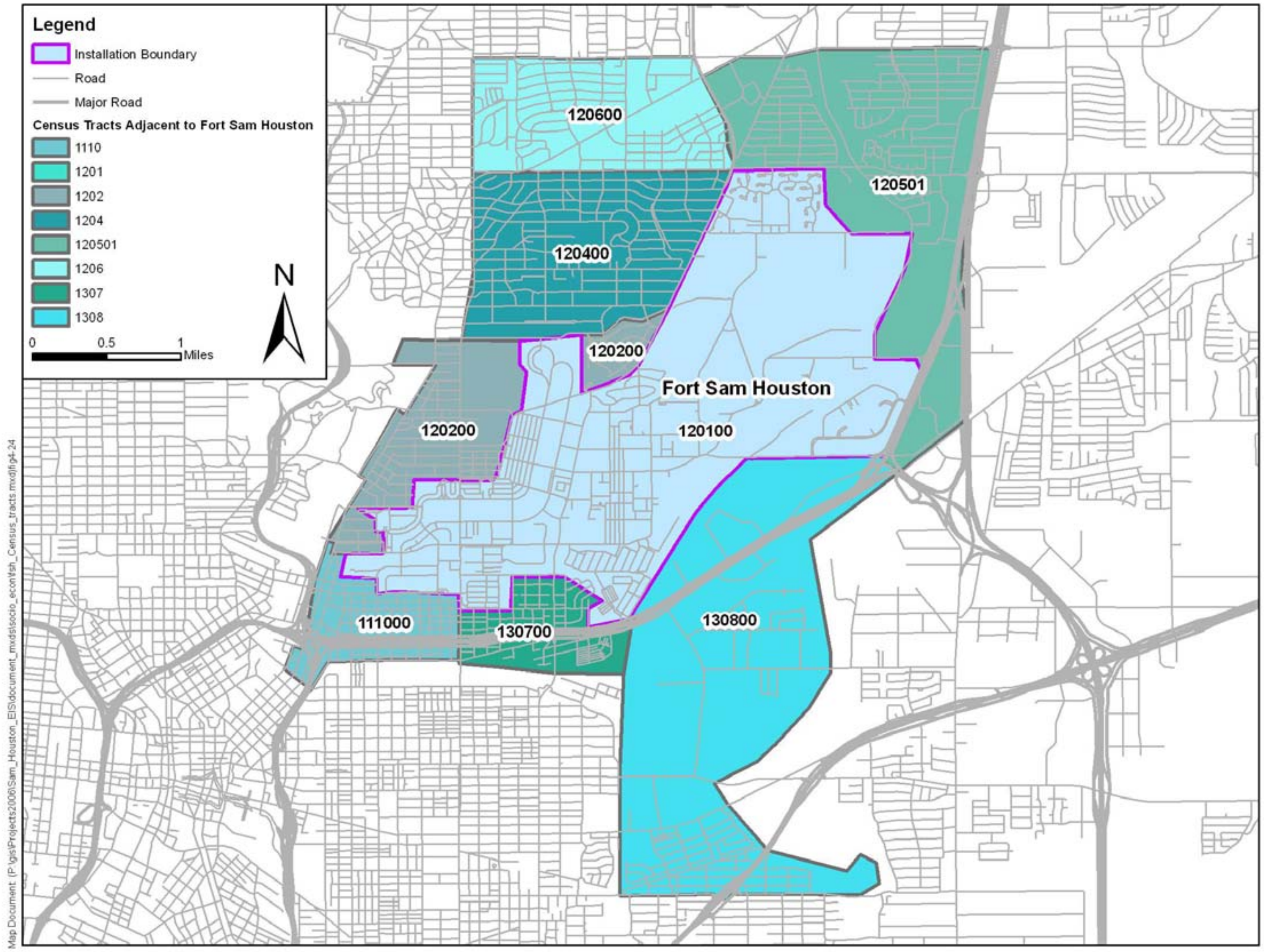

Figure 4-24 Census Tracts Within the FSH ROI
Source: U.S. Census Bureau (USCB) 2002

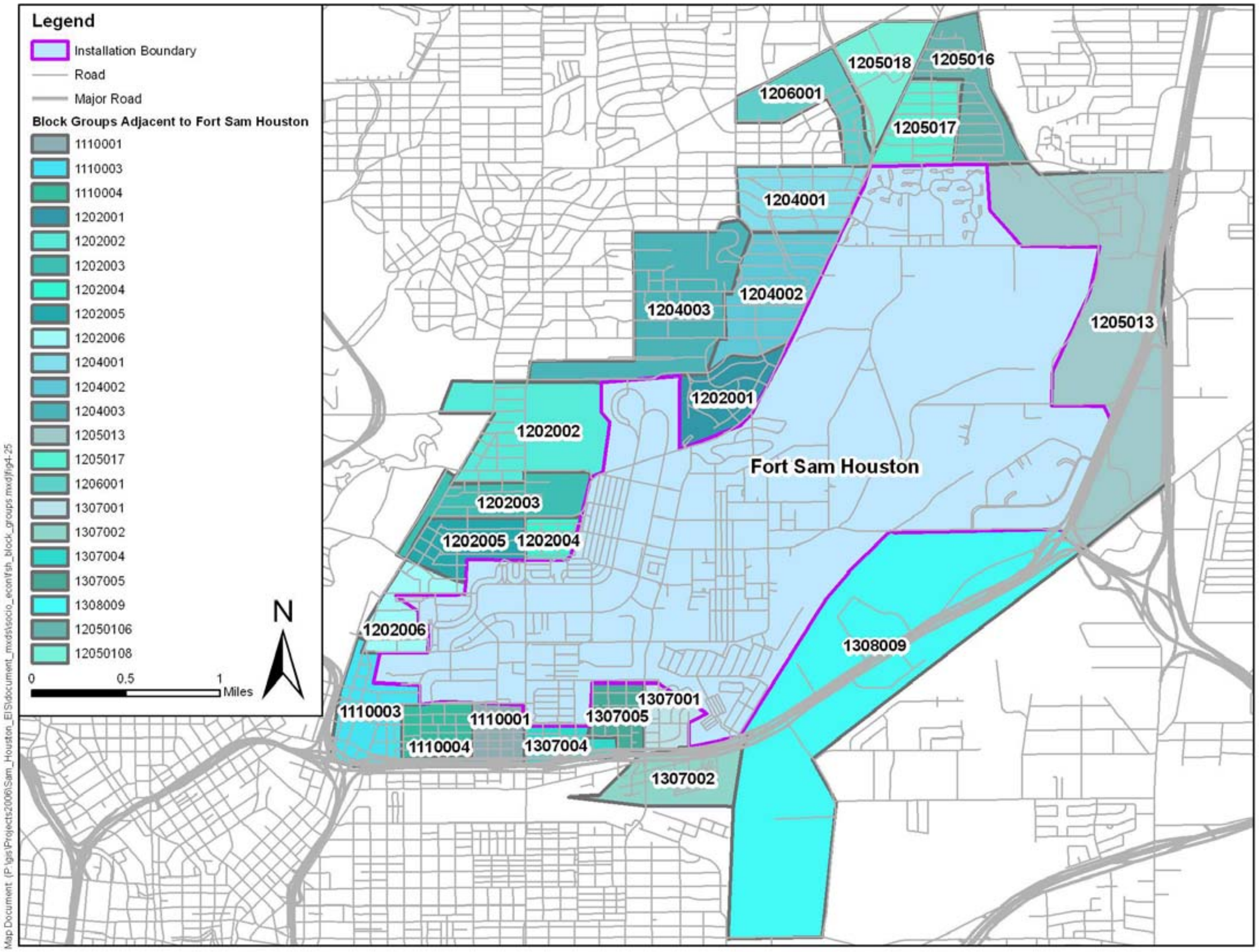

Figure 4-25 Block Groups Within the FSH ROI
Source: USCB 2002

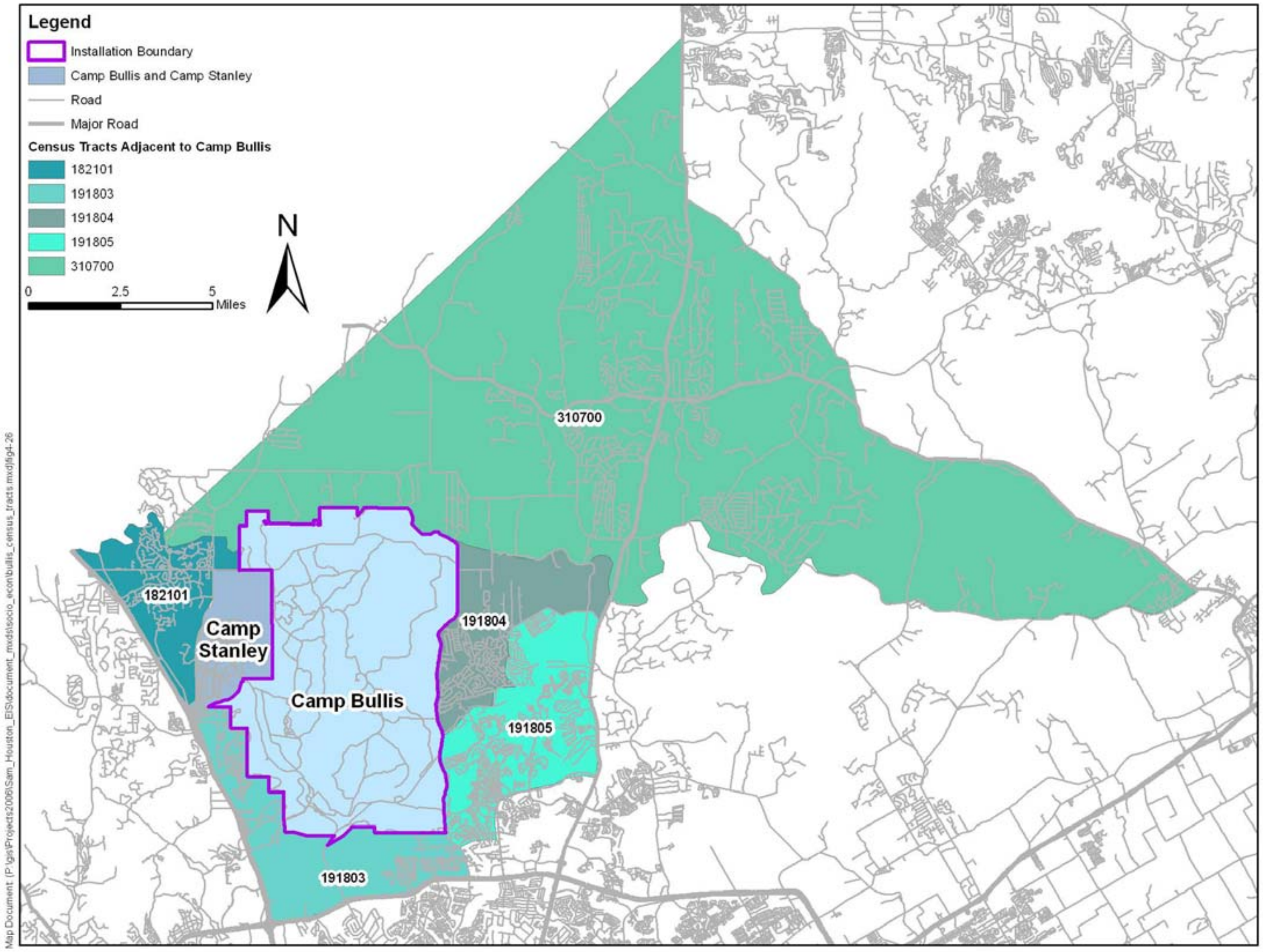

Figure 4-26 Census Tracts Within the Camp Bullis ROI
Source: USCB 2002

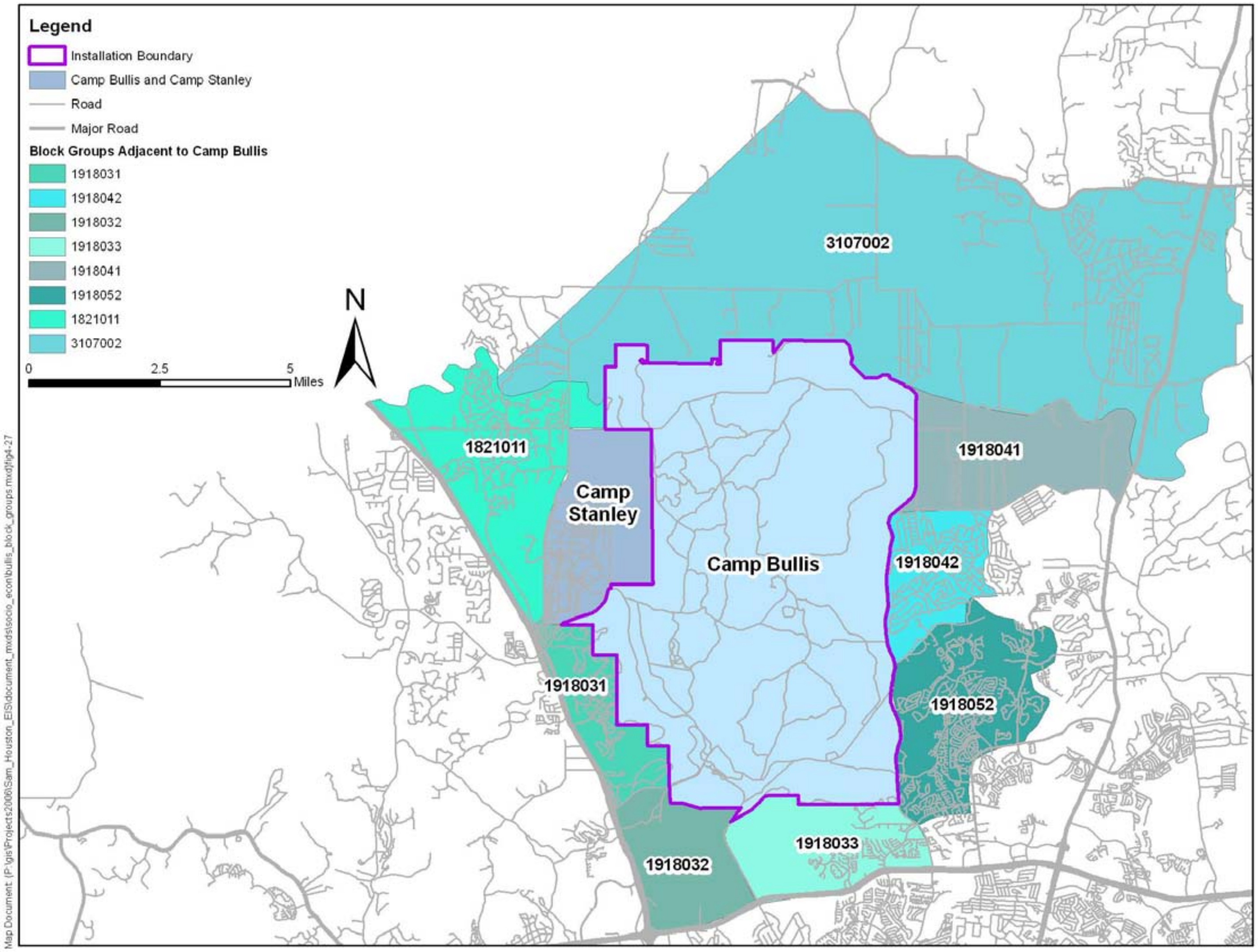

Figure 4-27 Block Group Within the Camp Bullis ROI
Source: USCB 2002

Economic Development

Personal Income

Median personal income levels increased within all household types in the FSH ROI between 1990 and 2000. The largest nominal percent changes were observed in the San Antonio MSA. Table 4-30 lists the 1990 and 2000 median personal incomes across household types and nominal percent changes during this period. Median household income in the combined census tracts in 2000 ranged from a high of $79,295 in USCB Census Tract 120400 to a low of $16,875 in USCB Census Tract 130700. Median household income in 2000 ranged from a high of $113,242 in USCB Census Tract 120400, block group 3, to a low of $16,738 in USCB Census Tract 111000, block group 4, in the combined block groups. Per capital personal income (PCPI) also varied by census tract in 2000, from a high of $45,134 in USCB Census Tract 120400 to a low of $7,608 in USCB Census Tract 130700. In the combined block groups, the highest PCPI was in USCB Census Tract 120400, block 3, ($64,997) and the lowest in USCB Census Tract 111000, block group 3 ($9,115) (USCB, 2002).

In the Camp Bullis ROI, the highest median household income in the combined census tracts was $109,424 (USCB Census Tract 191803), while the lowest median household income was $64,953 (USCB Census Tract 310700). Within the combined block groups of the Camp Bullis ROI, the highest median household income was $121,829 (block group 3, USCB Census Tract 191803) and the lowest was $67,619 (block group 2, USCB Census Tract 310700). The PCPI ranged within the Camp Bullis ROI combined census tracts from a high of $53,462 (USCB Census Tract 191803) to a low of $26,849 (USCB Census Tract 310700) (USCB, 2002). The PCPI within the combined block groups of the Camp Bullis ROI was within a similar range. Table 4-30 summarizes the median personal income levels by household type for the San Antonio MSA, Bexar County and FSH.

Table 4-30 Median Personal Income Levels by Household Type

	San Antonio MSA			Bexar County			FSH (Census Tract 1201)		
	1990 ($)	2000 ($)	Nominal Percent Change	1990 ($)	2000 ($)	Nominal Percent Change	1990 ($)	2000 ($)	Nominal Percent Change
Median Household Income	26,092	39,140	50.0	25,926	38,328	47.8	26,517	45,185	70.4
Median Family Income	29,952	44,729	49.3	29,717	43,724	47.1	26,295	44,811	70.4
Median Non-family Income	16,838	25,405	50.9	17,077	25,575	49.8	n/a	48,281	n/a
PCPI	11,865	18,518	56.1	11,827	18,363	55.3	11,068	14,026	26.7

n/a = not available
Source: USCB, 1993, 2002

Industry Earnings

Earnings data indicated that personal income within the San Antonio MSA increased by approximately 89 percent between 1990 and 2000, to $41.1 billion. Within Bexar County, personal income increased by approximately 85 percent during this period, to $36.3 billion. Non-farm income increased approximately 90 percent during this period in the San Antonio MSA, to approximately $41 billion, and 85 percent in Bexar County, to approximately $36 billion. Farm income increased 187 percent, to approximately $74 million, in the San Antonio MSA and 238 percent, to approximately $60 million, in Bexar County during this period. The industries with the greatest increase in earnings between 1990 and 2000 in both the San Antonio MSA and Bexar County were Agricultural Services, Mining, Construction and Transportation and Public Utilities. Only Federal and Civilian earnings decreased in both the San Antonio MSA and Bexar County (BEA, 2002a).

Employment

Total full-time and part-time employment increased approximately 35 percent in the San Antonio MSA and approximately 34 percent in Bexar County between 1990 and 2000. Substantial increases in employment were identified in Agricultural Services, Construction, Transportation and Public Utilities and Services in both the San Antonio MSA and Bexar County during this period. Decreases in employment opportunities were identified in Mining, Federal, Civilian and Military in both the San Antonio MSA and Bexar County between 1990 and 2000 (BEA, 2002b).

Demographics

The population within the San Antonio MSA increased substantially between 1990 and 2000 to approximately 1.6 million people, an increase of approximately 22 percent (USCB, 1993, 2002). The population of Bexar County increased approximately 17 percent between 1990 and 2000 to approximately 1.4 million people. The population within the USCB census tract containing FSH decreased approximately 33 percent between 1990 and 2000, to 5,508. Table 4-31 details the total population, percentage urban versus rural population, sex and age within the ROI. The population within all geographic areas slightly favors the female population at between 50.19 and 51.50 percent of the total population (Table 4-32). The majority of the population within all geographic areas falls within the age cohort 30 to 59 years. All geographic areas, excluding Camp Bullis, have approximately 40 percent of the population fall within that age cohort. Within the Camp Bullis ROI, this cohort accounts for approximately 50 percent of the population. The next largest cohort is 0 to 18 years across all geographic areas.

Table 4-31 2000 Population Profile of All Geographic Areas Within the ROI

	San Antonio MSA	Bexar County	FSH (Combined Census Tracts)	Camp Bullis (Combined Census Tracts)
Total Population	1,592,383	1,392,931	39,654	35,293
Percent Urban	88.67	94.05	100.00	54.44
Percent Rural	11.33	5.95	0.00	45.56
Male Population	773,656	675,559	19,254	17,578
0-18 Years	242,668	213,006	5,785	5,644
19-29 Years	126,927	115,009	3,725	1,258
30-59 Years	309,303	268,062	7,242	8,648
60+ Years	94,758	79,482	2,502	2,028
Female Population	818,727	717,372	20,400	17,715
0-18 Years	232,752	204,569	5,303	5,291
19-29 Years	128,642	116,783	3,745	1,292
30-59 Years	328,318	285,536	7,586	9,119
60+ Years	129,015	110,484	3,766	2,013

Source: USCB, 2002.

Table 4-32 Sex and Age Cohorts for all Geographic Areas Within the ROI

	San Antonio MSA		Bexar County		FSH*		Camp Bullis*	
	No.	Percentage	No.	Percentage	No.	Percentage	No.	Percentage
Total Population	1,592,383		1,392,931		39,654		35,293	
Sex								
Male	773,656	48.58	675,559	48.50	19,254	48.56	17,578	49.81
Female	818,727	51.42	717,372	51.50	20,400	51.44	17,715	50.19
Age Cohort								
0-18 Years	475,420	29.86	417,575	29.98	11,088	27.96	10,935	30.98
19-29 Years	255,569	16.05	231,792	16.64	7,470	18.84	2,550	7.23
30-59 Years	637,621	40.04	553,598	39.74	14,828	37.39	17,767	50.34
60+ Years	223,773	14.05	189,966	13.64	6,268	15.81	4,041	11.45

* includes all combined census tracts
Source: USCB, 2002.

Housing

The number of housing units in all geographic areas increased greater than 14 percent between 1990 and 2000 (USCB, 1993, 2002). Table 4-33 details the general housing profile for the ROI. Between 2000 and 2004, residential building permits within the San Antonio MSA increased 103.79 percent. Table 4-34 details the growth in housing units within the San Antonio MSA for 2000 to 2004. During this period, Comal County was ranked as the 83rd fastest growing county in the United States, increasing housing units at 17.7 percent (USCB, 2005a). Kendall County was ranked 89th, with an increase of 17.3 percent in the number of housing units (USCB, 2005a). Between 2003 and 2004, Kendall County ranked as the 37th fastest growing county, with an increase of 5 percent in the number of housing units, while Comal County was ranked 59th (4.4 percent increase) (USCB, 2005b). Within the City of San Antonio, single-family residential lots in master planned developments increased 475.15 percent between 2002 and 2005. Table 4-35 details the number of accepted and approved lots within the City of San Antonio from 2002 to 2005.

Table 4-33 Basic Housing Details Within the FSH and Camp Bullis ROI

	San Antonio MSA			Bexar County			FSH*			Camp Bullis*		
	1990	2000	Nominal Percent Change	1990	2000	Nominal Percent Change	1990	2000	Nominal Percent Change	1990	2000	Nominal Percent Change
Housing Units	504,411	599,772	18.91	455,832	521,359	14.38	11,767	15,358	30.52	7,150	12,909	80.55
Median Year Built	1972	1976	n/a	1971	1975	n/a	1958	1956	n/a	1979	1992	
Median Value	56,400	74,900	32.80	55,000	71,800	30.55	54,500	64,400	18.17	117,500	169,050	43.87

* includes all combined census tracts
n/a = not available
Source: USCB, 1993, 2002

Table 4-34 Housing Unit Estimates Within the San Antonio MSA 2000-2004

Geographic Area	Housing Unit Estimates				
	2004	2003	2002	2001	2000
Atascosa County	15,511	15,404	15,303	15,176	14,935
Bandera County	9,861	9,811	9,765	9,686	9,539
Bexar County	560,820	551,995	542,494	532,281	523,536
Comal County	38,512	36,878	35,471	34,289	33,030
Guadalupe County	37,002	35,892	35,028	34,433	33,753
Kendall County	11,272	10,738	10,371	10,011	9,689
Medina County	15,410	15,270	15,211	15,094	14,878
Wilson County	12,658	12,590	12,501	12,324	12,152
San Antonio MSA	701,046	688,578	676,144	663,294	651,512

Source: USCB, 2005c

Table 4-35 Single-family Residential Activity Within the City of San Antonio

Single-family Lots	Year of Approval				Percent Change over Period
	2002	2003	2004	2005	
Master Planned Development	6,708	14,626	17,802	38,581	475.15
Plat Applications	10,563	14,528	12,525	20,447	93.57
Planning Commission Approvals	9,741	10,736	13,449	12,459	27.90

Source: City of San Antonio Economic Development Department, 2005

Quality of Life

For the purpose of the EIS, quality of life is measured by the available and projected public services (fire protection, medical, police, recreation and education).

Fire Services

The Fire and Emergency Services Division at FSH provides necessary fire and rescue services on the installation and includes a substation at Camp Bullis. This division also provides fire and rescue resources to the surrounding San Antonio community when needed. Currently, Fire and Emergency Services has 50 personnel at two fire stations on FSH and substations at Camp Bullis and Camp Stanley. The department currently is equipped for fire-fighting/rescue, hazardous materials response services, fire inspection programs and first responder capabilities (Williams, 2006).

The City of San Antonio currently employs 1,018 uniformed firefighters at 48 fire stations throughout the 400 square miles that encompass the San Antonio Fire Department (SAFD) service area. SAFD also has three special operations units: the Hazardous Materials Response Team (35 members), the Technical Rescue Team (46 members) and the Airport Crash Rescue Team (26 members). There are 23 fire stations within a 5-mile radius from any boundary point of FSH (Figure 4-28). In FY 1999 to 2000, SAFD effectiveness was 3.73 minutes average citywide travel time. During this period, 90.7 percent of all citywide calls had travel times less than 6 minutes (Dose, 2004).

Medical and Emergency Services

FSH and Camp Bullis are serviced through DA-contracted Emergency Medical Services (EMS) from BAMC. Additionally, the Fire and Emergency Services Department at FSH acts as a first responder in medical emergencies until BAMC EMS can arrive on scene. The EMS services from BAMC primarily respond to FSH, Camp Bullis and Camp Stanley emergencies during the week and will expand their services as needed into the community on weekends (Acuña, 2006).

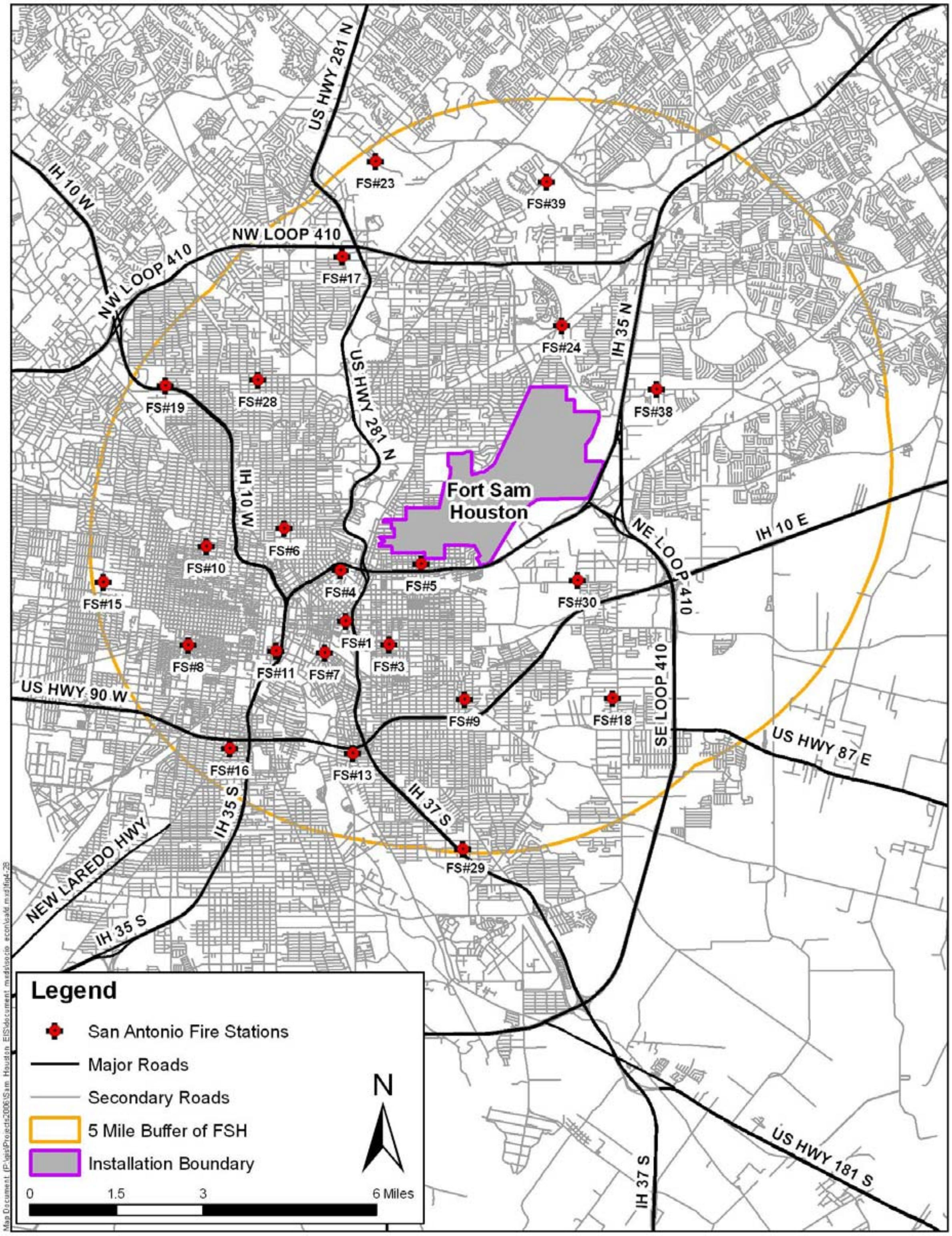

Figure 4-28 SAFD Stations near the FSH ROI
Source: Geo-Marine Engineering and Environmental Services, Inc., 2004

The San Antonio Emergency Medical Services (SAEMS) operates 26 full-time ambulances within a 417-square-mile service area. The City of San Antonio is served by nine major hospitals in the South Texas Medical Center area and 25 short-term (acute) hospitals throughout the city. In addition to the hospitals, San Antonio also has two psychiatric rehabilitation hospitals, two physical rehabilitation centers, two children's psychiatric hospitals, two state hospitals and two DoD hospitals (WHMC and BAMC). BAMC provides a 450-bed healthcare facility with Level I trauma services and graduate medical education for not only DoD but for the San Antonio region. BAMC is capable of expanding to 653 beds if needed for mobilization. WHMC provides 275 beds in its facility with the capability for Level I trauma services.

The average response time for FY 2003 to 2004 for SAEMS was 8.45 minutes. The average estimated response time for FY 2004 to 2005 was 8.3 minutes (SAEMS, 2006).

Police

FSH and Camp Bullis are serviced by an on-installation police force of 98 police officers and 15 non-officer employees. These officers are federal employees but not military police. Access control points (ACPs) are serviced by DA-contracted security personnel (148 persons). The FSH police force is a fully equipped department with the added capabilities of a special reaction team (Acuña, 2006).

The City of San Antonio employed 2,008 police officers as of 31 December 2005, a decrease of 1.6 percent from 2003. The ratio of officers to 1,000 individuals has remained stable between 1.55 and 1.57 from 2003 to 2005. Emergency response call response times averaged 5.18 minutes in 2005, 5.15 minutes in 2004 and 4.84 minutes in 2003. Average response time to all calls was 15.77 minutes in 2005, 15.25 minutes in 2004 and 15.35 minutes in 2003 (San Antonio Police Department [SAPD], 2006).

FSH is surrounded by patrol districts in three substations: Central, East and North. The patrol districts immediately adjacent to FSH include 2230 (Central); 4110, 4130, 4120 and 4140 (East); and 3320, 3340 and 3360 (North). Annual crime statistics have been highly variable between 1996 and 2005 within these three substations (SAPD, 2006). Table 4-36 lists the percentage change in eight types of major crimes per substation per year. Table 4-37 lists the number of major crimes by substation by year from 2001 to 2005, and Table 4-38 lists the major crimes by combined patrol districts adjacent to FSH by year from 2001 to 2005.

Table 4-36 Percentage Change in Major Crimes by Year Within the Substations Adjacent to FSH

Major Crime	Years									
	1996-1997	1997-1998	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	Annual Average
	Central Substation									
Homicide	4.17	(12.00)	(18.18)	27.78	(56.52)	70.00	35.29	0.00	(34.78)	1.75
Sexual Assault	9.35	(7.24)	26.24	(15.17)	(37.09)	(6.32)	5.62	58.51	(29.53)	(3.51)
Robbery	(16.25)	(15.82)	(0.45)	(4.94)	12.77	(2.10)	11.13	(6.36)	20.37	(2.24)
Assault	(6.32)	3.27	13.55	26.75	9.72	(5.39)	4.72	1.37	11.06	6.61
Burglary	9.73	(24.82)	(7.30)	2.66	19.14	(13.11)	9.24	8.10	(0.14)	(0.64)
Larceny, Theft	(8.79)	(10.53)	27.84	6.42	9.81	(2.50)	0.47	(1.70)	1.52	3.24
Vehicle Theft	0.61	(17.35)	8.10	(19.42)	10.15	(21.50)	19.93	(18.65)	1.38	(2.78)
Arson	(29.85)	(28.37)	9.90	22.52	nda	nda	nda	nda	nda	(6.45)
	North Substation									
Homicide	(45.45)	33.33	(25.00)	33.33	62.50	(15.38)	9.09	(58.33)	200.00	21.57
Sexual Assault	2.08	1.02	47.47	(5.48)	(40.58)	3.66	7.06	31.87	(17.50)	3.29
Robbery	(13.27)	(8.90)	7.42	5.09	24.91	4.99	(15.30)	11.53	(3.63)	1.43
Assault	(1.46)	17.42	35.71	30.21	23.83	1.75	4.99	(0.60)	11.06	13.66
Burglary	(0.43)	(1.16)	(3.71)	5.78	15.52	6.09	0.78	0.66	(0.54)	2.55
Larceny, Theft	(5.12)	(1.97)	52.79	17.83	8.53	(10.67)	(3.24)	(7.17)	3.57	6.06
Vehicle Theft	(2.00)	4.77	1.22	(6.34)	0.51	(4.26)	0.98	(2.56)	16.65	1.00
Arson	25.42	(4.05)	18.31	(13.10)	nda	nda	nda	nda	nda	6.65
	East Substation									
Homicide	(29.03)	(27.27)	50.00	(45.83)	92.31	(20.00)	(55.00)	111.11	26.32	11.40
Sexual Assault	11.11	6.00	8.49	(2.61)	(31.25)	(18.18)	14.29	18.06	14.12	2.22
Robbery	(15.50)	(20.10)	(5.35)	2.33	2.60	6.65	4.15	16.81	(9.02)	(1.94)
Assault	(7.67)	9.36	22.00	14.94	25.37	(9.82)	4.53	9.83	10.64	8.80
Burglary	(2.05)	(9.98)	(4.05)	4.15	24.44	(3.58)	6.92	5.28	9.54	3.41
Larceny, Theft	(14.65)	1.61	57.99	10.17	22.95	(10.58)	(8.03)	(7.82)	(4.12)	5.28
Vehicle Theft	(7.27)	(5.96)	4.34	(9.90)	4.12	(9.23)	4.36	(12.28)	19.34	(1.39)
Arson	(4.35)	(9.85)	(1.68)	12.82	nda	nda	nda	nda	nda	(0.76)

Note:
nda no data available
Source: SAPD, 2006

Table 4-37 Major Crimes by Substation by Year from 2001 to 2005

Crime Category	2001	2002	2003	2004	2005	Annual Average Percent Change
Central Substation						
Homicide	10	17	23	23	15	17.63
Rape	95	89	94	149	105	7.07
Robbery	477	467	519	486	585	5.76
Assault	4,638	4,388	4,595	4,658	5,173	2.94
Burglary	2,067	1,796	1,962	2,121	2,118	1.02
Larceny	5,562	5,322	5,272	5,123	4,933	(2.95)
Burglary Vehicle	2,589	2,625	2,712	2,725	3,034	4.13
Vehicle Theft	1,042	818	981	798	809	(4.71)
North Substation						
Homicide	13	11	12	5	15	33.84
Rape	82	85	91	120	99	6.27
Robbery	361	379	321	358	345	(0.61)
Assault	4,350	4,426	4,647	4,619	5,130	4.30
Burglary	2,412	2,559	2,579	2,596	2,582	1.75
Larceny	10,660	8,458	7,916	6,837	6,822	(10.23)
Burglary Vehicle	4,320	4,923	5,032	5,182	5,626	6.93
Vehicle Theft	1,173	1,123	1,134	1,105	1,289	2.70
East Substation						
Homicide	25	20	9	19	24	15.61
Rape	77	63	72	85	97	7.07
Robbery	316	337	351	410	373	4.65
Assault	3,820	3,445	3,601	3,955	4,376	3.80
Burglary	1,874	1,807	1,932	2,034	2,228	4.54
Larceny	5,678	5,095	4,507	3,956	3,692	(10.18)
Burglary Vehicle	1,743	1,541	1,596	1,670	1,702	(0.37)
Vehicle Theft	834	757	790	693	827	0.55

Note:
Source: SAPD, 2006

Table 4-38 Major Crimes by Combined Patrol Districts Adjacent to FSH by Year from 2001 to 2005

Crime Category	2001	2002	2003	2004	2005	Annual Average Percent Change
Patrol District 2230 (Central Substation)						
Homicide	0	1	1	1	2	50.00
Rape	7	2	2	3	2	(13.69)
Robbery	20	24	25	13	24	15.20
Assault	243	213	204	215	237	(0.24)
Burglary	115	99	97	132	127	4.09
Larceny	177	180	150	145	136	(6.13)
Burglary Vehicle	163	91	143	144	131	1.16
Vehicle Theft	44	43	56	29	39	3.56
Patrol Districts 3320, 3340, 3360 (North Substation)						
Homicide	3	7	2	1	4	77.98
Rape	28	15	26	25	10	(9.24)
Robbery	91	108	79	111	103	6.28
Assault	1,001	915	894	943	963	(0.82)
Burglary	408	463	503	472	436	2.08
Larceny	2,541	1,987	1,683	1,509	1,465	(12.59)
Burglary Vehicle	542	610	573	519	525	(0.45)
Vehicle Theft	219	195	205	202	202	(1.82)
Patrol Districts 4110, 4120, 4130, 4140 (East Substation)						
Homicide	10	9	1	6	5	96.11
Rape	22	16	27	21	26	10.77
Robbery	100	102	108	121	97	0.02
Assault	989	911	925	966	1,133	3.84
Burglary	475	409	490	569	694	11.00
Larceny	1,406	1,061	1,112	897	817	(12.00)
Burglary Vehicle	418	357	454	494	448	3.02
Vehicle Theft	244	188	211	205	238	0.63

Note:
Source: SAPD, 2006

Recreational Opportunities

The San Antonio MSA lies within six Level IV ecological regions, providing numerous opportunities for varied outdoor recreational amenities. There are 31 state parks, state historic sites or state natural areas and 5 national parks, national historic sites, national recreation areas or national seashores within 100 miles of San Antonio. San Antonio is also within 100 miles of multiple locations on the World Birding Center Site Partner locations. The San Antonio Parks and Recreation Department manages over 16,000 acres of park and open space, with 4,600 acres of developed parks and over 40 miles of developed trails in 210 parks. Within San Antonio are numerous cultural facilities, including the San Antonio Symphony and the Lyric Opera of San Antonio; museums such as the Institute of Texan Cultures, Witte

Memorial Museum and McNay Art Museum; theaters; and amusement parks and attractions such as Sea World San Antonio, Fiesta Texas and Paseo del Rio. San Antonio is the location for sporting events, such as the San Antonio Spurs (professional basketball), San Antonio Rampage (professional ice hockey), San Antonio Missions (AA minor league baseball), Valero Texas Open (professional golf) and the Texas Hill Country Triathlon.

The Sikes Act of 1960 (16 USC 670a *et seq.*) and amendments authorize the Secretary of Defense to carry out a program "to provide for the conservation and rehabilitation of natural resources on military installations, the sustainable multipurpose use of the resources, which shall include hunting, fishing, trapping, and nonconsumptive uses." The Sikes Act also sets the priority for uses of military lands. Military training has priority over non-military uses of the military lands. The Sikes Act Improvement Act of 1997 also requires an INRMP that shall provide for "fish and wildlife management, land management, forest management, and fish- and wildlife-oriented recreation." It also states that to the extent appropriate and applicable, the INRMP shall provide for "sustainable use by the public of natural resources to the extent that the use is not inconsistent with the needs of fish and wildlife resources and is subject to requirements necessary to ensure safety and military security." AR 200-3 provides that natural resources will be managed to allow outdoor recreational opportunities whenever practicable.

According to the INRMP (U.S. Army, 2001b) the Camp Bullis Outdoor Recreation Program consists of fishing, hunting, camping, hiking, walking, shooting sports, RV storage and hook-ups and a volleyball court for eligible personnel.[15] Currently, fishing is restricted to a catfish pond in the cantonment area. All deer hunting is from assigned stands to which each hunter is given a specific travel route. Turkey hunting follows the same procedures as deer hunting except that blinds/areas are assigned to each hunter. Camping is allowed year-round on Camp Bullis. Primitive camping is allowed in designated areas only. The developed sites are used by RVs with full hook-up provided. A sportsman's range is available for marksmanship practice with shotguns, pistols and rifles. Horseback riding, dog training and other clubs request access to Camp Bullis for their activities. The Alamo Area Council of Boy Scouts of America also requests the use of facilities to enhance its program. Scout requests for campouts and field learning skill activities usually are granted when there are no conflicts with military training.

Educational Opportunities

Children who live on the installation or are expected to move onto the installation within a given school year attend one of three schools in the FSH ISD. This district is made up of Robert G. Cole Junior/Senior

[15] An eligible person is defined as an active DoD identification card holder. Depending on the type of activity, an eligible person may sponsor a dependent.

High School, FSH Elementary and an alternative education school. Enrollment at these schools was 1,172 students for the 2005 to 2006 school year (Texas Education Agency [TEA], 2006). Children of affiliated personnel who live off-installation are enrolled in either an area public school or a private institution. The federal Government provides "impact aid" to the applicable school district to subsidize the education of children affiliated with a military installation (U.S. Army, 2001a) per the requirements of 20 USC 70, §VIII, Subsection 7703.

As of October 2005, there were 327,926 students enrolled in 507 regular public educational institutions within the San Antonio MSA. Table 4-39 lists the number of school districts or independent units, the number of schools and the number of students within each county. San Antonio is home to 14 institutions of higher learning, including the 4 schools within the Alamo Community College District and 10 4-year colleges and universities. The San Antonio Public Library System operates 22 public libraries, 1 private library and 2 libraries under construction.

Table 4-39 Primary Public School General Population Profile by County Within the San Antonio MSA, October 2005

County	Number of Districts	Number of Schools	Number of Students
Atascosa	5	20	8,498
Bandera	2	6	2,870
Bexar	27	376	284,780
Comal	2	26	19,601
Guadalupe	4	33	18,683
Kendall	2	13	7,266
Medina	5	18	8,607
Wilson	4	15	7,621
San Antonio MSA Total	51	507	357,926

Source: TEA, 2006.

Environmental Justice

Minority Populations

EO 12898 requires a federal agency to "make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high human health or environmental effects of its programs, policies, and activities on minority populations and low income populations." A message from President Clinton concerning EO 12898 stated that federal agencies should collect and analyze information concerning a project's effects on minorities or low-income groups when required by NEPA. If such investigations find that minority or low-income groups experience a disproportionate significant impact, then avoidance or mitigation measures are to be undertaken.

Table 4-40 lists the demographic profile for the three geographic units comprising the FSH ROI. Table 4-41 lists the 2000 demographic profile for the combined census tracts, the combined block groups, the San Antonio MSA, Bexar County and FSH. The demographic profile indicates that the San Antonio MSA, Bexar County, FSH, the combined census tracts and the combined block groups are concentrated minority population areas (Figure 4-29).

Table 4-40 Demographic Profile of the FSH ROI

	San Antonio MSA				Bexar County				FSH			
	1990		2000		1990		2000		1990		2000	
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
White, non-Hispanic	579,291	44.5	626,073	39.3	498,512	42.1	495,275	35.6	4,378	53.1	2,722	49.4
Black/African American	88,709	6.8	103,110	6.5	84,600	7.1	97,705	7.0	2,360	28.6	1,506	27.3
American Indian or Alaska Native	4,673	0.4	10,702	0.7	4,379	0.4	9,547	0.7	66	0.8	72	1.3
Asian	16,020	1.2	24,078	1.5	15,229	1.3	22,586	1.6	304	3.7	184	3.3
All Other Races or Combination of Races	613,406	47.1	828,420	52.0	582,674	49.2	767,818	55.1	1,137	13.8	1,024	18.6
Hispanic	616,878	47.4	815,980	51.2	586,124	49.4	757,004	54.3	1,261	15.3	931	16.9
Total Minority Population	722,808	55.5	966,310	60.7	686,882	57.9	897,656	64.4	3,867	46.9	2,786	50.6
Total Population	1,302,099		1,592,383		1,185,394		1,392,931		8,245		5,508	

Source: USCB, 1993, 2002

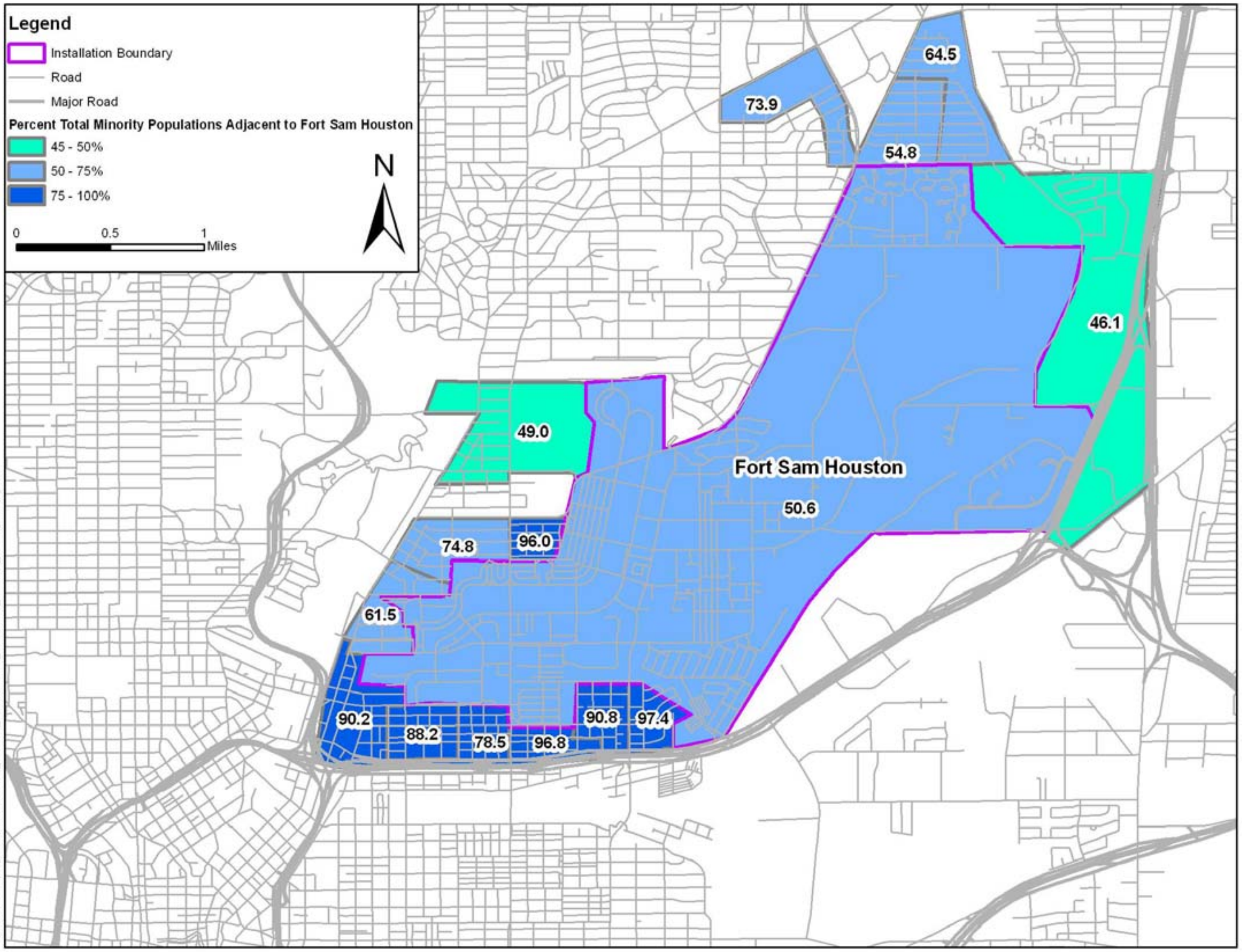

Figure 4-29 Minority Populations Within the FSH ROI
Source: USCB, 2002

Table 4-41 2000 Demographic Profile of All Evaluated Areas at FSH

	San Antonio MSA		Bexar County		FSH		Combined Census Tracts		Combined Block Groups	
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
White, non-Hispanic	626,073	39.3	495,275	35.6	2,722	49.4	14,531	42.6	6,886	40.0
Black/African American	103,110	6.5	97,705	7.0	1,506	27.3	5,287	15.5	1,673	9.7
American Indian or Alaska Native	10,702	0.7	9,547	0.7	72	1.3	150	0.4	83	0.5
Asian	24,078	1.5	22,586	1.6	184	3.3	579	1.7	214	1.2
All Other Races or Combination of Races	828,420	52.0	767,818	55.1	1,024	18.6	598	1.8	328	1.9
Hispanic	815,980	51.2	757,004	54.3	931	16.9	13,001	38.1	8,033	46.7
Total Minority Population	966,310	60.7	897,656	64.4	2,786	50.6	19615	57.4	10,331	60.0
Total Population	1,592,383		1,392,931		5,508		34,146		17,217	

Source: USCB, 2002

Table 4-42 lists the 2000 demographic profile of the Camp Bullis ROI and the population change from 1990 to 2000. Because there are no permanent residents at Camp Bullis, the ROI evaluated the surrounding census tracts and block groups. The population within the combined census tracts containing the Camp Bullis ROI increased 87.56 percent between 1990 and 2000, while the combined block groups increased 203.21 percent during this period (USCB, 1993, 2002). As shown in Table 4-42, neither the combined census tracts nor block groups would be considered a concentrated minority area.

Table 4-42 2000 Demographic Profile of the Camp Bullis ROI

Decennial Census Population	**Combined Census Tracts**		**Combined Block Groups**	
1990	18,817		8,261	
2000	35,293		25,048	
Percent Increase	87.6		203.2	
Race/Ethnicity	**Number**	**Percentage**	**Number**	**Percentage**
White, non-Hispanic	28,202	79.91	19,660	78.49
Black/African American	375	1.06	326	1.30
American Indian or Alaska Native	110	0.31	56	0.22
Asian	450	1.28	395	1.58
Native Hawaiian or Other Pacific Islander	25	0.07	11	0.04
All Other Races or Combination of Races	648	1.82	511	2.04
Hispanic	5,487	15.55	4,089	16.32
Total Minority Population	7,091	20.09	5,388	21.51

Source: USCB, 1993, 2002

Limited English Proficiency Populations

In August 2000, EO 13166 (*Improving Access to Services for Persons with Limited English Proficiency [LEP]*) was signed. This EO requires that federal agencies improve the accessibility of federal programs to eligible LEP individuals. This EO also requires federal agencies to ensure that stakeholders, such as LEP individuals and their representative organizations, recipients and other appropriate individuals or entities, have an adequate opportunity to provide input. These consultations will assist the agencies in developing an approach to ensure meaningful access by LEP individuals that is practical and effective, is fiscally responsible, is responsive to the particular circumstances of each agency and can be implemented readily.

In 2000, approximately 40,938 households (7.3 percent) in the San Antonio MSA and 38,043 households (7.8 percent) in Bexar County were considered isolated linguistically[16] (USCB, 2002). Within the USCB census tract (1201) containing FSH, 35 households (3.8 percent) were considered isolated linguistically. In the combined census tracts immediately outside FSH, 740 households (5.3 percent) were isolated linguistically, and in the combined block groups, 505 households were isolated linguistically (7.1 percent) (USCB, 2002).

Within the Camp Bullis ROI, 141 households (1.16 percent) were considered isolated linguistically in the combined census tracts (USCB, 2002). Within the combined block groups of the Camp Bullis ROI, 57

[16] A linguistically isolated household is one in which no member 14 years old and over: 1) speaks only English; or 2) speaks a non-English language and speaks English "very well." In other words, all members 14 years old and over have at least some difficulty with English (USCB, 2002).

households (0.66 percent) were considered isolated linguistically. Table 4-43 lists the number of linguistically isolated households per area by language.

Table 4-43 Linguistically Isolated Households by Area and Language

Language	Areas (number of linguistically isolated households/percent of total linguistically isolated households)						
			FSH ROI			Camp Bullis ROI	
	San Antonio MSA	Bexar County	FSH	Combined Census Tracts	Combined Block Groups	Combined Census Tracts	Combined Block Groups
Spanish	37,766/92.3	35,190/92.5	26/74.3	675/91.2	468/92.7	107/75.9	39/68.4
Other Indo-European	1,185/2.9	940/2.5	4/11.4	26/3.5	19/3.8	29/20.6	13/22.8
Asian/Pacific Island	1,780/4.4	1,706/4.5	5/14.3	39/5.3	18/3.6	5/3.6	5/8.8
Other	207/0.5	207/0.5	0/0.0	0/0.0	0/0.0	0/0.00	0/0.0
Total Linguistically Isolated Households	40,938/7.3	38,043/7.8	35/3.8	740/5.3	505/7.1	141/1.2	57/0.7
Total Households	560,293	489,252	930	14,062	7,137	12,142	8,572

Source: USCB, 2002

Average household size varies between all areas from a high of 5.97 individuals per household on FSH to a low of 2.43 in the combined census tracts. The average household size within the combined block groups was 2.44 persons per household; in the San Antonio MSA, it was 2.84; and in Bexar County, it was 2.85 in 2000 (USCB, 2002).

Average household size in both combined areas for the Camp Bullis ROI was 2.91 persons per household. Extrapolating average household size and the number of linguistically isolated households gives an estimated number of linguistically isolated individuals in all areas (Table 4-44).

Table 4-44 Linguistically Isolated Individuals by Area and Language

Language	Areas						
			FSH ROI			Camp Bullis ROI	
	San Antonio MSA	Bexar County	FSH	Combined Census Tracts	Combined Block Groups	Combined Census Tracts	Combined Block Groups
Spanish	107,256	100,292	155	1,640	1,142	311	113
Other Indo-European	3,365	2,679	24	63	46	84	38
Asian/Pacific Island	5,055	4,862	30	95	44	15	15
Other	588	590	0	0	0	0	0
Total Linguistically Isolated Individuals	116,264	108,423	209	1,798	1,232	410	166
Total Individuals	1,592,383	1,392,931	5,508	34,146	17,217	35,293	25,048

Source: USCB, 2002

Low-income Populations

Between 1990 and 2000, the poverty rate decreased approximately 4 percent in Bexar County, from 19.9 percent to 15.9 percent, and decreased 4.4 percent in the San Antonio MSA, from 19.5 percent to 15.1 percent. Nevertheless, during this period, the poverty rate increased in the USCB census tract containing FSH, from 4.8 percent to 6 percent (USCB, 1993, 2002). The average 2000 poverty rate within the combined census tracts was 19.7 percent, and the average poverty rate for the combined block groups was 20.6 percent (USCB, 2002). This indicates that the combined block groups could be considered a poverty area.

Further analysis indicates that the 2000 poverty rate exceeded 20 percent in 10 of the 21 block groups analyzed (Figure 4-30). Within the Camp Bullis ROI, the 2001 poverty rate within the combined census tracts was 3.01 percent, and within the combined block groups, it was 2.18 percent in 2000 (USCB, 2002).

Protection of Children

In April 1997, EO 13045 (*Protection of Children from Environmental Health Risks and Safety Risks*) was signed. This EO requires that all federal agencies "(a) shall make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children, and (b) shall ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks." The EO considered environmental health and safety risks to mean risks to health or to safety that are attributable to products or substances that the child is likely to come in contact with or ingest (*i.e.,* air, food, water, soil and products used or exposed to).

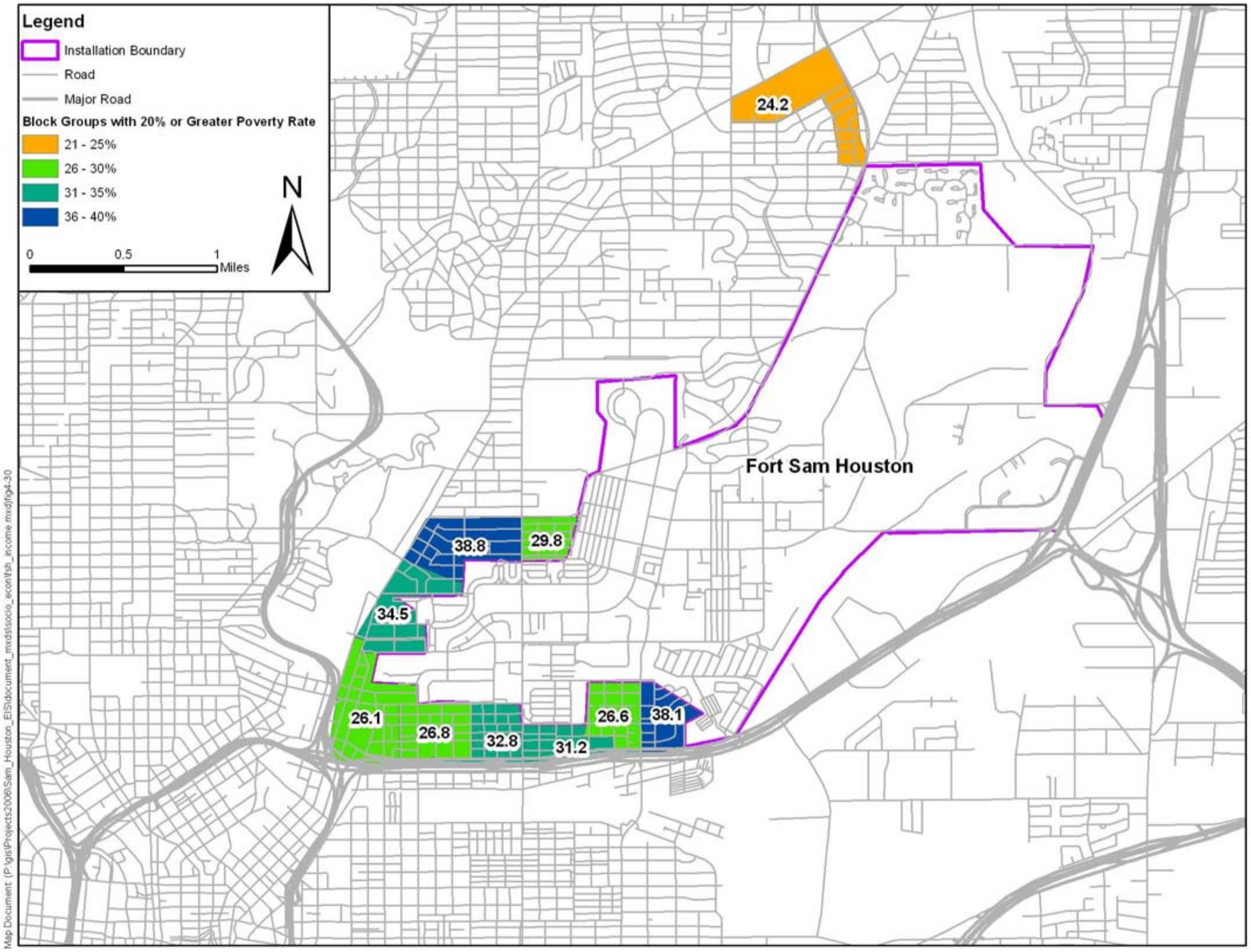

Figure 4-30 Low-income Populations Within the FSH ROI
Source: USCB, 2002

Population of Children Adjacent to Fort Sam Houston and Camp Bullis

According to the 2000 Census, the census tract containing FSH had a population of 1,942 persons age 18 or younger (35.26 percent of the total on-installation population [5,808 persons]), while Camp Bullis contained 0 persons 18 or younger. In the combined block groups including and adjacent to FSH, 27.49 percent of the total population was 18 years old or younger. The highest concentration of this age cohort was identified in block group 9, Census Tract 130800 (43.75 percent or 7 persons). The greatest number of this age cohort was identified in Census Tract 120100 (FSH), with block group 5, Census Tract 120200 containing the greatest number of persons (471 persons) outside FSH. In the combined block groups including and adjacent to Camp Bullis, 31.26 percent of the total population was 18 years old or younger. The highest concentration of this age cohort was identified in block group 3, Census Tract 191803 (40.1 percent or 863 persons). The greatest number of this age cohort was identified in block group 2, Census Tract 191805 (2,900 persons).

Environmental Contaminants

USEPA has identified five areas of environmental contaminants that affect children's health. These measures include outdoor air pollutants, indoor air pollutants, drinking water contaminants, pesticide residues and land contaminants. Regionally measurable contaminants can be located for outdoor air pollutants (forecast high O_3 days [HAPs]) and drinking water contaminants (annual water quality reports).

TCEQ has identified at least 10 high O_3 days per year since 1997 in the San Antonio region from March to October (TCEQ, 2006). The peak year was 1999, with 31 high O_3 days. In February 2006, USEPA released the 1999 National Scale Air Toxics Assessment. Data from this assessment indicate that Bexar County has a slightly higher average cancer risk (44.5 per million) from inhalation of toxics released in the air than Texas (36.7 per million) or the national average (41.5 per million) (USEPA, 2006a). Nevertheless, the hazard index (HI) for average respiratory risk (representing the sum of hazard quotients for substances that affect the same target organ) is slightly lower in Bexar County (5.89) than the national average (6.39) but slightly higher than the state average (5.47) (USEPA, 2006a). The HI for average neurological risk (representing the sum of hazard quotients for substances that affect the same target organ) follows a similar pattern with Bexar County (0.0852), slightly lower than the national average (0.104) but higher than the state average (0.0775) (USEPA, 2006a).

The San Antonio Water Systems (SAWS) annual water quality reports have indicated only one exceedance of lead in drinking water during a 1998 survey of 50 homes. This lead contamination was the result of leaching from lead solder in copper piping in an older home. No exceedance of lead was identified in later surveys.

4.10.2 Consequences

Realignment (Preferred) Alternative

Economic Development

Implementing the preferred alternative would create substantial economic benefits within the San Antonio MSA. Under the preferred alternative, approximately 5,179 employment positions would be created or relocated into the San Antonio MSA from outside the region. Approximately 2,283 positions would be relocated to FSH and Camp Bullis from within the San Antonio MSA. These position movements are anticipated to generate an estimated payroll of approximately $175.9 million per year, based on anticipated average annual salaries by government pay grade. The potential direct effect from the relocation of personnel indicates that the increase in 5,179 employment positions would generate an additional 12,915 positions and increase personnel earnings by $415.5 million per year (BEA, 2006). These direct effects are calculated using endogenous multipliers from BEA.

As part of the preferred alternative, approximately 7.9 million sf of renovated/remodeled space and new construction would occur on FSH and Camp Bullis (260,000 sf) from 2007 to 2015. The value of the new construction would be approximately $1.8 billion between 2007 and 2015. When discounted for the time value of money using 2006 as the base year, construction spending over the period 2007 to 2015 would equate to approximately $1.7 billion. Through the use of the Economic Impact Forecast System (EIFS) (Appendix F) with a 4.46 multiplier for employment and income, the total value of construction would flow through the regional economy from 2007 to 2015 as a 12.33 percent increase in total sales volume, a 4.95 percent increase in total personal income and a 4.85 percent increase in total employment. The construction investment is anticipated to induce an additional $8.7 billion in sales, $1.8 billion in total personal income and 44,599 employment positions.

Under the preferred alternative, additional analysis using the discounted value and lower multipliers based on the Regional Input-Output Modeling Systems (RIMS II) indicates that the final demand from 2007 to 2015 for construction activities would generate an additional $3.9 billion in final output of regional products, $1.3 billion in regional household earnings and 36,604 new employment positions within the San Antonio MSA (BEA, 2006). The RIMS II model is based on a general input-output (IO) table (BEA, 1997). An IO table reflects the distribution of inputs purchased and outputs sold. The model is used to create IO multipliers based on national IO accounts and secondary data. BEA develops the RIMS II multipliers in a three-step process that: 1) prepares an adjusted national industry-by-industry direct requirements table; 2) the adjusted national table is then used to prepare a regional industry-by-industry direct requirements table; and 3) the regional direct requirements table is used to prepare a regional industry-by-industry total requirements table, from which the IO multipliers are derived. Using the range of RIMS II multipliers indicates the potential range of economic flow-down effects throughout the San Antonio MSA. This flow-down effect would create a substantial economic benefit over the life of construction activities. Additionally, the ongoing operational activities associated with the preferred alternative would continue to provide economic benefit in the San Antonio MSA until a new equilibrium (absorption of relocation activities into the economy) would be achieved. Therefore, there would be substantial socioeconomic benefits anticipated for the regional economy from implementing the proposed action.

Demographics

Under the preferred alternative, approximately 11,608 employment positions would be relocated or repositioned at FSH and Camp Bullis due to the preferred alternative. This relocation of positions would require the relocation of 5,179 personnel from outside the defined San Antonio MSA (2,283 employment positions would be relocated from within the San Antonio MSA and 1,154 positions at FSH and Camp Bullis). Approximately 5,717 military dependents also would be relocated. The relocations outside the San Antonio MSA would increase the expected population of the region by less than 1 percent. The projected 2015 population for the San Antonio MSA, using a moderate growth rate, would be approximately 2,064,284. The addition of 10,152 persons would increase the population within the region by 0.6 percent over the estimated 2005 population (1,830,229) (Texas State Data Center, 2004).

Housing

As shown previously in Table 4-33, housing units within the San Antonio MSA have increased at an annual average rate of 1.85 percent between 2000 and 2004 (USCB, 2005). This rate has been slightly less than the estimated average annual population growth within the MSA of 1.9 percent (USCB, 2006). The average homeowner vacancy rate in 2000 was 1.4 percent, while the average renter vacancy rate was 6.9 percent. Overall, the vacancy rate of housing units within the San Antonio MSA was 6.6 percent in 2000. Implementing the preferred alternative would require an additional 4,237 residential housing units as a worst-case scenario (66.5 percent of relocated military personnel would require off-installation family housing [1,870 units], 33.5 percent of relocated military personnel would be expected to occupy UPH and 100 percent of relocated civilian and contract personnel would require off-installation housing [2,367 units]).

Extrapolating from the 2004 estimated number of housing units (Table 4-34) and based on 6.6 percent vacancy in total housing units, there would be an estimated 46,269 vacant housing units within the San Antonio MSA. Of these vacant units (46,269), the housing market would be divided into approximately 7,773 units available for purchase and 18,184 units available for rent. The increase in housing units between 2003 and 2004 in the San Antonio MSA (Table 4-34) (12,468 additional units) and the master planned development single-family residential lot applications in 2005 (Table 4-35) (38,581 lots) should yield sufficient flexibility in the regional housing market to accommodate the expected additional demand for 4,237 units and no significant impact.

Quality of Life

Implementing the preferred alternative would not create substantial significant impacts on the quality of life within the San Antonio MSA. The additional population growth anticipated from the preferred alternative falls within the projected growth scenarios to 2015. Demand for public services (*i.e.,* fire, medical, police and education) should follow the projected growth for these industries based on master planning for anticipated growth scenarios in the region.

Extrapolating from data in the 2005 American Community Survey, the probable increase in the school-age population generated by the preferred alternative would not create a substantial increase to the school districts available within the San Antonio MSA. As mentioned previously, there were 327,926 students enrolled in 507 public educational institutions within the 8-county San Antonio MSA. Using the San Antonio ISD as the baseline for comparison, 62,091 students were enrolled in kindergarten through grade 12 (USCB, 2005). Also from the 2005 American Community Survey, the number of households with children within the San Antonio ISD can be identified (39,187) (USCB, 2005). Implementing the preferred alternative would require 4,237 additional housing units (households). Of these, it would be anticipated that 1,635 households would have children under the age of 18, since approximately 38.6 percent of households within the San Antonio ISD have children under the age of 18. The average family size within the San Antonio ISD is 3.68 persons; therefore, the increase of 1,635 households with children, on average, would increase the school-age population by 2,747 children. These additional children would equate to an increase of 4.4 percent over the 2005 enrollment within the San Antonio ISD. This effect would be limited by the numerous school districts available within the San Antonio MSA and the cohort mix of children (i.e., younger than school age and private versus public education).

The preferred alternative, however, would create the need for additional personnel and facilities for the police, fire and emergency medical services on FSH and Camp Bullis due to the installations' population increase of greater than 35 percent. The FSH police force is expected to expand by 18 officers, 1 detective and 1 administrative clerk, due to the increased population of both FSH and Camp Bullis. The expanded force also would include officers for Camp Bullis. The expanded force would be anticipated to handle the initial increase in population with its associated demand, with no significant impact to the quality of life. Re-evaluation would be required during the later phases of personnel movement. The FSH fire services would need to activate one additional fire company near the expanded BAMC facilities, due to potential access issues associated with the railroad line and the Salado Creek floodplain. The increased facilities footprint on FSH would require additional manpower for fire protection support. These additional personnel requirements will need to be met to keep the same level of the current quality of life at the installation.

Environmental Justice

As mentioned previously, the San Antonio MSA, Bexar County, FSH, the combined census tracts and the combined block groups are concentrated minority population areas, while Camp Bullis and the area immediately surrounding Camp Bullis would not be considered an area of either concentrated minority population or low-income populations. The only area that would be considered a concentrated low-income population area would be the block groups immediately adjacent to FSH. In 2000, approximately 40,938 households (7.3 percent) in the San Antonio MSA and 38,043 households (7.8 percent) in Bexar County were considered isolated linguistically. Within the USCB census tract (1201) containing FSH, 35 households (3.8 percent) were considered isolated linguistically. In the combined census tracts immediately outside FSH, 740 households (5.3 percent) were isolated linguistically, and in the combined block groups, 505 households were isolated linguistically (7.1 percent) (USCB, 2002). The area immediately surrounding Camp Bullis had a linguistically isolated population of 141 households (1.16 percent of total households). Since implementing the preferred alternative would create only beneficial economic effects, environmental justice effects (disproportionately high significant environmental or human health impacts) would not be anticipated for the minority or low-income populations within the San Antonio MSA.

Protection of Children

Implementing the preferred alternative would not create significant effects on the protection of children since: 1) physical barriers would prevent access to potentially dangerous construction areas; 2) the construction and operational activities would not increase the number of forecast unhealthy days via the USEPA Air Quality Index; 3) the activities would not create significant HAP emissions; and 4) the activities would not create significant conditions in the FSH and Camp Bullis potable water supplies. Implementing the preferred alternative would not create a potential attractive nuisance due to measures that would be implemented to ensure controlled access to the construction site. There would be no significant effects to the environmental health and/or safety risks of children.

Minor Siting Variations

Implementing this alternative would create the same effects as the preferred alternative, which are described fully in the previous section.

No Action Alternative

Under the no action alternative, the proposed BRAC actions would not occur on FSH or Camp Bullis. There would be no change in the regional economic outlook; therefore, there would be no significant effects on socioeconomics.

4.11 TRANSPORTATION

4.11.1 Affected Environment

Roadways and Traffic

Transportation is defined for this analysis as the movement of vehicles from one place to another through a roadway network. The focus of this particular transportation analysis is the road network within the boundaries of FSH and Camp Bullis and in the areas immediately adjacent to the boundaries of each installation.

The affected environment from a transportation perspective therefore includes: 1) the major on-installation roads that provide the corridors for movement of vehicles to and from and within subareas of the installation that will support the preferred alternative and other anticipated organizational changes; and 2) arterial roads that provide direct access to and from the installation and the surrounding areas through ACPs. The off-installation segments of these direct access roads include:

- Walters Street from IH-35 to the ACP
- Harry Wurzbach to the ACPs at Williams Road and Stanley Road, along the northwest installation boundary
- The Wilson Street ACP at the west end of the installation
- The access road and ramps to the ACP on the IH-35 Service Road along the east installation boundary of the BAMC subarea at George C. Beach Avenue, and a

second ACP to this area from Binz-Engleman Road to George C. Beach Road on its south side

The ACP locations and the roadway network for the installation areas are shown in Figures 4-31, 4-32 and 4-33. Camp Bullis is a separate, non-contiguous facility located approximately 18 miles north of FSH within the northern San Antonio metropolitan area. Access is through a single ACP.

The greater San Antonio metropolitan area is experiencing steady growth, and the trend is expected to continue in the foreseeable future. Traffic flow on IH-35 is predicted to increase by up to 50 percent over the next 20 years, based on a 2 percent annual growth rate, which is a moderate estimate. This analysis will predict changes in the traffic flows to and from FSH in relation to the roadway network described above. This analysis will identify applicable off-installation traffic concerns further removed from the installation, but it will not develop or discuss the greater San Antonio metropolitan area or regional traffic issues completely.

For the purposes of analysis, transportation facilities are divided into two categories of flow: uninterrupted and interrupted. Uninterrupted facilities include an interstate highway with no fixed elements such as traffic signals or stop signs. Interrupted facilities such as conventional city streets and county roads have access points, intersections and stop conditions. Roadway networks are composed of various types of classified and functionally characteristic facilities, including freeways and interstates, major and minor arterials and various sizes of collector and local roads. Each also is classified as urban or rural. The roadway network within the effected environment is considered an interrupted facility and a collector/local road network.

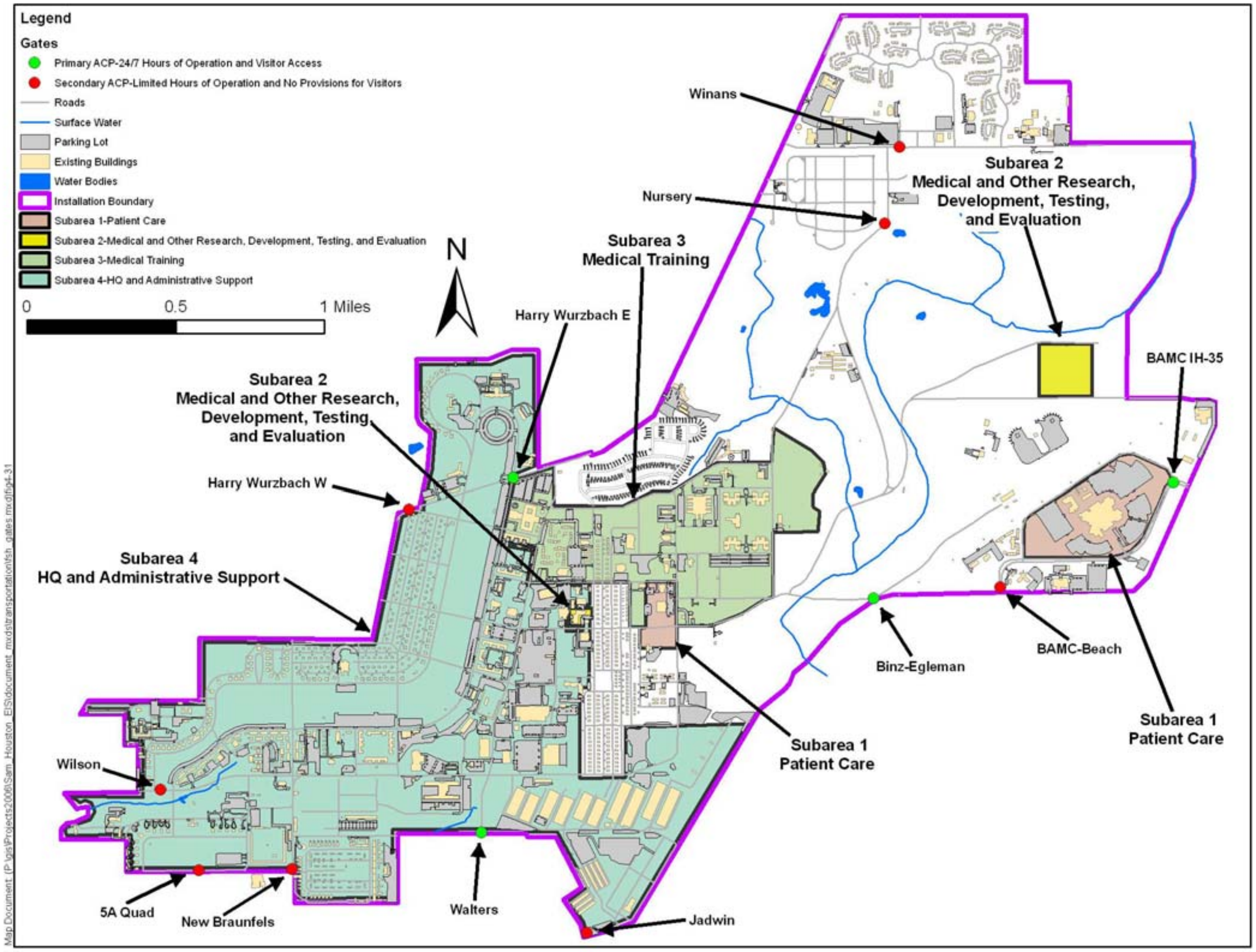

Figure 4-31 ACP Locations – FSH
Source: FSH GIS Department, 2006

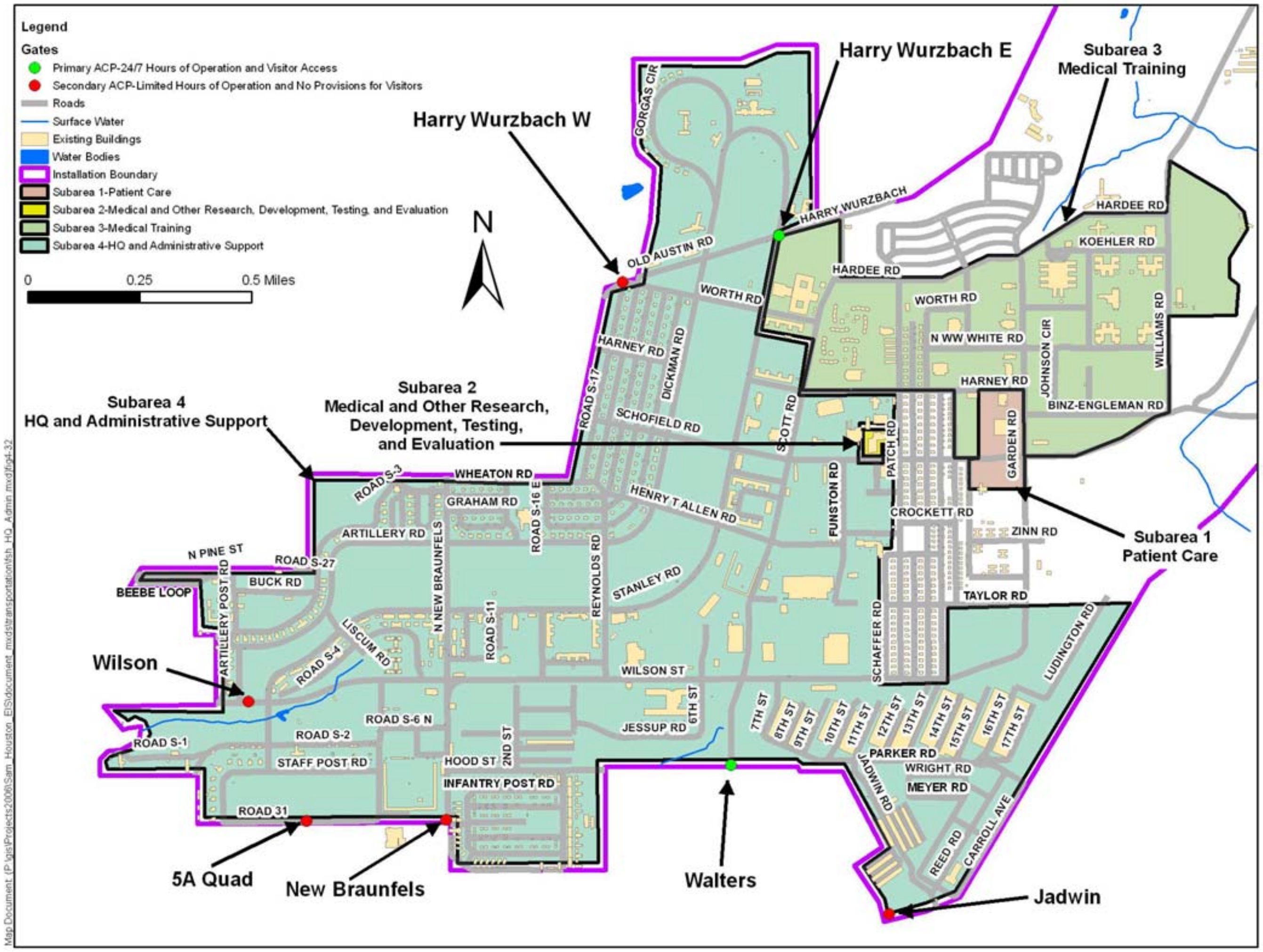

Figure 4-32 Roadway Network – METC/Main Installation/HQ
Source: FSH GIS Department, 2006

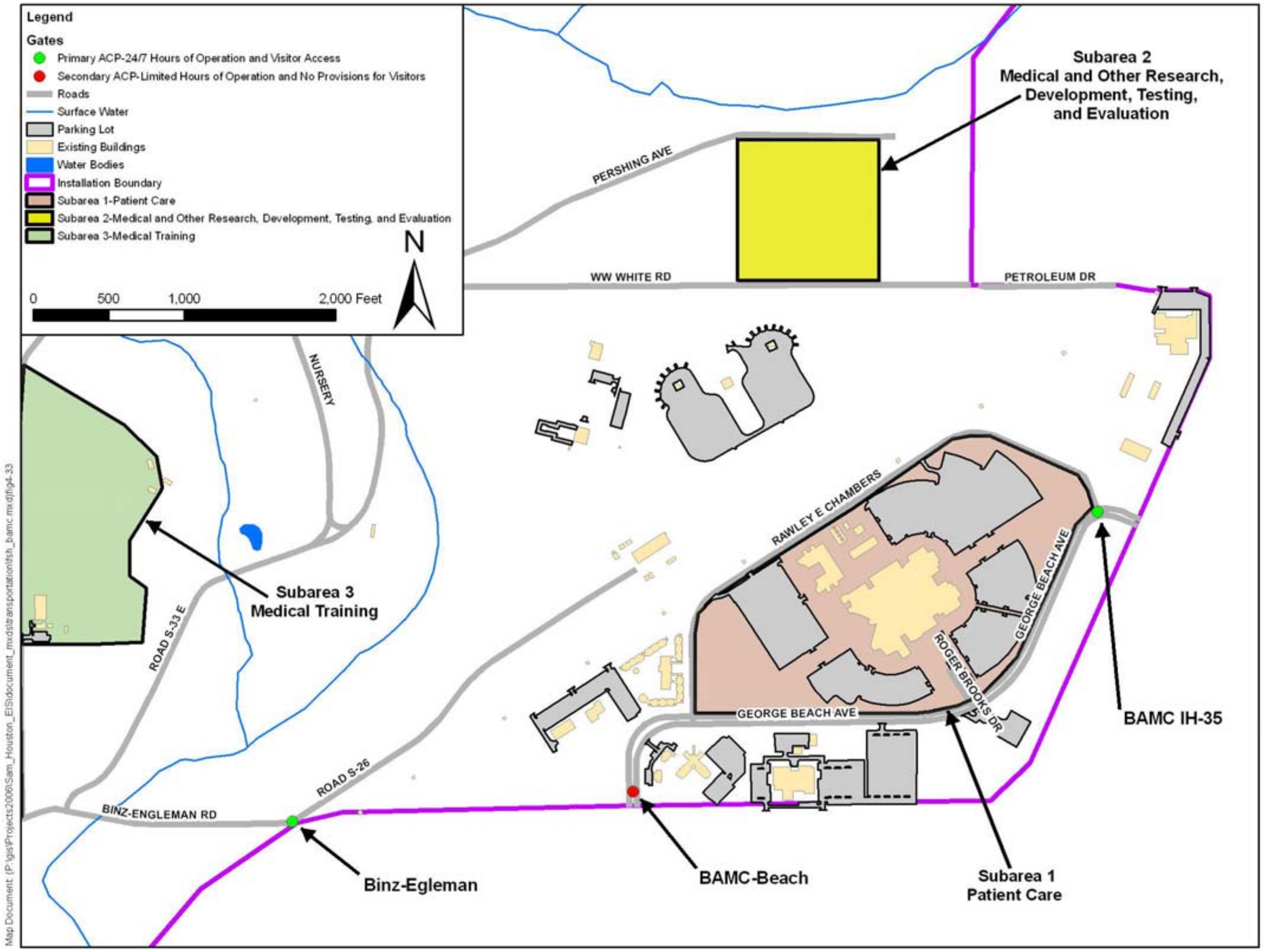

Figure 4-33 Roadway Network – BAMC Campus
Source: FSH GIS Department, 2006

Capacity analysis is a set of procedures for estimating the traffic-carrying ability of facilities over a range of defined operational conditions. Capacity is used to express the maximum hourly rate at which vehicles reasonably can be expected to traverse a point during a given period under prevailing roadway and traffic conditions.

Level of Service (LOS) is a measure of quality of operational conditions within a traffic stream based on service measures such as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience. Six LOSs, from A (best) to F (worst), define each type of transportation facility. Each LOS represents a range of operating conditions and the driver's perception of those conditions. Most analysis, design or planning efforts typically use service flow rates at LOS C or D or higher to ensure an acceptable operating service for facility users. LOS E generally is considered unacceptable for planning purposes unless there are extenuating circumstances or attaining a higher LOS is not feasible or extremely costly. For LOS F, it is difficult to predict flow due to stop-and-start conditions.

Roadway transportation conditions are evaluated using capacity estimates that depend on several factors. These factors include the number of lanes, the width of the lanes, roadway gradients, the location of lateral obstructions, the percentage of truck and bus volumes, other physical characteristics and the condition of the roadway network. Queuing refers to the backup formed due to vehicle delays.

Traffic volumes generally are reported as Annual Average Daily Traffic (AADT). This is the total number of vehicles per day averaged over the entire year. AADTs can be measured and/or developed in several ways. The information used in this report was received from several sources documented in the reference section at the end of this EIS.

These definitions and metrics are general transportation industry standards found in the Highway Capacity Manual (HCM), American Association of State Highway and Transportation Officials (AASHTO) and Institute of Transportation Engineers (ITE) guidelines and nomenclature. They are used throughout the analysis and discussions of the transportation element of this EIS. Traffic calculations are included in Appendix G.

Fort Sam Houston Transportation

For the purposes of a transportation review and analysis, FSH can be divided into three distinct sections:

1. The west and central-south main portion of the cantonment area encompassing the METC and HQ/administrative areas, as well as the main community and warehouse/industrial areas and the majority of FSH family housing

2. The BAMC patient support and medical/other research areas to the east
3. The community support, schools, outdoor recreation and family housing area in the north main installation

This last section is not expected to derive significant traffic from the preferred alternative due to its remote location. The most significant and critical areas from a traffic perspective are the first two sections, with increased mission requirements in the METC and HQ/administrative subareas and in the BAMC patient support and medical/other research subareas. The ACPs are also key elements of the traffic analysis. They represent 100 percent stop-and-check conditions on entry to the installation and slowed exiting from the installation. See Figures 4-31, 4-32 and 4-33 for ACP locations and the major roadway network for the respective significant traffic analysis areas.

Central-south Section

The central-south section at FSH is the most heavily trafficked area within the installation. The METC is bounded by Hardee, Williams, Stanley and Schofield Roads. It is composed of an urban downtown grid pattern of roadways, generally at perpendicular intersections. The roads are two-lane, low-speed and relatively low-volume. At several intersections, traffic signals were removed and replaced with four- or two-way stop conditions representing a positive indicator of acceptable traffic flow.

Both the a.m. and p.m. peak-hour existing conditions analysis reflects that the intersections within the METC are operating at acceptable LOS, generally C or higher, as shown in Table 4-45. All intersections are significantly below operational capacities, allowing opportunities for growth.

Table 4-45 METC Intersection Survey

Intersection	Existing a.m. Peak LOS	Existing p.m. Peak LOS
Schofield/Scott	B	B
Schofield/Stanley	B	B
Schofield/Garden	B	B
Schofield/Williams	A	B
Schofield/Patch	A	A
Hardee/Stanley	A	A
Hardee/Scott	B	C
Hardee/Patch	A	A
Hardee/Garden	A	A
Hardee/Williams	A	A
Harney/Stanley	A	A

The HQ/administrative area at the southwest end of the installation also is operating under desirable traffic conditions at LOS A for most roadway segments, as shown in Table 4-46. The volume/capacity ratios are also within acceptable ranges. While individual intersections in this area were not analyzed, they are generally non-signalized, two-way stop conditions that are also indicative of desirable traffic conditions. This area of the installation does not experience critical traffic backups during peak hours or throughout the regular business weekday.

Table 4-46 Roadway Segment Analysis – HQ/Administrative Area

Region Headquarters	Corridor N New Braunfels		Existing Conditions		
Location	**Direction**	**ADT**	**ADT**	**VPH**	**LOS**
Road S-3 (E)	East	230	455	46	A
	West	225			
Road S-6 (W)	East	231	451	45	A
	West	220			
Wilson (E)	East	2,015	4,248	425	A
	West	2,233			
Wilson (W)	East	2,724	4,618	462	A
	West	1,894			
Road S-4 (E)	East	134	273	27	A
	West	139			
Stanley (E)	East	1,065	1,920	192	A
	West	855			
Stanley (W)	East	1,462	2,417	242	A
	West	955			
Dickman/Artillery Post (E)	East	472	1,049	105	A
	West	577			
Dickman/Artillery Post (W)	East	247	556	56	A
	West	309			
Graham (E)	East	363	810	81	A
	West	447			
Service Street 1 (E)	East	106	161	16	A
	West	55			
Service Street 2 (W)	East	57	116	12	A
	West	59			
Wheaton Road (E)	East	142	170	17	A
	West	28			

ADT Average daily traffic from USACE, 2006b
VPH Vehicle per hour; generally at 10 percent of ADT
LOS Level of Service

Traffic patterns within the community center area below the METC area and east of the HQ/ administrative area do not experience the conventional peak-hour flows that are prevalent at other sections of the installations. Because of the services they provide and the nature of the commercial activity, they experience relatively constant, lower volumes throughout the day and slightly peak during the noon hour for lunch activity. Traffic flow in this area is considered operating at an acceptable LOS of C or higher. Many of the truck deliveries and access for this area are serviced by the Jadwin ACP.

BAMC Campus

The roadway network within this area functionally consists of only one through road, George Beach Avenue, which is a four-lane, divided roadway with a center turn lane and a raised median. The current analysis for this roadway segment indicates that it operates at LOS A (Table 4-47). George Beach Avenue provides access to the primary parking areas and ancillary facilities within the BAMC campus. Access to this road is through the BAMC-IH-35 ACP on the east, and directly from IH-35 and the Binz-Engleman ACP on the west from Binz-Engleman Road. There is also a minor, two-lane undivided perimeter road (Rawley E. Chambers) that provides a loop facility primarily for maintenance and fire protection purposes and also for deliveries of medical supplies. This road should be maintained to provide the requisite service.

Table 4-47 Roadway Segment Analysis – BAMC Area

	Corridor George Beach Avenue		Existing Conditions	
Region BAMC Location	**Direction**	**VPH**	**DS**	**LOS**
George Beach Avenue	Two-way	788	55	A

VPH Vehicle per hour; generally at 10 percent of ADT
LOS Level of Service
DS Directional split

The concern at this area of the installation is the morning peak queuing at the ACPs. Based on discussions with staff, current conditions at the BAMC-IH-35 ACP queue traffic in the a.m. peak along the access ramp from IH-35. This queue rarely extends to the interstate and generally is cleared during a short time within the a.m. peak hour. Several improvements have been developed, presented and discussed to alleviate this condition; however, at this time, there are no specific plans or a schedule for implementation of improvements.

ACPs

The ACPs provide secured access between the installation roadway infrastructure and the local road network. There are currently 12 ACPs on FSH (the pedestrian gate was included as an ACP but was not used in the traffic analysis). They fall into one of two categories of operations: 1) primary ACPs with

24/7 hours of operation and a visitor center to process undocumented arrivals; and 2) secondary ACPs that offer limited hours of operations and no allowance for visitors.

The primary ACPs are located at desirable points to provide access to all areas of the installation. This is evident in the percent distribution for the ACPs as shown in Table 4-48. The distribution level for the primary gates is about 20 percent each, with the secondary ACPs providing a well-proportioned distribution.

Table 4-48 Percent Distribution – ACP

Data Source: Field Counts from Tuesday 11 April 2006 to Thursday 13 April 2006					
		Peak Hour			**Distribution**
ACP	**ADT**	**AM**	**PM**	**MD**	**Percentage**
Walters Primary	6,208	585	365	532	20.0
Binz-Engleman Primary	5,179	523	438	386	16.7
BAMC Beach Primary	2,784	614	226	168	9.0
BAMC - IH-35	6,162	897	230	423	19.9
Jadwin	491	101	30	34	1.6
Wilson	1,177	240	45	83	3.8
Nursery	3,342	452	202	280	10.8
Winans	2,089	332	247	104	6.7
Harry Wurzbach - East (Scott)	0	0	0	0	0.0
Harry Wurzbach - West	2,503	554	246	106	8.1
Camp Bullis	1,033	168	31	56	3.3
Total	**30,969**	**4,466**	**2,060**	**2,172**	**100.0**

ADT Average daily traffic from Fort Sam Houston and Camp Bullis, 2004
MD Mid-day

The most significant ongoing improvement plans for the ACPs are the widening and improvements to the Walters Gate, which include additional capacity and improvements to the visitor processing area and the recently opened primary ACP at the Harry Wurzbach-East (Scott) gate. This ACP opened in late May, and relevant traffic data were not available for this analysis. It is anticipated that traffic using this ACP will be relocated primarily from the Nursery ACP. Most of the other ACPs also have some level of improvements planned. They are being developed beyond the scope of the preferred alternative and are key components of an overall installation access plan.

Off-installation

FSH is located within a well-developed roadway network system composed of all levels of roads. The primary access to the main area is through Walters Street, which is currently a four-lane road, two lanes in each direction. There are ongoing plans to improve and widen Walters Street to IH-35 to four incoming (northbound) lanes and two outgoing (eastbound) lanes. Included will be bridge and ramp modifications at the interchange. While these improvements are in the planning and development phase and not yet scheduled specifically, they can be classified as short-range (three to six years).

The BAMC campus has direct access to IH-35 and Loop 410. This provides convenient access to the major roadway infrastructure on the east side of San Antonio, as well as the downtown area. To alleviate the queuing at the BAMC-IH-35 ACP during the a.m. peak, studies have been performed to improve the frontage road and access ramps and develop other improvements and modifications to the ACP and adjacent roadways, although no specific improvements currently are scheduled. The future traffic planning and modeling efforts will address conditions at this location.

There are no other specific planned or programmed projects in the immediate areas beyond the ACPs connecting to the local roadway networks. The local agencies and the Texas Department of Transportation, however, regularly update their respective transportation improvement plans to accommodate continued regional and local growth.

Public Transportation

The City of San Antonio is serviced by VIA, the metropolitan transit system, with bus routes throughout the metropolitan and surrounding areas. Based on their current schedules and routes, they do not provide services on the installation itself, but there are numerous routes in the immediate surrounding off-installation areas. Several routes provide access at the Walters and New Braunfels ACPs. The area adjacent to the northern portion of the installation also has select bus routes with full connectivity and coverage for the entire VIA transit network.

4.11.2 Consequences

Realignment (Preferred) Alternative

With the implementation of the preferred alternative, there will be an increase in installation personnel as shown in Table 2-1. This increase in personnel falls into various categories, each with different profiles for trip generation. In particular, a large portion of the population increase will be for transient students, unaccompanied enlisted and military dependents who predominantly reside on FSH. These categories generally are viewed as low trip generators. This analysis of the traffic impacts of the preferred alternative includes and compensates for this.

For traffic analysis purposes, historical data and projections for specific land use patterns are used to project and distribute trip generations for the respective areas of the installation. This information, along with the specific staffing increases at their respective locations on the installation, is the basis for the analysis of the existing and additional demands on the roadway infrastructure system. The analysis focuses on the peak hours, which predominantly dictate the most severe traffic conditions, other than specific events or unusual circumstances.

Based on reviews of the existing data projections of the type and magnitude of the growth resulting from the preferred alternative, estimated growth ratios range from 1.9 to 3.2, as shown in Table 4-49. Projected growth for the ACPs, which ranges from 2.0 to 3.2, is shown in Table 4-50. This analysis does not take into account the effects on traffic patterns due to the opening in May 2006 of the new Harry Wurzbach - East (Scott) ACP, for which there are no available traffic data.

Table 4-49 Growth Ratios

Subarea	Existing Conditions	Proposed Conditions
METC	1,900 Faculty and Administrative Personnel	3,600 Faculty and Administrative Personnel
	ADSL 4965	ADSL 9003
	Additional Staff = 1,700 Personnel + 4,038 ADSL	
	Growth Ratio (P/E) = 1.5	
BAMC	3,536 - 3,842 Personnel	Additional 1,940 Personnel
	Additional Staff = 1,940 Personnel	
	Growth Ratio (P/E) = 2.0	
HQ and Administrative Support	1,125 Personnel	3,623 Personnel
ACSIM*	None	1,550 Personnel
470th BDE**	370 Personnel	695 + 80 = 775 Personnel in Full Level
Fifth Army/ ARNORTH**	335 Personnel	420 Personnel
Sixth Army/ USARSO**	420 Personnel	878 Personnel
	Additional Staff = 2,498 Personnel	
	Growth Ratio (P/E) = 3.2	

* IMA, NETCOM, ACFS and AFC
** AMF actions

Table 4-50 Proposed ACPs – Growth Ratios

ACP	Growth Ratio P/E
Walters	2.4
Binz-Engleman	2.0
BAMC Beach	2.0
BAMC-IH-35	2.0
Jadwin	3.2
Wilson	3.2
Winans	2.0
Harry Wurzbach - East (Scott)	2.1
Harry Wurzbach - West	3.2
Nursery	2.0
5A Quad	3.2
New Braunfels	2.7

As shown in the tables, under the preferred alternative, the primary growth area is the METC, although a majority of the growth will be due to student loads that are very low traffic generators. Up to 70 percent of the students are expected to live in the immediate vicinity in new dorms. They will not generate vehicular traffic during peak hours, and their trips will be limited to off-peak periods. The total additional projected trips generated for this area are calculated at 3,600 trips per peak hour. This additional load was distributed throughout the METC roadway network proportionately, similar to the existing traffic distribution, since no major changes to the land use are anticipated. Based on this distribution, the intersection analysis (Appendix G) reveals that the intersections in the area will continue to operate at an acceptable LOS of D and higher, as shown in Table 4-51, and most will operate at LOS B or higher. The exception is the Hardee and Scott Roads intersection. This location was analyzed under current stop conditions. Installing a signal would bring this intersection up to an acceptable LOS of C or better.

Table 4-51 Intersection Summary

Region	**Existing and Proposed Conditions**			
METC	**Methodology: HCM**			
	Existing LOS		**Result from Preferred Alternative LOS**	
Intersection	**a.m. Peak**	**p.m. Peak**	**a.m. Peak**	**p.m. Peak**
Hardee Road and Stanley Road	A	B	A	B
Hardee Road and Scott Road	B	C	F	F
Hardee Road and Patch Road	A	A	A	A
Hardee Road and Garden Avenue	A	A	A	A
Hardee Road and Williams Road	A	A	A	A
Schofield Road and Williams Road	A	B	A	B
Schofield Road and Scott Road	B	B	C	C
Schofield Road and Stanley Road	B	B	C	C
Schofield Road and Patch Road	A	A	D	A
Schofield Road and Garden Avenue	B	B	B	B
Harney Road and Stanley Road	A	A	A	A

LOS Level of Service
HCM Highway Capacity Manual (NRC, 2000)

For the METC area, the roadway improvements discussed and recommended in the Area Development Plan for the Defense Medical Education and Training Center remain valid and need to be implemented for the preferred alternative. They include widening and improving Scott Road as the primary roadway from the Walters ACP to the core of the METC area, accommodating left turn lanes at some of the key intersections in the redesigned METC area, and other intersections, and safety improvements throughout the area.

Potential future infrastructure improvements will need to be developed closely with the specific final construction documents to ensure coordinated improvements. Establishing a grid network of roadways with Stanley Road, Patch Road and Garden Drive as the primary north-south roads and Hardee Road, Harney Road and Sheffield Road as the primary east-west roads is the desirable method to address continued growth within the METC area. Similarly, the existing grid network of roadways should be maintained, extended and developed more fully for the HQ/administrative support and community center areas as well. Roadway and intersection improvements should be developed in accordance with current AASHTO and State guidelines, with safety considerations a high priority.

The HQ/administrative support area is expected to experience the largest growth ratio at 3.2 compared to the existing conditions; however, its relatively low volumes and adequate roadway network will allow this area to function at an acceptable LOS. Existing roadways and intersections are adequate to accommodate the additional trip capacities calculated at 2,550 trips per peak hour. Existing conditions were shown previously in Table 4-46. The preferred alternative is shown in Table 4-52.

Table 4-52 Roadway Segment Analysis – HQ/Administrative Support Area

	Corridor N New Braunfels		Resulted from Preferred Alternative Conditions		
Region HQ Location	**Direction**	**ADT**	**ADT**	**VPH**	**LOS**
Road S-3 (E)	East	736	1,456	146	A
	West	720			
Road S-6 (W)	East	739	1,443	144	A
	West	704			
Wilson (E)	East	6,448	13,594	1,359	D
	West	7,146			
Wilson (W)	East	8,717	14,778	1,478	D
	West	6,061			
Road S-4 (E)	East	429	874	87	A
	West	445			
Stanley (E)	East	3,408	6,144	614	B
	West	2,736			
Stanley (W)	East	4,678	7,734	773	B
	West	3,056			
Dickman/Artillery Post (E)	East	1,510	3,357	336	A
	West	1,846			
Dickman/Artillery Post (W)	East	790	1,779	178	A
	West	989			
Graham (E)	East	1,162	2,592	259	A
	West	1,430			
Service Street 1 (E)	East	339	515	52	A
	West	176			
Service Street 2 (W)	East	182	371	37	A
	West	189			
Wheaton Road (E)	East	454	544	54	A
	West	90			

The remaining area of the installation, the community center and light industrial and residential areas also would experience growth, but the magnitude and volume are not expected to produce traffic concerns. Continued monitoring and adjustments of the general installation traffic management plan would address the concerns within these remaining areas.

The growth ratio for the BAMC is projected at 2.0, and the trips generated are calculated at 2,200 per peak hour. This is attributable to the expanded inpatient and outpatient care facilities, the health clinic and associated administrative expansions and new parking facilities. The proposed parking garage and associated pedestrian entrance would alleviate a portion of the anticipated growth and remove up to 2,500 vehicles from the a.m. peak hour queuing at the IH-35 ACP. The proposed parking garage would provide an alternative point of entry to the queuing for the BAMC-IH-35 ACP. The parking deck also would remove these vehicles from George Beach Avenue, thereby maintaining an acceptable LOS, shown in Table 4-53, for this facility, while allowing growth resulting from the preferred alternative.

Table 4-53 Roadway Segment Analysis – BAMC Campus

	Corridor George Beach Avenue		Preferred Alternative		
Region BAMC Location	**Direction**	**ADT**	**ADT**	**VPH**	**LOS**
George Beach Avenue	Two-way	25,219	25,219	2,522	B
		0			

ADT Average daily traffic
VPH Vehicle per hour, generally at 10 percent of ADT
LOS Level of Service

An additional consideration in this area is the proposed research facility, the Directed Energy Laboratory, to be located between W.W. White Road and Pershing Avenue, north of the main BAMC campus. The existing railroad tracks limit the feasible connection to the main BAMC roadway network. Access to this area is anticipated from a new roadway extension from W.W. White Road, connecting to Nursery Drive. This alignment will alleviate some traffic from the BAMC area while providing a more direct connection to the installation.

Camp Bullis also would experience minor traffic growth due to its use as an additional area for training facilities. The projected growth will be minor in relation to overall impacts, since the additional trips are expected to be buses or other high-occupancy vehicles originating from FSH.

With the implementation of the preferred alternative, installation staffing and facilities would increase. This would result in increased vehicular traffic and increased queues at the ACPs, resulting in overall lower LOS for intersections and roadway segments throughout the installation. In general, the traffic implications would remain in the conventionally accepted ranges of LOS D or better, provided the installation continues its strategic traffic planning and improvements program, including modifications and upgrades at the ACPs. Additionally, specific measures would include signalizing the Hardee and Scott Roads intersection and adding turning lanes to the Schofield and Patch Roads intersection. Roadway improvements and intersection modifications should be coordinated closely with the proposed work of the preferred alternative and with the off-installation programmed improvements by local and State agencies.

Minor Siting Variations

Minor siting variations will have the same impact as the preferred alternative.

No Action Alternative

FSH has a traffic management and growth plan for each area that addresses the needs of proposed growth and development. The continued monitoring and adjustments proposed in those plans remain adequate responses and remedies for planning for installation growth. Under the no action alternative, planned modifications and upgrades to the FSH ACPs would continue. Those would be minor traffic increases with the AMF actions that already have begun.

4.12 UTILITIES

The utility systems addressed in this analysis include the facilities and infrastructure used for:

- Water pumping, treatment, storage and distribution
- Recycled water distribution
- Wastewater collection, pumping, treatment, storage and discharge
- Stormwater collection and discharge
- Energy generation and distribution, including electricity and natural gas
- Communications systems
- Solid waste collection and disposal

The average daily utility demand (consumption or generation) at FSH is shown in Table 4-54. Figure 4-34 shows the locations of water wells, water storage tanks and water treatment facilities on FSH.

Table 4-54 FSH Average Daily Utility Demand

Utility (Units)	Average Usage
Water Generation (MGD)	1.4
Recycled Water (MGD) (Sep 05 – Jan 06)	2.3
Wastewater Generation (MGD)	0.8
Electrical Consumption (MWh/day)	604.2
K-therms Solid Waste Generation (tons/day)	23.2
Natural Gas Consumption (K-therms/day)	108.7

Note:
K-therms – 1 million Btu (British thermal units)

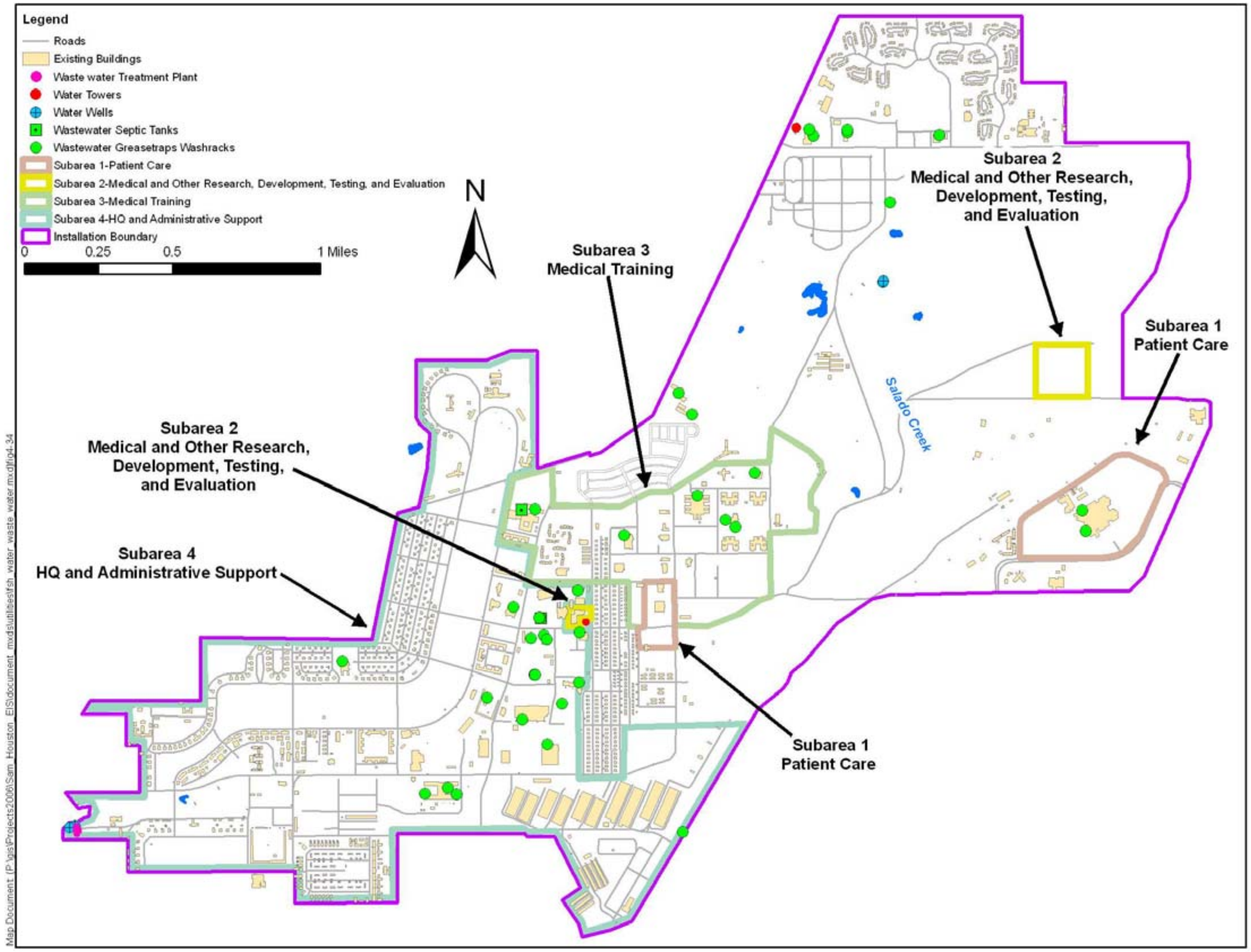

Figure 4-34 FSH Water and Wastewater Facilities
Source: FSH GIS Department, 2006

The average daily utility demand (consumption or generation) at Camp Bullis is shown in Table 4-55.

Table 4-55 Camp Bullis 2005 Average Daily Utility Demand

Utility (Units)	Average Usage
Water Generation (MGD)	0.11
Wastewater Generation (MGD)	0.06
Electrical Consumption (MWh/day)	41.1
Solid Waste Generation (tons/day)	2.3
Propane Consumption (gallons/day)	309.0

Note:
Wastewater generation is equal to recycled water usage at Camp Bullis.

4.12.1 Affected Environment

Potable Water System

Fort Sam Houston

Potable water for FSH is supplied by five wells (Nos. 1, 2, 5, 6 and 7). These wells can produce a total of 14 MGD from the artesian zone of the Edwards Aquifer. The well water is treated chemically through one of two treatment plants at the installation prior to storage and distribution across FSH. Average daily consumption is approximately 1.4 MGD. Total storage capacity is 2.05 million gallons. Potable water treatment for all five wells consists of injection of chlorine, fluoride and a corrosion inhibitor (phosphate) into the raw water supply prior to pumping to elevated storage tanks. Figure 4-34 shows the locations of water wells and water storage tanks.

***Southwest Water Treatment Plant, Water Well Nos. 1, 2 and 7*:** Located in the southwestern portion of the installation. This area includes Facilities 2190 (potable water pump house for Water Well No. 7) and 2194 (potable water pump house and treatment facility for Well Nos. 1 and 2). Other structures without facility numbers include three temporary storage containers, a tin shed, an auxiliary diesel pump engine, a fluoride tank and a corrosion inhibitor (phosphate) tank. The southwest water treatment plant is located on an unnamed road in the southwesternmost corner of FSH, north of Nika Street and west of Pine Street.

***South Potable Water Storage Tank (Facility 2600)*:** This 1-million-gallon, elevated water storage tank is in the center of the installation at the intersection of Schofield Road and Patch Road.

***North Potable Water Storage Tank (Facility 1565)*:** This 1-million-gallon elevated water storage tank is in the northwest portion of the installation at the intersection of Winans Road and Harry Wurzbach Highway near the FSH National Cemetery.

***Water Well Nos. 5 and 6*:** Located within Facility 3186 (potable water pump house) in the northeastern portion of the installation. Facility 3186 is next to Salado Creek, east of Nursery Road.

***Northeast Water Treatment Plant*:** Located near Water Well Nos. 5 and 6 in the northeastern portion of the installation on the golf course east of Nursery Road. This area includes Facility 3190 (potable water chlorinator facility) and Facility 3194 (electrical control facility). Other structures located on the parcel do not have facility numbers and include electrical transformers, an auxiliary diesel generator, a fluoride tank and a phosphate tank.

As part of the TCEQ requirements for public supply water wells, periodic testing of the water quality from the five water wells is conducted. The water testing includes analysis for VOCs, semivolatile organic compounds (SVOCs), pesticides, herbicides and inorganic chemical constituents (including lead). Based on testing of the system to date, all five water wells currently comply with the Safe Drinking Water Act (SDWA).

Camp Bullis

Potable water for Camp Bullis is supplied by three wells (Nos. 3, 15 and DMSET). Water Well Nos. 3 and 15 can produce a total of 0.19 MGD from the Trinity Aquifer. The DMSET well production rate is operated manually and restricted to 40 gallons per minute (gpm) to control drawdown in the formation while maintaining a minimum water level in the elevated storage tank. Potable water treatment for all three wells consists of injection of chlorine, fluoride and a corrosion inhibitor (phosphate) into the raw water supply prior to pumping to elevated storage tanks. Total storage capacity on-installation is 0.45 million gallons. Figure 4-35 shows the locations of water facilities on Camp Bullis.

***North Water Storage Tank (Facility 6145)*:** A 200,000-gallon, elevated water storage tank located on an unnamed gravel road between Marne Road and Lewis Valley Road. Included on this property is Facility 6144, a potable water support/treatment facility that houses the potable water treatment chemicals and feed pumps.

***DMSET Water Well (Facility 6148)*:** Facility 6148 and the associated potable water support/treatment facility (Facility 6149) are south of the north water storage tank on an unnamed gravel road between Marne Road and Lewis Valley Road. Facility 6149 houses the potable water treatment chemicals and feed pumps used to treat water from the DMSET well.

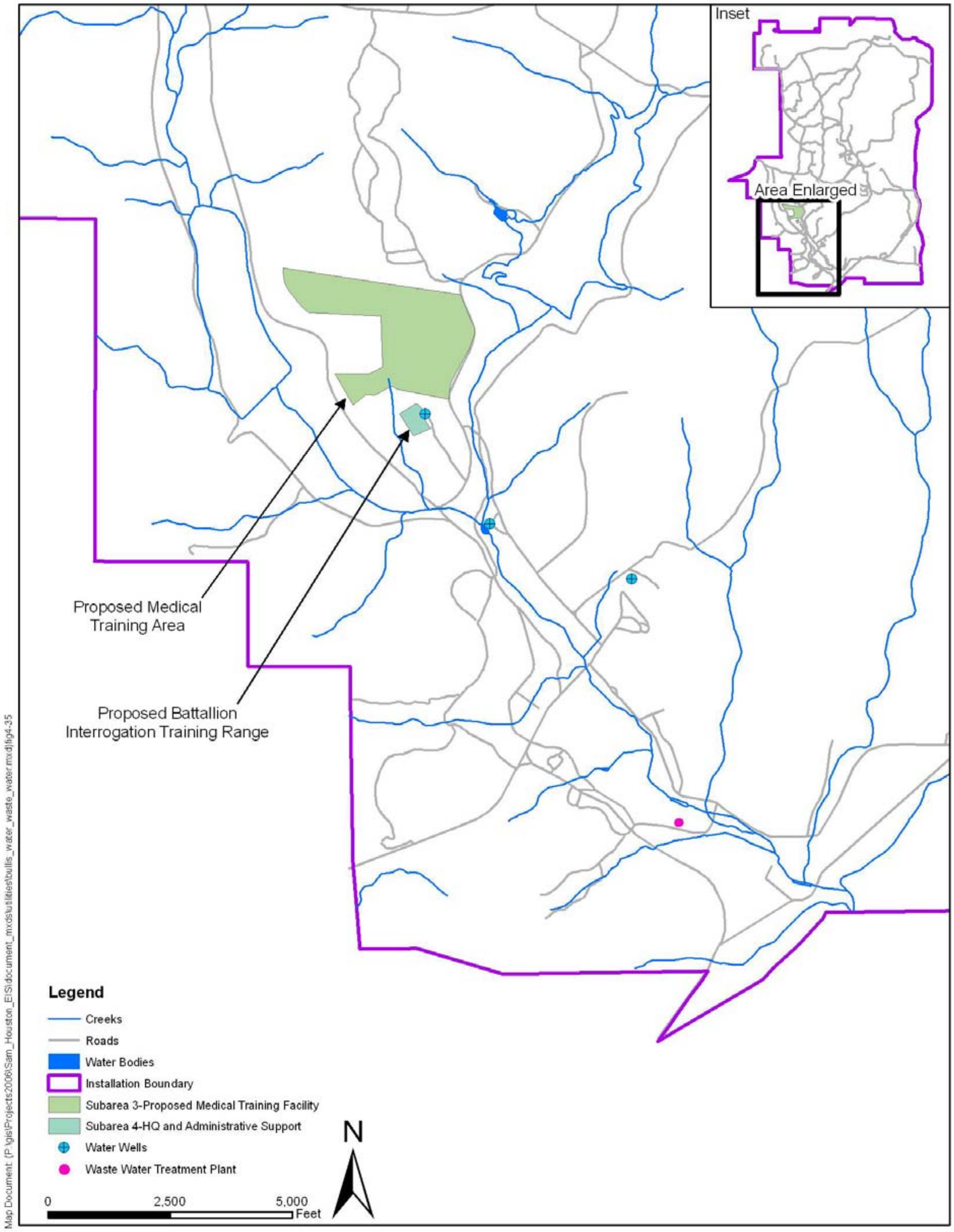

Figure 4-35 Camp Bullis Water and Wastewater Facilities
Source: FSH GIS Department, 2006

***Water Well No. 3 (Facility 6210)*:** Located east of the housing quarters on a gravel road extension of Bullis Road.

***South Water Storage Tank (Facility 6212)*:** A 250,000-gallon, elevated water storage tank located on an unnamed gravel road extension of Bullis Road. Included on this property are Facilities 6207 (potable water valve facility), 6208 (potable water booster pump), 6209 (potable water treatment), 6211 (formerly housed water treatment activities) and open storage areas (*e.g.*, empty tanks, heavy equipment, surplus plumbing supplies and surplus building materials).

***Water Well No. 15 (Facility 6219)*:** Facility 6219 and the associated potable water support/treatment facility (Facility 6217) are south of the north water storage tank on an unnamed gravel road west of Lewis Valley Road. Facility 6217 houses the potable water treatment chemicals and feed pumps used to treat water from Water Well No. 15.

As part of the TCEQ requirements for public supply water wells, periodic testing of the water quality from the five water wells is conducted. The water testing includes analysis for VOCs, SVOCs, pesticides, herbicides and inorganic chemical constituents (including lead). Based on testing of the system to date, all three water wells currently comply with the SDWA. VOCs have been detected in the DMSET water well and Water Well No. 15 at concentrations less than the MCL established by USEPA. The results of water testing conducted to date indicate that the water currently does not pose a threat to human health or the environment.

Recycled/Reuse Water System

Fort Sam Houston

FSH currently purchases recycled water from SAWS for use in irrigation systems and cooling towers. Areas of FSH irrigated by recycled water include the RV park, the golf course, 1600 Area, 3800 Area, the Youth Center and the Medical (MED) Museum. Cooling towers using recycled water include BAMC, AMEDDC&S, Medical Laboratories 1 and 2, Medical Command (MEDCOM) HQ, 2791 barracks, the main PX and the 1300 Area plant. Recycled water distribution has been installed to irrigate BAMC, AMEDDC&S, MEDCOM HQ, 1300 Area and the Centers for Disease Control (CDC)/Chapel area but has not been connected.

In total, FSH has approximately 24,000 linear feet of recycled water lines throughout the installation. The SAWS water recycling program has the capacity to deliver 35,000 acre-feet of water per year

(11,404.8 million gallons) to users throughout San Antonio. Recycled water usage on FSH in 2005 amounted to 0.73 MGD (2.24 acre-feet (af)/day).

Camp Bullis

Treated wastewater effluent is stored temporarily in evaporation/storage ponds and ultimately is discharged through spray irrigation. Camp Bullis operates under a zero discharge operating permit (TCEQ Permit No. 12080-01), redistributing treated wastewater effluent through irrigation of the nearby firing ranges. Annual wastewater treatment effluent has averaged 19.77 million gallons, or 0.05 MGD. Recycled/reuse water is not used for irrigation at any facilities other than the ranges.

Wastewater System

Fort Sam Houston

The wastewater collection system consists of approximately 262,000 linear feet of main pipelines. These pipelines are constructed of terra cotta, concrete, cast iron, asbestos concrete and polyvinyl chloride (PVC) pipe in various diameters ranging from 6 to 48 inches. Wastewater collected through the system is delivered, in general, via gravity flow into sewer mains owned and maintained by SAWS. One well-type lift station, located to the north and east of the FSH National Cemetery, pumps wastewater from the Watkins Terrace Housing Area to connect with the gravity flow system. The FSH National Cemetery is an adjacent federal (Department of Veterans Affairs) installation and not part of FSH. No wastewater is treated at FSH (USACE, 2001b).

FSH currently maintains wastewater discharge permits with SAWS covering the discharges from the installation. The wastewater discharges are monitored under Industrial Wastewater Discharge Permit No. HV-0299. The requirements of this permit include sampling for inorganic chemicals, fats, oils and grease, pH, temperature, solids, biochemical oxygen demand (BOD) and TSS at several manholes where the wastewater leaves the installation and enters the SAWS system. Wastewater quantity from FSH is not measured directly, but rather is based on a percentage of the water consumption, currently 59.5 percent, or 0.8 MGD.

Camp Bullis

The wastewater collection system consists of approximately 43,000 linear feet of main pipelines. The system includes six lift stations. Five of the lift stations are stand-alone, and the sixth is located within Facility 6284. The lift stations deliver the wastewater to the Camp Bullis wastewater treatment plant.

Treated effluent is stored temporarily in evaporation/storage ponds and ultimately is discharged through spray irrigation. Camp Bullis operates under a zero discharge operating permit (TCEQ Permit No. 12080-01), redistributing all treated wastewater effluent through irrigation of the nearby firing ranges. Camp Bullis's average wastewater production is 0.06 MGD. Figure 4-35 shows the locations of the sewage lift stations and wastewater treatment facilities on Camp Bullis.

***Wastewater Treatment Plant*:** The treatment plant is designed for a daily flow of 0.68 MGD and a 2-hour peak flow of 2.38 MGD of influent. The system currently operates at less than 10 percent of design capacity. Clarifiers, lift stations and a 200,000-gallon wastewater process tank (Facility 5920) used for secondary treatment are located east of the cantonment area in the southern portion of the installation. The wastewater treatment plant is located north of Range Control Road between Military Highway and Wilderness Trail. The current facility was installed in 1997 to replace an abandoned wastewater treatment facility. The wastewater treatment facilities at Camp Bullis, operating under TCEQ Permit No. 12080-01, consist of a conventional, activated-sludge process plant. Treatment units include a bar screen, a grit chamber, an aeration basin, a final clarifier, a chlorine contact chamber and an evaporating/storage pond system with a spray irrigation system for the final discharge. Sediment and sludge generated at the wastewater treatment plant are transported off-site, as needed, for final disposal (USACE, 2001b).

***Spray Irrigation Holding Ponds*:** Also known as oxidation ponds, these are located within Facility 5925 southeast of the wastewater treatment plant on the south side of Range Control Road. Facility 5925 was designed as the tertiary water treatment facility, but the pumps have been removed and the facility currently serves as the spray irrigation holding pond service facility.

Stormwater System

Fort Sam Houston

FSH is drained primarily by Salado Creek. The creek runs north to south through the eastern portion of the installation and drains into the San Antonio River. Flow from FSH into the creek is primarily from surface runoff. The western part of FSH is drained by the Alamo Ditch, a tributary of the San Antonio River. The southern and central portions of FSH proper are drained by the City of San Antonio's stormwater drainage system. FSH experiences major flooding every three to four years. During flood conditions, a large portion of the training area is inundated, including Facility 3186 (which houses Water Well Nos. 5 and 6) and the western water treatment facility (Facilities 3190 and 3194) (USACE, 2003b). Because of the reoccurring flood events, pumps for Water Well Nos. 5 and 6 were converted from surface-mounted to submersible pumps.

Camp Bullis

No stormwater system is currently in place at Camp Bullis. Stormwater drainage at Camp Bullis is generally through natural settings (*e.g.*, interim creeks and valleys). Natural drainage is enhanced by curbing, parking lots and ditches. Stormwater management requirements for construction and operation are described in Section 4.7.2.

Energy Sources

Electrical power

Fort Sam Houston

As part of utility privatization, electrical power systems at FSH were privatized in September 2000. Electrical power is provided by City Public Service (CPS). Power to the substation is distributed to various facilities via lines owned by CPS and metered at each individual facility. In addition to the electrical power provided by CPS, FSH has several auxiliary generators to supply emergency power to BAMC and other critical mission facilities during emergencies (U.S. Army, 2001a).

Camp Bullis

As part of utility privatization, electrical power systems at Camp Bullis were privatized in September 2000. Camp Bullis is supplied with electric power by contract with CPS. There are currently no contractual limitations on the amount of electricity the installation may purchase. The electrical distribution at the installation was upgraded to 1,500 kilovolt-amperes (kVA) 13,200-volt capacity within the last 10 years (USAF, 1995). Power to the substation is distributed to various facilities via lines owned by CPS and metered at each individual facility. The installation has generators to support critical systems during periods of interrupted power from CPS.

Natural Gas Service

Fort Sam Houston

As part of utilities privatization, natural gas supply at FSH was privatized in September 1999. CPS owns and maintains the gas distribution lines throughout the installation. In 2005, FSH natural gas usage was 39,691.6 K-therms (39,691,620 therms).

Camp Bullis

Propane gas is used at Camp Bullis for heating. Storage tanks are located near the facilities that use the propane. The gas is supplied by local vendors, and at present, there is no limit on the amounts that may be purchased by Camp Bullis. In 2005, Camp Bullis purchased 112,784.7 gallons of propane.

Communications

Fort Sam Houston

FSH currently has over 96,000 linear feet (18 miles) of jell-filled copper telephone communications cabling and 131,000 linear feet (25 miles) of jell-filled fiber optic cabling to support secure telephone and data communications on-installation (Martin, 2006).

Camp Bullis

Camp Bullis currently has over 15,000 linear feet (3 miles) of jell-filled copper telephone communications cabling and 15,000 linear feet (3 miles) of jell-filled fiber optic cabling to support secure telephone and data communications on-installation (Martin, 2006).

Solid Waste

Fort Sam Houston

All solid waste from FSH is collected and disposed off-site by contract disposal services. Solid waste is disposed at an approved and certified TCEQ solid waste landfill. For calendar year 2005, FSH produced approximately 8,500 tons of solid waste.

Camp Bullis

All solid waste from Camp Bullis is collected and disposed off-site by contract disposal services. Solid waste is disposed at an approved and certified TCEQ solid waste landfill. For calendar year 2005, Camp Bullis produced approximately 830 tons of solid waste.

4.12.2 Consequences

Realignment (Preferred) Alternative

Potable Water

Potable water usage would increase with the increased presence caused by selection of the preferred alternative. Impact to the existing systems for FSH and Camp Bullis is considered not significant because current production capabilities at each installation are sufficient to produce potable water supplies. Potable water increase was estimated using factors for average water consumption applied to the daily loading of students (24-hour) and employees (8-hour). Factors, supplied by USEPA, for each application were 50 gpd for an 8-hour resident and 150 gpd for a 24-hour resident (JDAAF, 1987). Potable water usage is expected to increase from 1.4 to 2.32 MGD (an increase of 0.92 MGD [3.33 acre-feet per day]) for FSH and from 0.11 to 0.13 MGD (an increase of 0.02 MGD [0.06 acre-feet per day]) for Camp Bullis.

In addition to increased water demand from personnel increases, new facilities also would cause an increase in water usage during construction and post-construction activities. It is not anticipated that the DoD water usage demand would exceed the withdrawal allocation at FSH. Therefore, the preferred alternative is not expected to have a significant impact on the Edwards or Trinity Aquifers.

Recycled/Reuse Water System

The preferred alternative would not have a significant impact on the recycled/reuse water system at FSH. At FSH, recycled water would continue to be used to provide irrigation and water tower water and would be available for connection to the wash racks.

Camp Bullis's reuse water would increase as wastewater generation increases. Wastewater generation is expected to increase from 0.06 to 0.07 MGD. This is related directly to the amount of reuse water available for irrigation.

Wastewater System

Wastewater generation would increase with the increase in personnel at both FSH and Camp Bullis. Impacts to the existing FSH system are considered not significant, because the current systems have sufficient capacity to convey the wastewater to the SAWS wastewater treatment facility. In the case of Camp Bullis, the on-site wastewater treatment facility has sufficient capacity; however, the current lift stations are not adequate to convey wastewater from the location of the preferred alternative to the wastewater treatment plant. Therefore, an additional list station likely would be required. Wastewater system increases were based on historical ratios of water consumption to wastewater production: 59.5 percent for FSH and 53.75 percent for Camp Bullis. Wastewater production is expected to increase at FSH from 0.8 to 1.49 MGD, while Camp Bullis is expected to increase from 0.06 to 0.07 MGD. Current SAWS facilities are capable of treating the increased wastewater influent from FSH. The current Camp Bullis wastewater treatment system is operating below design capacities; after the preferred alternative has been completed, the system would continue to operate below design capacities of 0.68 MGD.

Increased wastewater treatment plant operations would increase the air emissions associated with the operation; however, the impact is considered negligible.

Stormwater System

As the impervious area increases, an increase in peak flows would intensify erosion and sedimentation downstream of FSH. Implementation and management of SWPPP BMPs would help prevent the effects of the increase in stormwater. Improvements in stormwater retention are planned for the construction phases, as well as improved channeling of the stormwater.

Selection of the preferred alternative would need to address stormwater runoff and stream infiltration during the construction periods; these should be addressed in an updated SWPPP for each installation. No stormwater system is in place at Camp Bullis.

Impacts from stormwater systems also are discussed in Section 4.7.

Energy Sources

Current infrastructure is adequate to support increased growth and utility usage of electrical and natural gas systems resulting from the preferred alternative at FSH. Electrical usage is expected to increase approximately 50 percent over current usage (increase from 604.2 to 906.3 MWh/day). Natural gas usage is expected to increase from 108.7 to 163.1 K-therms/day.

Camp Bullis's electrical infrastructure would have to be constructed to provide adequate electrical service to the location of the preferred alternative; however, current CPS infrastructure is adequate to support increased growth and electrical system usage on Camp Bullis. New facilities would require placement of a propane tank near the mechanical room to supply propane for combustion. Electrical consumption is expected to increase by approximately 20 percent, or from 41.1 MWh/day to 49.3 MWh/day.

Increased natural gas and propane consumption would result in increased air emissions from gas combustion. The increased air pollutant emissions from increased fuel combustion are discussed in Section 4.4. FSH air emissions increases are estimated at approximately 11.9 tons/year of NO_x, 20.0 tons/year of CO and 1.3 tons/year of VOCs, while Camp Bullis air emissions increases are estimated at 0.01 ton/year of NO_x, 0.17 ton/year of CO and 0.01 ton/yr of VOCs.

Communications

The FSH Directorate of Information Management (DOIM) plans to install new communications cabling and use existing cable service in existing and new underground conduit to provide service to each planned preferred alternative facility at FSH and Camp Bullis. The preferred alternative anticipated facility and user growth would require a new Small End Office Switching Facility (Switch Node) to support both telephone and data requirements. Currently, there are no plans at FSH or Camp Bullis to install aerial communication cables in support of the preferred alternative. Planned cabling provides required Switch Node redundancy for emergency service. Cabling would support all current and planned data and telephone communications transmission speeds (Martin, 2006), including the preferred alternative.

Solid Waste

Current infrastructure is adequate to support increased growth and solid waste disposal on both FSH and Camp Bullis. Current off-site landfill facilities have adequate capacities to properly dispose of solid wastes generated at FSH and Camp Bullis. Solid waste generation at FSH is expected to increase from 23.2 to 34.8 tons/day, while Camp Bullis generation is expected to increase from 2.3 to 2.8 tons/day. These figures should be decreased by applying pollution prevention (P2) or recycling programs at the installation.

Disposal of construction debris will be needed during the construction periods at each installation. Construction debris is estimated using USEPA data averaging 6 pounds of debris for each square foot of facility. An estimated 17 to 19 facilities (618,837 sf) would need to be demolished/deconstructed to allow adequate construction space for the preferred alternative. This equates to approximately 1,900 tons of debris to be disposed during construction and demolition/deconstruction activities at FSH alone. Environmental regulations promulgated by RCRA require characterization of demolition/deconstruction debris to determine proper disposal criteria. State regulations that require more stringent disposal criteria also may exist. Asbestos and lead characterization activities for building materials should be carried out before demolition/deconstruction.

No demolition/deconstruction of facilities is expected at Camp Bullis.

Minor Siting Variations

Minor siting variations would have the same expected consequences as the preferred alternative, because minimal changes in resources would be realized from minor siting variations.

No Action Alternative

Under the no action alternative, the utility systems would not be changed or affected significantly, because no changes to the distribution or collection systems would take place.

4.13 HAZARDOUS MATERIALS AND TOXIC SUBSTANCES

A hazardous material is any item or agent (biological, chemical or physical) that has potential to cause harm to humans, animals or the environment, either by itself or through interaction with other factors or substances. Hazardous materials are defined and regulated in the United States primarily by laws and regulations administered by USEPA, OSHA, DOT and NRC. Each has its own definition of a hazardous material.

OSHA's definition includes any substance or chemical that is a "health hazard" or "physical hazard," including:

- Chemicals that are carcinogens, toxic agents, irritants, corrosives or sensitizers
- Agents that act on the hematopoietic system
- Agents that damage the lungs, skin, eyes or mucous membranes
- Chemicals that are combustible, explosive, flammable, oxidizers, pyrophorics, unstable-reactive or water-reactive
- Chemicals that in the course of normal handling, use or storage may produce or release dusts, gases, fumes, vapors, mists or smoke that may have any of the previously mentioned characteristics[17]

USEPA incorporates the OSHA definition and adds any item or chemical that can cause harm to people, plants or animals when released by spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping or disposing into the environment.[18]

DOT defines a hazardous material as any item or chemical that when being transported or moved is a risk to public safety or the environment and is regulated as such under the Hazardous Materials Regulations (49 CFR 100 to 180); International Maritime Dangerous Goods Code; Dangerous Goods Regulations of the International Air Transport Association (IATA); Technical Instructions of the International 4-124 Civil Aviation Organization; or USAF Joint Manual, *Preparing Hazardous Materials for Military Air Shipments*.

[17] Full definitions can be found at 29 CFR 1910.1200.
[18] 40 CFR 355 contains a list of over 350 hazardous and extremely hazardous substances.

NRC regulates items or chemicals that are "special nuclear source" or byproduct materials or radioactive substances.[19]

Army policy for hazardous waste management and waste-related P2 is outlined in Section 5.0 of AR 200-1, *Environmental Protection and Enhancement*. Normal operations at FSH and Camp Bullis produce RCRA hazardous waste, as defined in 40 CFR Parts 261 to 265 and 30 TAC 335. Most hazardous waste is generated by processes related to vehicle and equipment maintenance and medical activities. Current hazardous waste management activities at FSH and Camp Bullis are performed by a licensed contractor in concert with the Directorate of Emergency Services (DES).

Hazardous wastes are handled, transported and stored in accordance with the *Hazardous Waste Management Plan* at Fort Sam Houston and Camp Bullis (USACHPPM, 1999a). The plan sets forth procedures to achieve and maintain regulatory compliance regarding material management or administrative responsibilities; turn-in procedures; a hazardous material; inventory; training; a waste analysis plan; a tracking system; and hazardous waste storage, packaging, labeling and shipment requirements. In addition to this plan, Spill Prevention Control and Countermeasures (SPCC) Plans and Installation Spill Contingency Plans (ISCPs) have been developed and implemented for FSH and Camp Bullis. These plans provide prevention and control measures to minimize the potential for spills of hazardous and toxic chemicals, and establish plans and procedures for controlling and managing sudden releases of petroleum products and other hazardous materials.

4.13.1 Affected Environment

Uses of Hazardous Materials

Section 4.0 of AR 200-1, *Environmental Protection and Enhancement*, outlines Army policy for HM management and related P2. The Army and USEPA encourage a reduction in the use of hazardous and toxic materials due to their toxicity.

Activities and maintenance processes at FSH and Camp Bullis require the use of hazardous and toxic materials. The most commonly used hazardous materials include aviation and motor fuels, various grades of petroleum products, paints, solvents, thinners, adhesives, cleaners, batteries, acids, bases, refrigerants, compressed gases and pesticides. The management and distribution to shops of hazardous materials at FSH and Camp Bullis are accomplished primarily through the Director of Logistics supply channels based on forecast and immediate needs. Special hazardous materials, including pesticides, medical

[19] See 10 CFR 20.

supplies and fuels, are maintained and distributed through alternative channels. In addition, approved individuals or organizations may obtain small quantities of hazardous materials from off-installation sources with International Merchant Purchase Authorization Cards (IMPACs). The Directorate of Public Works (DPW) performs hazardous material reporting for compliance with EPCRA and other regulations.

Storage and Handling Areas

Most hazardous materials at FSH and Camp Bullis are used in small to moderate quantities with limited spill potential. Some materials and chemicals, however, are stored in larger quantities depending on the needs of specific facilities.

Fort Sam Houston

Hazardous wastes at FSH are accumulated at satellite accumulation sites around the installation. Satellite accumulation sites are areas near the point of waste generation where up to 55 gallons of a hazardous waste stream, or 1 quart of an acutely hazardous waste stream, may be accumulated. More than one drum may be present; however, more than 55 aggregate gallons may not be present at any satellite accumulation site. More than one waste stream, and therefore more than one drum, may be accumulated, but no more than one drum of any waste stream may be accumulated. Once accumulation volume limits are reached, wastes subsequently are moved within the installation to Facility 3600, a regulated, less-than-90-day hazardous waste storage area. Facility 3600 accommodates the storage of hazardous waste containers for up to 90 days until they can be collected by a USEPA-licensed transporter and delivered to an approved off-site disposal facility. Off-site transport is contracted by the DRMO. Table 4-56 lists the hazardous material/waste accumulation sites and storage areas on FSH. Each of these facilities is shown in Figure 4-36.

Table 4-56 Summary of Hazardous Material/Waste Satellite Accumulation Sites and Less-than-90-day Storage Areas

Facility No.	Facility Name	Contents	Container Type
320	Gymnasium Pool	Chlorine	150-pound cylinder
350	Toyland/Four Seasons	Pesticides, fertilizers, paints	Various containers
1521	90th U.S. Army Reserve Support Command	Automotive gasoline (MOGAS), paint, oil, diesel, brake fluid, antifreeze, mineral spirits, sulfuric acid	55- and 30-gallon drums, 5-gallon containers
2190	Water Treatment Plant	Chlorine, calcium hypochlorite, paint, hydraulic oil	150-pound cylinder, 5-gallon containers
2382	147th Medical Logistics Motor Pool	Antifreeze, oils, brake fluids, hydraulic fluid	Various containers
2411	Auto Hobby Shop	Paint-related waste, oil, antifreeze	55-gallon drums

Facility No.	Facility Name	Contents	Container Type
2610	Army and Air Force Exchange Service (AAFES) Fueling Station	Mineral spirits	55-gallon drum
2630	Veterinary Laboratory	Spent solvents	1-gallon jars
2631	Veterinary Laboratory	Ethyl acetate, acetone, methyl alcohol, formaldehyde, hexane	1-gallon and 1-liter containers
2841	AMEDD School Radiology and Photo Laboratory	Developer fixative, acetic acid	1-gallon containers
2912	MWR Golf Cart Maintenance	Waste oil, waste antifreeze, mineral spirits, paints	Various containers
3100	MWR Golf Course Maintenance	Oils, mineral spirits, diesel fuel, algaecides, herbicides, insecticides, pesticides, lead acid batteries, antifreeze, paint thinners	Various containers
3600	BAMC Cytology Laboratory	Waste ethanol, formalin, sulfuric acid	5-gallon container
3600	BAMC Histology Laboratory	Alcohol, xylene	5-gallon container
3600	BAMC Chemistry Laboratory	Methanol	5-gallon container
3600	BAMC Photo Laboratory	Waste developer fixative	5-gallon container
3600	Clinical Investigation Laboratory	Solvents, acids, bases	5-gallon container
3600	Morgue	Formaldehyde	1-gallon container
3882	Roads and Grounds	Contaminated gasoline, oil, used batteries, antifreeze	55-gallon drums and 1- to 5-gallon containers
4055	DOL Maintenance	Paint-related waste, contaminated gasoline, antifreeze, sodium iodate, formaldehyde	Various containers
4168	Self Help Store	Household hazardous waste	Plastic containers
4168	Pest Control Shop	Insecticides, rodenticides, herbicides, fungicides	Various containers
4192	AAFES Warehouse	Paints, thinners	Quart and gallon containers
4197	Refrigeration Sign Shop	Oil, mineral spirits	5-gallon container and 30-gallon unit
4209	DPW Maintenance	Transmission fluid, contaminated gas and diesel, transmission oil, hydraulic fluid, motor oil, antifreeze, mineral spirits	55-gallon drums
Less-than-90-day Storage Area			
3600	BAMC 90-day Hazardous Waste Storage Area	Various from BAMC operations	Multiple containers
4055	90-day Hazardous Water Storage Area	Various hazardous and petroleum wastes	Multiple containers

Source: Weston, 2003.

Camp Bullis

The Camp Bullis SPCC Plan and the ISCP (Weston, 2006) address handling and spills of hazardous materials. The SPCC Plan establishes procedures and guidance for the prevention, detection and response to spills of oils or hazardous substances on Camp Bullis, or in the vicinity of Camp Bullis. The ISCP specifies procedures to be followed when responding to releases, accidents and spills involving oils or hazardous substances. Table 4-57 lists the hazardous material/waste accumulation sites and storage areas on Camp Bullis. Each of these facilities is shown in Figure 4-37.

Table 4-57 Camp Bullis Summary of Hazardous Material/Waste Satellite Accumulation Sites

Facility No.	Facility Name	Contents	Container Type
5005	Lawn Maintenance – Pole Barn	MOGAS, oil	5-gallon container
5901	Hazardous Waste 180-day Storage Area	Various hazardous and petroleum wastes (*e.g.*, magnesium batteries, paint-related wastes, contaminated soils)	Various
5132	DPW Maintenance	Oils, gasoline, hydraulic fluid, mineral spirits	Quart, 5- and 55-gallon drum, 30-gallon unit
5424	Air Force Security	Solvent	30-gallon unit
5920	Wastewater Treatment Plant	Chlorine	150-pound cylinders
6005	National Guard Motor Pool	Oil, diesel, recycled antifreeze, waste diesel fuel, waste oil, waste antifreeze, brake fluid	5-gallon containers, 55-gallon drum, various
6104	AMEDDC&S Motor Pool	Oil, antifreeze, lead acid batteries, hydraulic fluid, paint, waste oil, water diesel, waste antifreeze, mineral spirits	55-gallon drums, individual quart containers, 5-gallon containers, aerosol cans, 30-gallon units
6130	Soldier Medic Training Site	Solvent	30-gallon unit
6143	DMSET (Arms Room)	Lubricants, mineral spirits	1-ounce bottle, 30-gallon unit
N/A	Rock Crusher/Asphalt Plant	Lubricants	55-gallon drum

Source: Weston, 2006

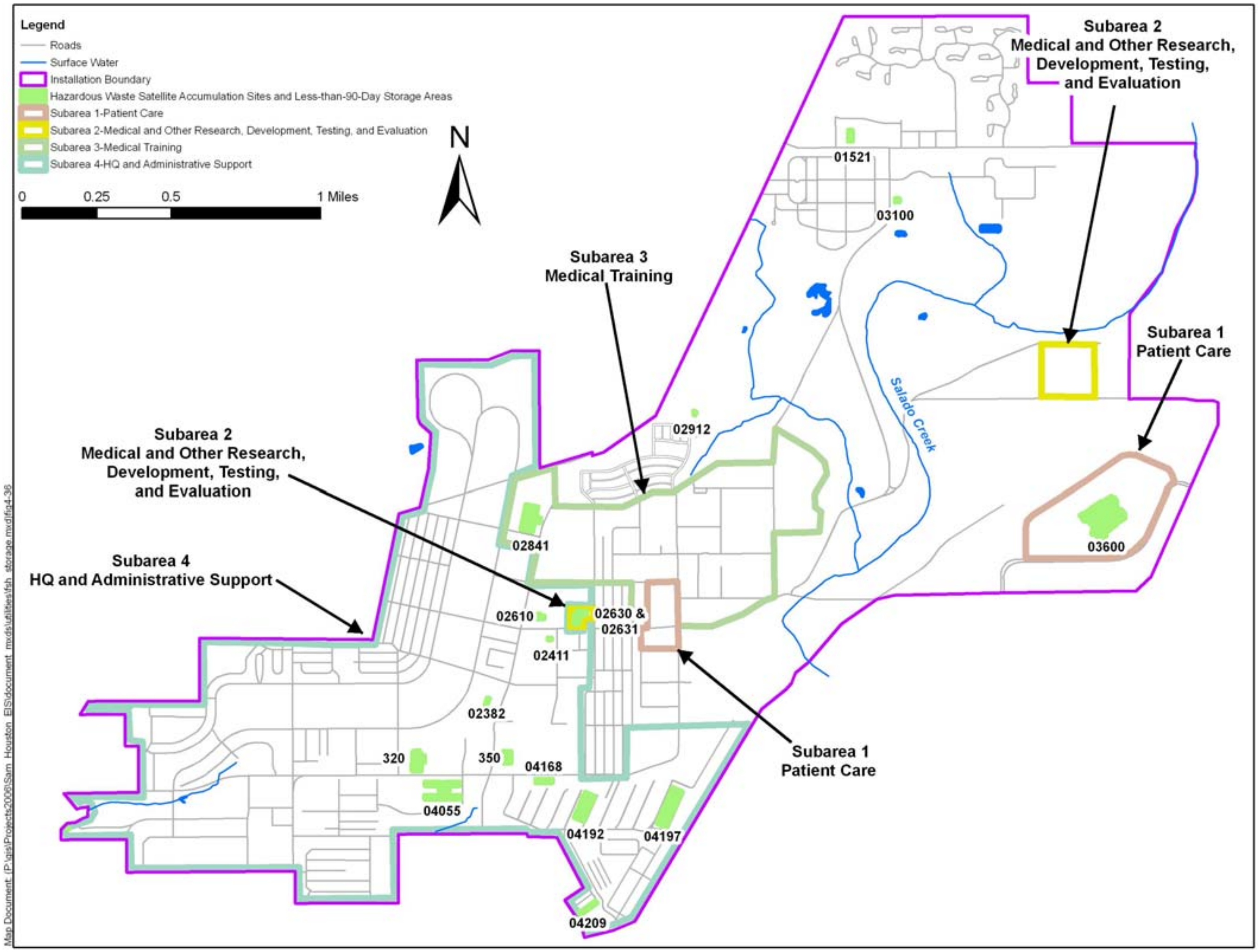

Figure 4-36 FSH Hazardous Material Collection Sites
Source: FSH GIS Department, 2006

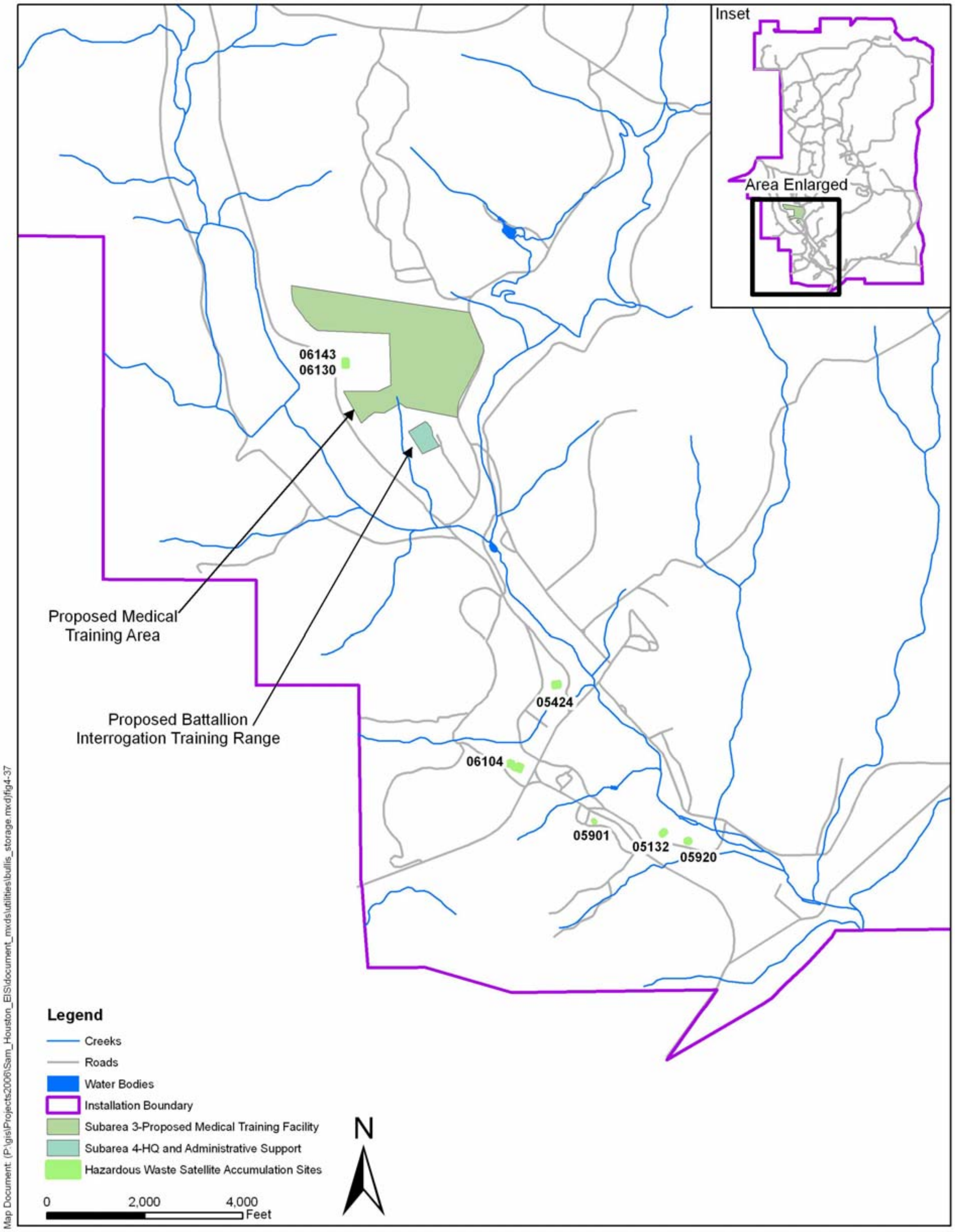

Figure 4-37 Camp Bullis Hazardous Material Collection Sites
Source: FSH GIS Department, 2006

Hazardous Waste Disposal and Reduction

FSH is categorized by USEPA as a large-quantity hazardous waste generator, which means that the installation generates more than 2,204 pounds of hazardous waste per month. FSH is regulated under RCRA as a hazardous waste management facility. It is the responsibility of the DRMO to dispose of hazardous wastes generated on the installations (USACE, 2004). In accordance with State and federal waste regulations, hazardous waste is transported off-site for proper disposal within 90 days. No hazardous waste is disposed on either installation.

Recycling efforts and procedural changes, including product substitutions, have been implemented where feasible to reduce the need for hazardous waste disposal from installation activities. Some of the current activities for hazardous waste reduction at FSH and Camp Bullis include:

- Direct exchange of used vehicle batteries for new ones and use of rechargeable batteries where applicable
- Limited recycling of used antifreeze
- Used oil recycling
- Occasional off-spec fuel reuse
- Closed-loop biodegradable parts washers at some maintenance facilities
- Dry chemical photographic processing at BAMC and the graphics shop
- Significant solvent recovery efforts at BAMC
- Prime vendor pharmaceuticals contract at dental and medical activities
- Partial implementation of hazardous substances management system (HSMS) and hazardous materials pharmacy operations at the DOL to reduce excess storage of hazardous materials that may become waste

Future opportunities for further hazardous waste reduction as outlined in the P2 Plan include:

- More widespread efforts to recycle all types of batteries
- Used antifreeze recycling
- Used oil, off-spec fuel and other waste (petroleum, oil and lubricant [POL]) -related generation reduction initiatives
- Pollution-reducing weapons maintenance techniques and methods
- Further reduction in solvent generated from parts washers

- Reuse of shop rags
- Alternatives to paint-related wastes
- Paint thinner recycling
- Miscellaneous maintenance waste (brakes, filters, cans, dry sweep and materials segregation)
- Additional solvent recovery and distillation for hospital wastes
- Miscellaneous medical-related wastes (mercury, regulated medical waste [RMW] and pharmaceuticals)
- Installationwide comprehensive use of HSMS and hazardous material pharmacy implementation for the entire installation for good housekeeping

Special Hazards

Certain regulated non-hazardous wastes and RMWs, while not defined by RCRA and TCEQ as hazardous substances, require special management procedures. These wastes are the result of common FSH activities and processes associated with hazardous waste generation.

Used tires, used compressed gas cylinders and fluorescent light bulbs are not considered “hazardous” by the regulatory definition; nonetheless, they are regulated wastes. Currently, these materials are disposed through the DRMO and recycled or disposed off-installation.

Storage Tanks

Section 4.5 of AR 200-1, *Environmental Protection and Enhancement*, outlines Army storage tank management policy and incorporates federal regulations. Environmental Office DPW manages storage tanks and storage tank releases at FSH and Camp Bullis in accordance with AR 200-1 and the FSH and Camp Bullis SPCC Plans and ISCPs (Weston, 2003, 2006).

These plans provide prevention and control measures to reduce the potential for spills from storage tanks and to establish plans and procedures for controlling and managing sudden releases of petroleum products or hazardous materials. Petroleum fuels and products, as well as waste POL products, are stored in various tanks throughout FSH and Camp Bullis. Materials stored include No. 2 diesel fuel (DF-2), gasoline, jet propellant (JP-8), motor oil and waste oil.

Fort Sam Houston

Table 4-58 summarizes information regarding storage tanks at FSH.

Table 4-58 FSH Storage Tanks

Tank Identification	Bldg. No.	Size (gallons)	Contents	Year Installed	Tank Material	Type of Tank
None	16	250	DF-2	Unknown	Steel	AST
None	16	250	DF-2	Unknown	Steel	AST
Unknown	331	10,000	Gasoline	Unknown	FRP	UST
Unknown	331	10,000	Gasoline	Unknown	FRP	UST
Unknown	331	10,000	Gasoline	Unknown	FRP	UST
None	1521	55	Waste Oil	Unknown	Steel	Drum
None	2190	500	DF-2	Unknown	FRP	AST
None	2190	500	DF-2	Unknown	Steel	Day Tank
None	2382	55	Waste Oil	Unknown	Steel	Drum
None	2382	55	DF-2	Unknown	Steel	Drum
None	2411	300	Waste Oil	Unknown	FRP	AST
38	2610	10,000	DF-2	1993	FRP	UST
39	2610	10,000	Gasoline	1993	FRP	UST
40	2610	10,000	Gasoline	1993	FRP	UST
41	2610	10,000	Gasoline	1993	FRP	UST
None	2610	500	Waste Oil	Unknown	FRP	AST
None	2610	250	Motor Oil	Unknown	Steel	AST
46	2630	500	DF-2	1980	FRP	UST
None	2630	50	DF-2	Unknown	Steel	Day Tank
None	2912	1,000	Gasoline	Unknown	Steel	AST
None	3100	550	Waste Oil	Unknown	FRP	UST
None	3100	550	DF-2	Unknown	Steel	AST
None	3100	550	DF-2	Unknown	Steel	AST
None	3600	55	Gasoline	Unknown	Steel	Drum
None	3882	55	Waste Oil	Unknown	Steel	Drum
None	3882	55	Gasoline	Unknown	Steel	Drum
58	4050	10,000	JP-8	1983	FRP	UST
59	4050	10,000	JP-8	1983	FRP	UST
60	4050	10,000	JP-8	1983	FRP	UST
61	4050	10,000	JP-8	1983	FRP	UST
None	4055	55	Waste Oil	Unknown	Steel	Drum
None	4209	300	Waste Oil	Unknown	FRP	AST

AST – Aboveground storage tank
UST – Underground storage tank
Day Tank – Emergency generator day use tank
JP-8 – Jet propellant
FRP – Fiberglass, reinforced plastic
DF-2 – No. 2 diesel fuel
Source: Weston, 2003

Camp Bullis

Table 4-59 summarizes storage tanks at Camp Bullis.

Table 4-59 Camp Bullis Storage Tanks

Tank Identification	Bldg. No.	Size (gallons)	Contents	Year Installed	Tank Material	Type of Tank
None	5000	200	DF-2	Unknown	Steel	AST
None	5005	1,000	DF-2	Unknown	Steel	AST
None	5010	200	DF-2	Unknown	Steel	AST
None	5020	300	DF-2	Unknown	Steel	AST
None	5920	300	DF-2	Unknown	Steel	AST
None	6005	55	Motor Oil	Unknown	Steel	Drum
None	6005	55	DF-2	Unknown	Steel	Drum
None	6005	55	Waste Oil	Unknown	Steel	Drum
65	6102	10,000	JP-8	Unknown	FRP	UST
66	6102	10,000	Gasoline	Unknown	FRP	UST
None	6104	55	Oil	Unknown	Steel	Drum
None	6104	55	Waste Oil	Unknown	Steel	Drum
None	6104	55	DF-2	Unknown	Steel	Drum
None	6118	500	DF-2	Unknown	Steel	AST
None	6110	200	DF-2	Unknown	Steel	AST
None	6210	200	DF-2	Unknown	Steel	AST
None	6208	500	DF-2	Unknown	Steel	AST
None	6210	500	DF-2	Unknown	Steel	AST
None	WET Site	55	Waste Oil	Unknown	Steel	Drum
None	Asphalt Plant	55	Waste Oil	Unknown	Steel	Drum
None	Asphalt Plant	55	Oil	Unknown	Steel	Drum
None	Asphalt Plant	100	DF-2	Unknown	Steel	Mobile
None	MOUT Site	500	DF-2	Unknown	Steel	AST
None	ITAM	500	DF-2	Unknown	Steel	Mobile
None	Black Jack	200	DF-2	Unknown	Steel	AST
None	DEPMED	500	Unused	Unknown	Steel	AST

UST Underground storage tank
AST Aboveground storage tank
JP-8 Jet propellant
Source: Weston, 2006

DF-2 No. 2 diesel fuel
WET Weekend training
FRP Fiberglass, reinforced plastic
ITAM Integrated Training Area Management
DEPMED Deployable Medical

Facility 6149 had a diesel release of approximately 100 to 150 gallons from a generator belly tank (not classified as a storage tank) in December 1999. Approximately 130 cubic yards of impacted soil subsequently was excavated and transported to a regional landfill for disposal. The results of soil sampling activities on the open excavation indicated that fuel-related VOCs were not present and that moderate concentrations of total petroleum hydrocarbons (TPH) remain in soil at concentrations that currently do not pose a threat to human health or the environment. The open excavation subsequently was backfilled with clean soils (Alamo Environmental, 2000).

Installation Restoration Program

Fort Sam Houston

Contamination of groundwater and soil is tracked and mitigated through the Army Environmental Database for Restoration (AEDB-R). Three Installation Restoration Program (IRP) sites are located on FSH. These include FTSH-26 (which includes Landfills 8A, 8B, 10 and 12), FTSH-29 (which includes Landfills 4A, 6 and 7) and FTSH-30 (which includes Landfills 2, 3, 4B and 5) (U.S. Army Environmental Center [USAEC], 2006b). Figure 4-38 shows the locations of the FSH IRP sites.

The following paragraphs summarize the FSH environmental investigations conducted at each IPR site as taken from the *Fort Sam Houston, Texas, Army Defense Environmental Restoration Program Installation Action Plan, 7 February 2006* (USAEC, 2006b).

***Landfill 2 (FTSH-30)*:** Landfill 2 is located within the east-central portion of FSH in the Salado Creek floodplain. The AEDB-R designation changed from FTSH-26 to FTSH-30. It is approximately 6 acres in size and is collocated with Landfill 3. Landfill 2 is reported to have received domestic, medical and construction wastes from 1954 to 1979.

A landfill assessment was performed in 1994 and 1995 and included a geophysical survey, surface and subsurface soil sampling and monitoring well installation. Exploratory trenching was completed in June 2000 for remedial investigation and design purposes.

Groundwater sampling for MW-0201 conducted in October 2004 was included in the combined Affected Property Assessment Report (APAR). No concentrations exceeding the protective concentration limits (PCLs) were detected. An APAR was submitted on 31 August 2005, recommending a Remedy Standard B closure (waste left in place) with long-term management. A Response Action Plan (RAP) will be required to document planned monitoring and maintenance activities along with LUCs (USAEC, 2006b).

***Landfill 3 (FTSH-30)*:** Landfill 3 is located along the east-central portion of FSH in the Salado Creek floodplain. It is approximately 3.3 acres in size and is collocated with Landfill 2. Landfill 3 is reported to have received domestic, medical and construction wastes until its closure in 1979.

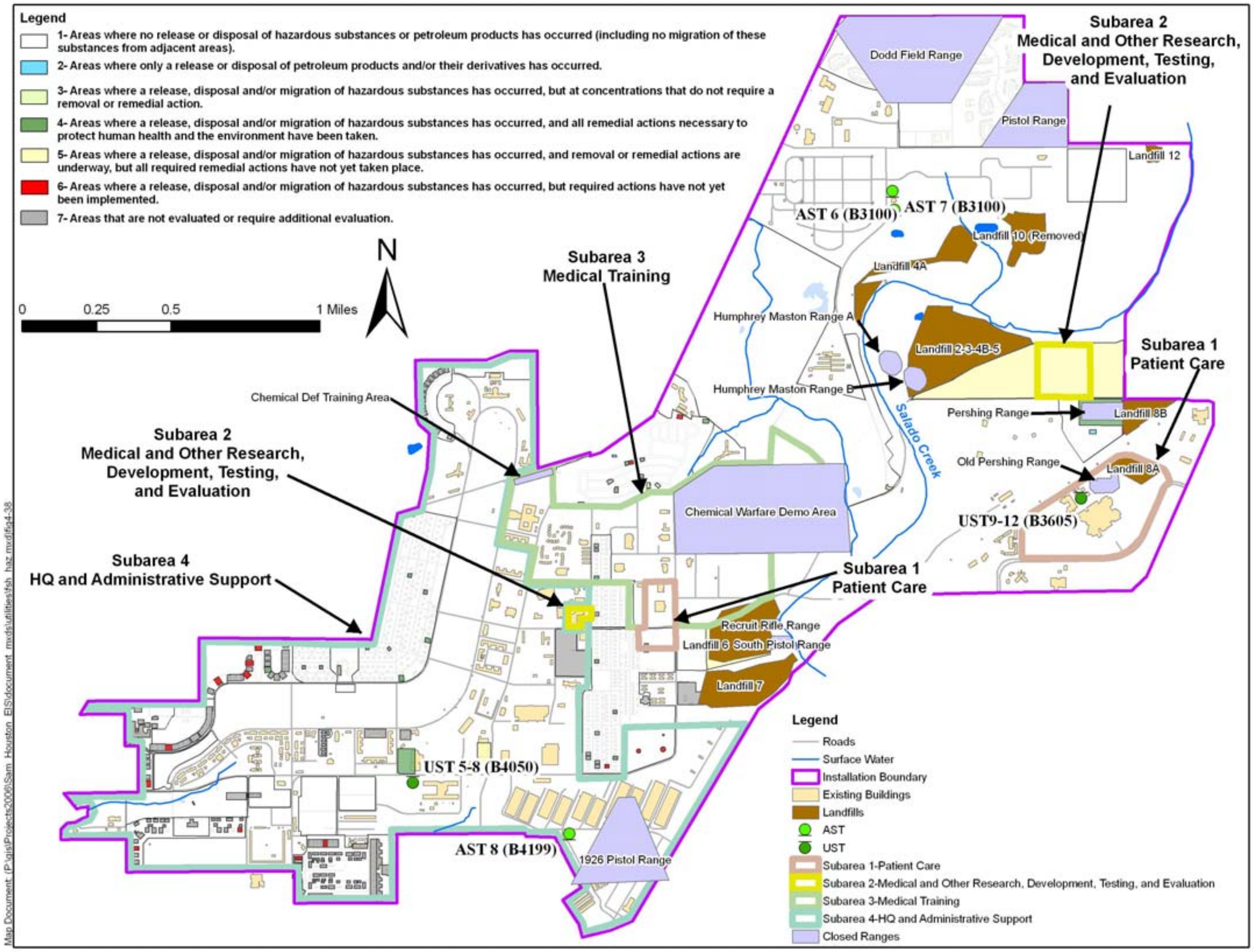

Figure 4-38 FSH IRP, Landfills and Closed Ranges
Source: FSH GIS Department, 2006

A landfill assessment was performed in 1994 and 1995 and included a geophysical survey, surface and subsurface soil sampling and monitoring well installation. Exploratory trenching was completed in June 2000 for remedial investigation and design purposes.

Groundwater concentrations exceeding the PCL for lead and arsenic were detected in samples collected in October 2004. The results were included in the combined APAR submitted to TCEQ on 31 August 2005, recommending a Remedy Standard B closure with long-term management. A RAP will be required to document planned monitoring and maintenance activities along with LUCs (USAEC, 2006b).

***Landfill 4A (FTSH-29)*:** Landfill 4A is located within the east-central portion of FSH. The AEDB-R designation changed from FTSH-26 to FTSH-29. This landfill is located north and west of Salado Creek, which also separates it from Landfill 4B. It is approximately 14 acres in size. This area-fill is reported to have received construction debris from 1960 to approximately 1975.

A landfill assessment was performed in 1994 and 1995 and included geophysical and soil gas surveys, surface and subsurface soil sampling and monitoring well installation. Exploratory trenching was completed in June 2000 for remedial design purposes. In August 2000, measures were taken to control erosion. The results have been included in the combined APAR, which was reviewed by TCEQ. A response to comments was submitted in February 2006 (USAEC, 2006b).

***Landfill 4B (FTSH-30)*:** Landfill 4B is located along the east-central portion of FSH in the Salado Creek floodplain. It is approximately 15 acres in size. Landfill 4B is reported to have received medical and construction wastes from 1960 to approximately 1975.

A landfill assessment was performed in 1994 and 1995 and included a geophysical survey, surface and subsurface soil sampling and monitor well installation. Metals and SVOCs were detected in two surface soil samples at concentrations above maximum background. Subsequently, groundwater sampling was performed, which revealed metals above the MCL. Exploratory trenching was completed in June 2000 for remedial investigation and design purposes. Two additional wells were installed and sampled in October 2004. Arsenic was detected at concentrations exceeding the PCL.

A combined APAR was submitted to TCEQ on 31 August 2005, recommending a Remedy Standard B closure with long-term management. A RAP will be required to document planned monitoring and maintenance activities along with LUCs (USAEC, 2006b).

***<u>Landfill 5 (FTSH-30)</u>*:** Landfill 5 is located within the east-central portion of FSH in the Salado Creek floodplain, was designated under FTSH-26 in the AEDB-R and has been redesignated as FTSH-30. The landfill is estimated to be 19 acres in size. This trench and fill landfill is reported to have received domestic, medical and construction wastes from 1953 until 1975.

A landfill assessment was performed in 1994 and 1995 and included a geophysical and soil gas surveys, surface and subsurface soil sampling and monitoring well installation. Metals, SVOCs and TPH constituents were detected in four surface soil samples at concentrations above maximum background. Subsequently, groundwater sampling was performed, which revealed metals above the MCL. Exploratory trenching was completed in June 2000 for remedial design purposes. One new well was installed in October 2004, and one existing well was replaced due to damage. No concentrations exceeding the PCLs were detected in groundwater samples collected in October 2004 (USAEC, 2006b).

A combined APAR was submitted to TCEQ on 31 August 2005, recommending a Remedy Standard B closure with long-term management. A RAP will be required to document planned monitoring and maintenance activities along with LUCs (USAEC, 2006b).

***<u>Landfill 6 (FTSH-29)</u>*:** Landfill 6 is located within the southeastern portion of FSH. This landfill is located west of Salado Creek and east of Garden Avenue. The landfill is estimated to be 23 acres in size. This trench and fill landfill is reported to have received domestic, construction and incinerator residue and debris from the mid-1950s until 1973.

A landfill assessment was performed in 1994 and 1995 and included a geophysical and soil gas surveys, surface and subsurface soil sampling and monitoring well installation. Metals and SVOCs were detected in four surface soil samples and VOCs in one subsurface soil sample, at concentrations above maximum background. Subsequently, groundwater sampling was performed, which revealed metals above the MCL. Installationwide metals background concentrations were established in January 2005, and the report was approved by TCEQ on 7 April 2005.

Exploratory trenching was completed in June 2000 for remedial design purposes. In August 2000, measures were taken to control erosion. Groundwater samples collected in October 2004 indicated the presence of lead concentrations exceeding the PCL in two monitoring wells along Salado Creek, along with minor erosion issues. The results have been included in the combined APAR and reviewed by TCEQ. A response to comments was submitted in February 2006 (USAEC, 2006b).

***Landfill 7 (FTSH-29)*:** Landfill 7 is located within the southeastern portion of FSH. This landfill is located west of Salado Creek and east of Garden Avenue. An unnamed tributary of Salado Creek separates Landfill 7 from Landfill 6. The landfill is estimated to be 22 acres in size. This trench and fill landfill is reported to have received domestic, construction, organic material and chemical debris from the mid-1950s until 1979. This site currently is being used to store plant mulch.

A landfill assessment was performed in 1994 and 1995 and included a geophysical and soil gas surveys, surface and subsurface soil sampling and monitoring well installation. Metals and SVOCs were detected in surface soil samples at concentrations above maximum background. Subsequently, groundwater sampling was performed, which revealed metals above the MCL. Installationwide metals background concentrations were established in January 2005, and the report was approved by TCEQ on 7 April 2005. Exploratory trenching was completed in June 2000 for remedial design purposes. In August 2000, surface debris was removed and measures were taken to control erosion. In 2004, erosion of the western end of the landfill and the presence of exposed debris were noted during sampling. Samples collected in October 2004 revealed the presence of lead in groundwater at concentrations exceeding the PCL. The results have been included in the combined APAR and reviewed by TCEQ. A response to comments was submitted in February 2006.

***Landfill 8A (FTSH-29)*:** Landfill 8A is located within the eastern portion of FSH. This landfill currently is located beneath the north end of the new BAMC parking lot. It is estimated to be 6.5 acres in size. This cover and compact landfill is reported to have received construction debris into the 1970s.

A landfill assessment was performed in 1994 and 1995 and included surface and subsurface soil sampling and monitoring well installation. Metals were detected in surface soil samples at concentrations above maximum background. Subsequently, groundwater sampling was performed, which revealed metals above the MCL.

In June 2000, 12 soil borings were installed to provide sufficient data to define the approximate limits of the landfill and to determine the characteristics of the waste. On 25 January 2001, FSH received a TNRCC response letter recommending further investigation and reporting. Only one of 12 borings drilled found measurable quantities of groundwater.

TCEQ verbally agreed that no further action was acceptable in a February 2004 meeting. In August 2004, FSH submitted a Technical Memorandum documenting evidence that waste disposal activities did not occur on a large scale at Landfill 8A. The memorandum requested declassification of the site as a landfill. On 1 October 2004, FSH received TCEQ concurrence with the declassification of Landfill 8A. Three groundwater monitoring wells were plugged and abandoned in September 2005. Any further investigation will be conducted under the Military Munitions Response Program (MMRP). This site has been identified as an MMRP site and is referred to as the "FTSH-008-R-01 Old Pershing Range." All further cleanup actions will be managed under the MMRP.

***Landfill 8B (FTSH-29)*:** Landfill 8B is located within the eastern portion of FSH. This landfill also is known as the Explosive Ordnance Detonation and Disposal (EOD) area at the Pershing Firing Range (FTSH-13) and is located due east of the former firing range. This landfill is approximately 4 acres in size. This cover and compact landfill is reported to have received construction debris and potentially exploded and unexploded ordnance during the 1970s.

A landfill assessment was performed in 1994 and 1995 and included subsurface soil sampling and monitoring well installation. Metals were detected at concentrations above maximum background. Subsequently, groundwater sampling was performed, which revealed metals above the MCL. In 1996, a preliminary assessment screening was performed at this site and identified that SVOCs and metals concentrations in the soil were above the PCL. In 1999, an unexploded ordnance (UXO) and geophysical survey was performed, which identified potentially explosive debris.

Site characterization fieldwork by way of exploratory trenching was completed in June 2000, and an APAR was submitted in December 2000, recommending a future removal action. Further evaluation, however, is expected to show that the site does not pose a significant environmental risk. This, coupled with the potential UXO hazard, has led to a reassessment of the need for any removal.

An installationwide metals background study was performed in late 2004. Two additional monitoring wells were installed to improve delineation and gradient definition. Samples collected from all wells in October 2004 showed no contaminants of concern (COCs) exceeding the critical PCLs. A combined APAR was prepared and submitted to TCEQ in July 2005. TCEQ provided comments on the APAR in October 2005. A response to comments was submitted in February 2006.

***Landfill 10 (FTSH-29)*:** Landfill 10 is located within the northeastern portion of FSH. This landfill is located east-southeast of the national cemetery. This landfill is approximately 10 acres in size. This covered, surface dump landfill contained construction and cemetery debris. It is unknown when this surface dump was in use.

A landfill assessment was performed in 1994 and 1995 and included subsurface soil sampling and monitoring well installation. Metals were detected at concentrations above maximum background. Subsequently, groundwater sampling was performed, which revealed metals above the MCL.

A removal action was performed between November 1999 and February 2000. The final report was submitted to TNRCC in October 2000. TCEQ review comments on the field summary report were sent to FSH on 11 January 2001, requiring additional investigation and reporting. Confirmation sampling was performed in May 2001. An APAR recommending no further action was prepared and submitted to TNRCC on 5 November 2001. TCEQ disagreed with the classification of groundwater as a Class 3 resource (not usable for potable water supply). Further testing indicates that the groundwater was a Class 2 resource.

The APAR was revised to reflect the change in classification and the associated PCLs and resubmitted to TCEQ on 18 February 2005. This report was approved by TCEQ on 21 April 2005 with the condition that Landfill 10 be deed recorded. The deed recording for the landfills, to include LUCs, was performed on 15 July 2005 to complete the closure process. Four groundwater monitoring wells were plugged and abandoned in September 2005.

***Landfill 12 (FTSH-29)*:** Landfill 12 is located within the northeastern portion of FSH. This landfill is approximately 1 acre in size. This landfill was reported to be an area fill with no control. It received construction debris and domestic refuse during the 1950s.

A landfill assessment was performed in 1994 and 1995 and included soil gas and geophysical surveys, surface soil sampling and monitoring well installation and sampling. Minimal concentrations of metals were detected above maximum background. Subsequently, groundwater sampling was performed, which revealed metals above the MCL.

A removal action was performed between February and March 2000. The final report was submitted to TNRCC in October 2000.

TNRCC review comments on the field summary report were sent to FSH on 10 January 2001, requiring additional information to be submitted. An APAR recommending no further action was prepared and submitted to TNRCC on 5 November 2001. TCEQ disagreed with the classification of the aquifer as a Class 3 groundwater source and therefore did not approve the APAR.

The APAR was revised to reflect the change in classification and the associated PCLs and resubmitted to TCEQ on 18 February 2005. This report was approved by TCEQ on 21 April 2005, with the condition that Landfill 12 be deed recorded. The deed recording for the landfills, to include LUCs, was performed on 15 July 2005, in order to complete the closure process. Five groundwater monitoring wells were plugged and abandoned in September 2005.

Camp Bullis

One IRP site is located on Camp Bullis (Landfill 8 [Site 8]). The location of Landfill 8 is shown in Figure 4-39. The following paragraphs summarize the environmental investigations conducted at each IRP site as taken from the *Camp Bullis, Texas, Army Defense Environmental Restoration Program Installation Action Plan, 7 February 2006* (USAEC, 2006b).

Landfill 8 (Site 8)**:** The Site 8 landfill is located in the central area of Camp Bullis between Lewis Creek and Cunningham Hill. The landfill comprises approximately 6 acres and is divided by Lewis Valley Road. A karst hydrogeologic environment (*i.e.,* dominated by carbonate rocks where significant dissolution of the rock has occurred due to flowing surface water and groundwater) underlies Site 8, which significantly complicates the groundwater investigation. A portion of the groundwater beneath Site 8 discharges to Lewis Creek, which is a tributary to Salado Creek. During periods of high flow, Salado Creek flows south of Camp Bullis and recharges the Edwards Aquifer.

Aerial photographs indicate that disposal activities occurred at Site 8 between 1945 and 1950, and ended between 1952 and 1955. During the landfill assessment in 1995, chemical agent identification sets (CAIS) were discovered. The Army performed a sweep to remove CAIS debris from the landfill surface, but has not performed any intrusive investigations within the landfill due to the health and safety logistics associated with potential chemical warfare agent (CWA) sites. Since the landfill assessment in 1995, non-intrusive investigations have been performed on the landfill (including surface geophysics and passive soil-gas surveys) and investigations have been performed outside the landfill (including groundwater, surface water and sediment sampling and groundwater tracer testing). The investigations outside the landfill confirmed that CWA is not present in the groundwater; however, trichloroethylene (TCE) and other chlorinated VOCs were detected in groundwater and surface water samples above drinking water regulatory levels (MCLs/PCLs). The source of VOC contamination in the groundwater and surface water downgradient of Site 8 has not been confirmed, but it may be the result of neutralizing CAIS with decontamination agent, non-corrosive, (DANC) which contained solvents. TCEQ has issued a compliance plan stipulating continued investigation, monitoring and response action.

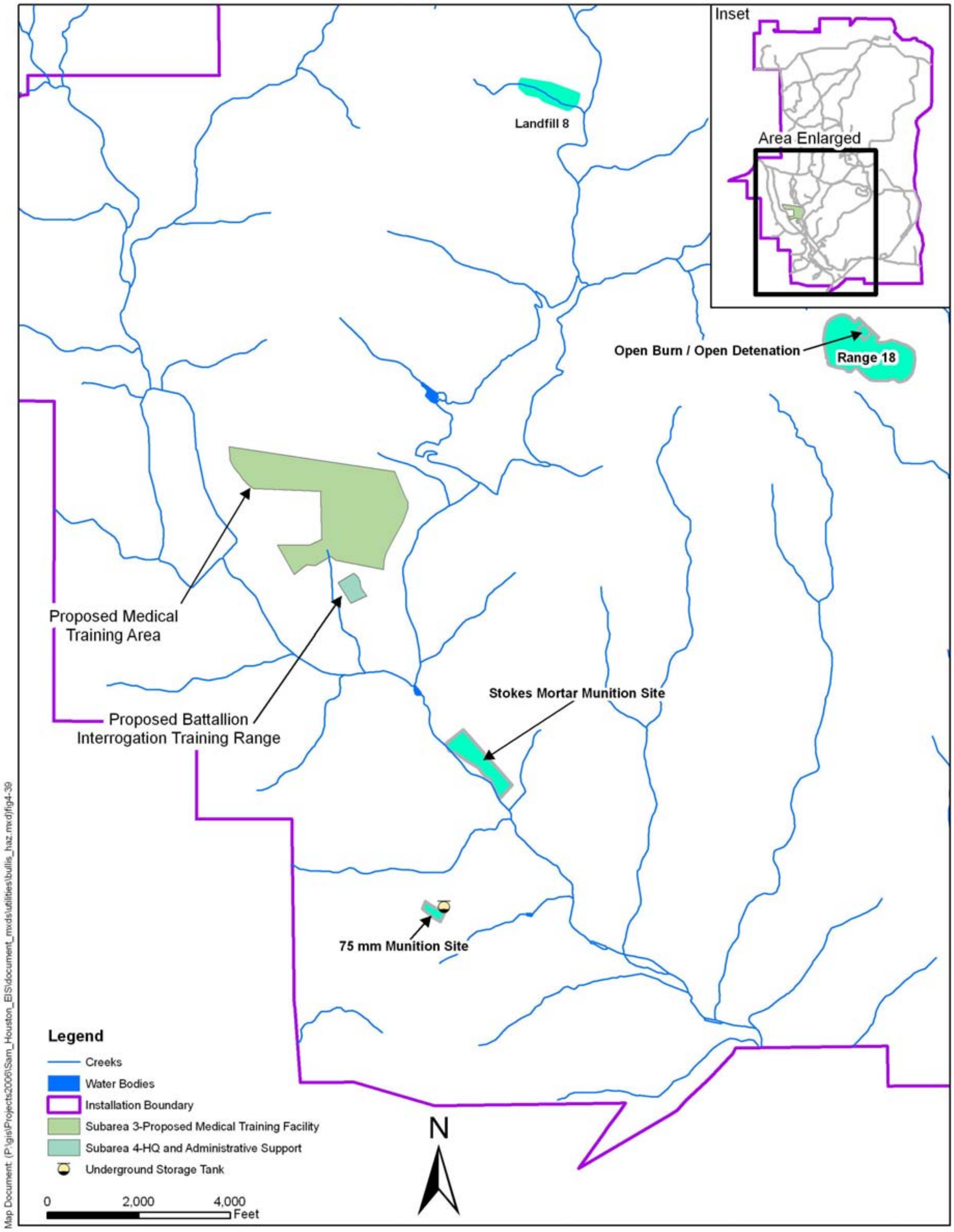

Figure 4-39 Camp Bullis IRP, Landfills and Closed Ranges
Source: FSH GIS Department, 2006

Between 1997 and 2001, 21 groundwater monitoring wells were installed. Groundwater sampling in the monitoring wells and select Camp Bullis water supply wells, and surface water monitoring in nearby Lewis and Salado Creeks, were performed approximately quarterly until 2003, when a stage-based sampling program was implemented. During the stage-based program, water samples were collected during low, moderate and high (flood) flow stages to better assess contaminant transport in the karst system. The calendar-based and more recent stage-based sampling programs indicated that VOCs are not migrating off-installation at concentrations above MCLs/PCLs. Groundwater samples collected in 2001 and 2004 from off-site water supply wells located within 0.25 mile of the Camp Bullis boundary did not contain VOCs, further suggesting that Site 8 COCs are not migrating off-installation at detectable concentrations.

In 2004, the Final Site 8 Work Plan was submitted to comply with recent Texas Risk Reduction Program (TRRP) rules adopted by TCEQ. The Site 8 Work Plan included an updated conceptual site model (CSM) and identified the investigation activities required to fill data gaps in the CSM, including additional groundwater tracing, borehole geophysics/hydrophysics, repeating the soil-gas survey, converting karst features to monitoring wells and collecting data to support an Ecological Risk Assessment (ERA). These investigation activities are currently underway, and once complete, an APAR and a RAP will be prepared for Site 8.

Military Munitions Response Program

The MMRP was established in 2001 to manage the environmental, health and safety issues presented by UXO, discarded military munitions (DMM) and munitions constituents (MC). The MMRP is an element of the Defense Environmental Restoration Program (DERP), under which the Secretary of Defense carries out environmental restoration resulting from historical activities.

Fort Sam Houston

Twenty-six sites have been identified for inclusion under the MMRP at FSH and are shown in Figure 4-38. MMRP preliminary assessments have been completed; however, further assessments are planned for all MMRP sites. All MMRP site data for FSH were taken from the *Fort Sam Houston, Texas, Army Defense Environmental Restoration Program Installation Action Plan, 7 February 2006* (USAEC, 2006b).

Chemical Defense Training Area (FTSH-001-R-01): This is a multi-use range/site with potential for groundwater contamination. In the late 1930s, three chemical munitions magazines were located on what is now the northern parking lot at the AMEDDC&S, just south of Harry Wurzbach Highway. Some chemical defense exercises (gas mask drills) were conducted in this area before World War II. This 2.69-acre area currently contains medical and office buildings.

Dodd Field Small Arms Range (FTSH-002-R-01): This is a small arms range site. In 1888, a small arms target range was constructed in the western portion of a parcel of land just north of FSH that later would become Dodd Field. The target butts were located just south of Rittiman Road and east of Harry Wurzbach Highway in an area that is currently the Watkins Terrace family housing area. The contours of the target butts still are portrayed on maps dated 1926 and 1940. The firing points were to the south, with the 600-yard line east of Road S-43 and north of Dashiell Road. Use of the range likely was discontinued in 1915 with the construction of barracks, hangars and a runway for the development of an aviation post that operated until 1917. This closed range is 87.24 acres in size.

Meade Field (FTSH-003-R-01): This is a multi-use range site with potential for groundwater contamination. During the mobilization for World War I, this 114.82-acre area was a multi-use area used to train troops for combat. This would have involved the use of grenades (smoke and practice), small arms and artillery simulators and demolitions. Riot control agents were used between the 1960s and 1970s to simulate toxic chemical agents. Through 1997, the area was used for operational readiness training for combat medics that involved aeromedical evacuations and the use of small arms, smoke and simulators.

Development of the area for other purposes began in 1941, when horse stables were constructed in the southwest corner of the site. In 1961, the Charles Kelly Heliport was constructed in the northwest corner of Meade Field. In 1991, an RV park was constructed in the northeast corner of the site.

1926 Pistol Range (FTSH-004-R-01): This is a small arms range site. A 1926 training map shows a pistol range located south of Wilson Street along the extension of Chaffee Road between Buildings 4193 and 4194 in the former Kelly AFB Annex. The approximate dates of use for this range are 1926 through 1938. Warehouses and office buildings currently are located on this former 31.84-acre range.

Staff Post Firing Range (FTSH-005-R-01): This is a small arms range site. The earliest known small arms firing range on FSH was located in the Staff Post area near the intersection of Wilson Street and Liscom Road. The target butts would have been located near the west end of Building 230. This range was in use from about 1867 to 1887, when troop strength at the installation varied between 80 and 200

Soldiers. The former site is approximately 615.1 acres in size. Part of the former firing range contains office buildings, while the rest remains undeveloped.

Chemical Warfare Demonstration Area (FTSH-006-R-01): This is a multi-use range site. In 1920, a chemical warfare demonstration was conducted in the area between Salado Creek and Garden Street. Unknown numbers of 4-inch Stokes mortars and 8-inch Livens projectors were fired during the demonstration. The mortars fired thermite and white phosphorus rounds. The Livens projectors fired oil-filled incendiary drums and titanium tetrachloride rounds to simulate mustard gas. The range fan for the 200-yard rifle range overlies this site. Total acreage of the area is 128.79 acres. It is currently a recreation area.

Closed Pershing Field (FTSH-007-R-01): This is a multi-use range site. During the mobilization for World War I, this area was a multi-use area used to train troops for combat. This would have involved the use of grenades (smoke and practice), small arms and artillery simulators or demolitions. A 1926 training map depicts a machine gun range at the western end of Pershing Field. Records indicate that from 19 July 1938 to 23 November 1938, the machine gun range was redeveloped as a "1,000-inch range" and renamed the "Humphrey-Maston Range." During the 1930s, a pistol range was opened just south of the Humphrey-Maston Range in the western end of Pershing Field. The use of the range was discontinued in November 1939. In 1955, the U.S. Modern Pentathlon Training Center moved to FSH. Shortly thereafter, the former pistol range was designated as the "Pentathlon Range." This 100.88-acre training area was used from 1917 until approximately 1962. The current FSH golf course was constructed over part of this former training area, while other parts of the area were used for landfills from 1953 to 1979, with the rest remaining undeveloped. Subsurface sampling conducted in May 2006 showed no explosives contamination in the subsurface soils.

Old Pershing Range (FTSH-008-R-01): This is a small arms range site. The 4.93-acre small arms range was built in 1960 and was used until the replacement range, the New Pershing Range, was built in 1970. The proximity of the National Guard Armory complex, built in 1974, limited the amount and type of training conducted in this area. This former range area is currently the location of BAMC and office buildings.

Fire Training Area (FTSH-009-R-01): This is a multi-use range site with potential for groundwater contamination. This 55.36-acre area is part of the land acquired for the construction of Camp Travis in 1917 to prepare for World War I troop buildup; the western boundary of the training area was along the edge of the cantonment barracks. Camp Travis later became part of FSH in 1922. The area was used primarily for small arms training from 1917 to 1945. A "recruit rifle range" was reported to have existed in 1940 toward the east end of the area. The range fan for the former 200-yard rifle range also overlies this area. A fire station, fire training facilities and softball fields currently are located on a portion of this site.

***Penthalon Range-TD (FTSH-010-R-01)*:** This is a small arms range site. This 7.7-acre site is part of the range fan of the former pentathlon pistol range and lies to the east of the current installation boundaries. The pentathlon pistol range was used from approximately 1930 through 1939, and then again from 1955 until approximately 1962. Currently, this area is used for residential areas and undeveloped floodplain. This property never was owned by the U.S. Army and is not being considered under the Formerly Used Defense Sites (FUDS) inventory. U.S. Army use of this property ended in 1962.

***Salado Creek Training Area (FTSH-011-R-01)*:** This is a multi-use range site with potential for groundwater contamination. In 1917, the area was used for World War I training that included grenades, mortars and practice bombs from aircraft. From 1946 to 1997, the 45.46-acre Salado Creek training area was used for individual training of medical officers and enlisted personnel and unit training, primarily military police and Army Medical Department organizations. This training would have involved small arms, artillery simulators, smoke and practice grenades and riot control agents. A 1926 training map shows a 200-yard rifle range located on the western edge of the Salado Creek training area east of Salado Creek and south of the current bridge over the creek on Binz-Engleman Road. The range also is depicted on site maps dated 1938, 1943 and 1951. This area currently is undeveloped.

***200-yard Rifle Range (FTSH-012-R-01)*:** This is a small arms range/site. A 1926 training map shows a 200-yard rifle range located in the southern portion of the Salado Creek training area east of Salado Creek and the current bridge over the creek on Binz-Engleman Road. The range also is depicted on site maps dated 1938, 1943 and 1951. According to available records, there is no evidence of the range being used in 1951. The 0.89-acre area is currently an undeveloped area within the floodplain of Salado Creek.

***Stonewall Jackson Field-TD (FTSH-013-R-01)*:** This is a multi-use range/site. This 76.13-acre site was formerly part of the Stonewall Jackson Field training area. During the mobilization for World War I, this area was a multi-use area used to train troops for combat. From 1925 to 1931, the area also was used as a practice bombing range for aircraft flying out of Dodd Field. Black powder practice bombs have been found in Stonewall Jackson Field as recently as 1983. A 1926 training map does not depict any training areas within this former area of Stonewall Jackson Field. In 1941, troop barracks were constructed in this area as part of the Dodd Field Recruit Reception Center; barracks still are depicted on a 1956 map. The range fans for the Humphrey-Maston Machine Gun Range and the Stonewall Jackson Field Pistol Range overlay this site. In 1980, 31.68 acres of this site were transferred to the Department of Veterans Affairs for development as a national cemetery. In 1998, the remaining 45.1 acres of land also were transferred to the Department of Veterans Affairs for further development of the national cemetery.

***Landfill 8B (FTSH-015-R-01)*:** This is a multi-use range/site. The landfill (AEDB-R Site FTSH-26), also known as the EOD area, is approximately 4.86 acres and located east of the Pershing Firing Range. According to the March 2002 Installation Action Plan (IAP) and the May 2000 Site Characterization Work Plan, it is reported to have received construction debris and potentially exploded and unexploded ordnance from 1970 to 1985. The area was surface cleared by a UXO team in 1999 and 2000 prior to geophysical surveys being conducted across the site. Only UXO-related items that included hand grenade spoons, one empty M-16 mine casing and expended small arms rounds have been located and removed; no UXO has been detected. The remedial investigation for Landfill 8B recently was completed under the IRP. The landfill currently is surrounded by an 8-foot chain-link fence topped with barbed wire.

***Pistol Range-TD (FTSH-016-R-01)*:** This is a small arms range/site. The Pistol Range-TD is the 36.34-acre section of the original range fan of the pistol range that extends past the installation boundary. A 1926 training map and a map dated May 1940 based on 1938 aerial photographs depict a pistol range located in the southeast corner of the Stonewall Jackson Field training area. The pistol range does not appear on a map dated July 1943 or any other available historical maps. Currently, the property contains the City of San Antonio Park and residential areas. This property never was owned by the U.S. Army and is not being considered under the FUDS inventory. U.S. Army use of this property ended in 1943.

***Stonewall Jackson Field (FTSH-017-R-01)*:** This is a multi-use range/site. During the mobilization for World War I, this 283.78-acre area was a multi-use area used to train troops for combat. From 1925 to 1931, the area also was used as a practice bombing range for aircraft flying out of Dodd Field. Black powder practice bombs have been found at the site as recently as 1983. The training area also was used during World War II for various types of training, including the use of practice landmines. The presence of the Fourth Army antenna farm in this area in 1947 would have limited the use of the training area as a live-fire training range. A 1926 training map and a map dated May 1940 based on 1938 aerial photographs depict a pistol range located in the southeast corner of the Stonewall Jackson Field training area. The pistol range does not appear on a map dated July 1943 or any other available historical maps. No additional information on this pistol range was located during the records review. The range fans for the Humphrey-Maston Machine Gun Range and the pentathlon pistol range also overlay the Stonewall

Jackson Field training area. Parts of this site currently are used for utility/ground improvements and landfills, with the rest remaining undeveloped.

***Trench Warfare Complex (FTSH-018-R-01)*:** This is a multi-use range/site with potential for groundwater contamination. Beginning in 1917, this 65.77-acre area was used for combat training during the troop buildup for World War I. This training included practice grenades, small arms, rifle grenades, smoke and demolitions. After 1970, training was limited to field training exercises with small arms, simulators and smoke and riot control agents. Training was curtailed further in the area after 1974 with the construction of the National Guard Armory Complex in the northeast portion of the site. BAMC and office buildings currently are located on this former training site.

***1926 Pistol Range (FTSH-019-R-01)*:** This is a small arms range site. The 1926 Pistol Range-TD is the 1.23-acre section of the original range fan of the 1926 pistol range that extends past the installation boundary. A 1926 training map shows a pistol range located south of Wilson Street along the extension of Chaffee Road between Buildings 4193 and 4194 in the former Kelly AFB Annex. The approximate dates of use for this range are 1926 through 1938. The property currently is used for railroad right-of-way. This property never was owned by the U.S. Army and is not being considered under the FUDS inventory. U.S. Army use of this property ended in 1938.

***200-yard Rifle Range-TD (FTSH-020-R-01)*:** This is a small arms range site. The 200-yard Rifle Range-TD is the 253.22-acre section of the original range fan of the 200-yard rifle range that extends past the installation boundary. A 1926 training map shows a 200-yard rifle range located in the southern portion of the Salado Creek training area east of Salado Creek and the current bridge over the creek on Binz-Engleman Road. The range also is depicted on site maps dated 1938, 1943 and 1951. According to available records, there is no evidence of the range being used in 1951. This former range currently is used as a residential area and the San Antonio Country Club. This property never was owned by the U.S. Army and is not being considered under the FUDS inventory. U.S. Army use of this property ended in 1951.

***Dodd Field Small Arms Range-TD (FTSH-021-R-01)*:** This is a small arms range site. The Dodd Field Small Arms Range-TD is the 1,153.47-acre section of the original range fan of the Dodd Field Small Arms Range that extends past the installation boundary. In 1888, a small arms target range was constructed in the western portion of a parcel of land just north of FSH that would later become Dodd Field. Use of the range likely was discontinued in 1915 with the construction of barracks, hangars and a runway for the development of an aviation post that operated until 1917. Light commercial development and residential areas currently are located on this site. This property never was owned by the U.S. Army and is not being considered under the FUDS inventory. U.S. Army use of this property ended in 1915.

***Staff Post Firing Range-TD (FTSH-022-R-01)*:** This is a small arms range site. The Staff Post Firing Range-TD is the 317.17-acre section of the original range fan of the Staff Post Firing Range that extends past the installation boundary. The earliest known small arms firing range on FSH was located in the Staff Post area near the intersection of Wilson Street and Liscom Road. This range was in use from about 1867 to 1887. This area currently is used for commercial warehouses, railroad and utility right-of-way. This property never was owned by the U.S. Army and is not being considered under the FUDS inventory. U.S. Army use of this property ended in 1887.

***Staff Post Firing Range-TD2 (FTSH-023-R-01)*:** This is a small arms range site. The Staff Post Firing Range-TD2 is the 118.9-acre section of the original range fan of the Staff Post Firing Range that extends past the installation boundary. The earliest known small arms firing range on FSH was located in the Staff Post area near the intersection of Wilson Street and Liscom Road. This range was in use from about 1867 to 1887. This area currently is used for residential and commercial activities. This property never was owned by the U.S. Army and is not being considered under the FUDS inventory. U.S. Army use of this property ended in 1887.

***Staff Post Firing Range-TD3 (FTSH-024-R-01)*:** This is a small arms range site. The Staff Post Firing Range-TD3 is the 0.79-acre section of the original range fan of the Staff Post Firing Range that extends past the installation boundary. The earliest known small arms firing range on FSH was located in the Staff Post area near the intersection of Wilson Street and Liscom Road. This range was in use from about 1867 to 1887. A residential area currently is located on this property. This property never was owned by the U.S. Army and is not being considered under the FUDS inventory. U.S. Army use of this property ended in 1887.

***200-yard Firing Range 2 (FTSH-025-R-01)*:** This is a small arms range site. A 1926 training map shows a 200-yard rifle range located in the southern portion of the Salado Creek training area east of Salado Creek and the current bridge over the creek on Binz-Engleman Road. The range also is depicted on site maps dated 1938, 1943 and 1951. According to available records, there is no evidence of the range being used in 1951. This 417.3-acre area currently contains the PX, Commissary, office buildings and houses.

***Staff Post Firing Range 2 (FTSH-026-R-01)*:** This is a small arms range site. The Staff Post Firing Range 2 is a 20.44-acre section of the original range fan of the Staff Post Firing Range. The earliest known small arms firing range on FSH was located in the Staff Post area near the intersection of Wilson Street and Liscom Road. The target butts would have been located near the west end of Building 230. This range was in use from about 1867 to 1887.

***Pistol Range (FTSH-027-R-01)*:** This is a small arms range site. The pistol range is the 34.89-acre section of the original range fan of the pistol range that extends past the Stonewall Jackson Field training area. A 1926 training map and a map dated May 1940 based on 1938 aerial photographs depict a pistol range located in the southeast corner of the Stonewall Jackson Field training area. The pistol range does not appear on a map dated July 1943 or any other available historical maps. Currently, the property contains the FSH Middle School and High School, a football stadium and a few residential areas.

Camp Bullis

Four MMRP sites have been identified at Camp Bullis. No further action has been approved for two sites based on the results of site inspections. MMRP preliminary assessments have been completed; however, further assessments are planned for all MMRP sites beginning in FY 2008. Figure 4-39 shows the locations of the two remaining MMRP sites. All MMRP site data for Camp Bullis were taken from the *Camp Bullis, Army Defense Environmental Restoration Program Installation Action Plan, 7 February 2006* (USAEC, 2006b).

***Stokes Mortars Munition Site (CBULL-0010R-01)*:** This 101.49-acre area located near Training Area 8 contained several 3-inch Stokes mortars, 2.36-inch high-explosive anti-tank rockets and 37-mm rounds. These rounds were found during routine work in the area, such as grading, land clearing, mowing and trenching. The area is currently the location of Building 6215, Outdoor Recreation HQ, an RV parking area and a baseball field.

***75-mm Munitions Site (CBULL-004-R-01)*:** Several live 75-mm rounds were removed from a pit formerly located near Building 6104 in the motor pool within the main cantonment area. A backhoe operator who was digging a drainage channel unearthed the ordnance. At least five complete rounds (*i.e.,* unfired projectile and propellant-filled case) were retrieved from the ditch line. This area is estimated to be less than 1 acre in size and is currently an unimproved parking area.

Compliance-related Cleanup

Compliance-related cleanup (CC) includes actions to address the cleanup of contaminated sites not funded under the DERP (IRP or MMRP) and the cleanup of contaminated sites at Army facilities overseas, and is managed by IMA.

Fort Sam Houston

***Former Dry Cleaning Facility (CC FSH330)*:** Building 330 is a former dry cleaning facility located in the southcentral portion of FSH near the intersection of Scott Road and Wilson Street. The building was used as a dry cleaning facility formerly known as the Camp Travis Laundry Facility. It was constructed in 1922 and is considered a historic building. The building partially has been demolished, with only a small portion of the building remaining, including the saw-tooth roof and frame. The site is approximately 16,000 sf.

There is TCE and perchloroethylene (PCE) contamination at the site. In 2003, Halff Associates performed a geotechnical investigation that included 12 soil samples from 5 soil borings for VOC and TPH analysis. PCE and TCE were found in two of the soil borings as deep as 8 feet bgs, exceeding the corresponding State Regulatory TRRP Tier 1, 30-acre Soil PCLs for these chemicals. In June 2004, 10 additional soil borings and 3 temporary monitoring wells were installed. Fifty-five soil samples and three groundwater samples were collected. Analytical results indicated that PCE, TCE, trichloropropane and dichloropropane are present in soil above residential TRRP PCLs. PCE also was reported in groundwater above the residential TRRP PCL. In August 2005, an APAR was submitted to TCEQ. Comments were received from the State in December 2005 and are being addressed by the installation. In December 2005, an additional 11 soil boring and groundwater samples were collected to delineate the groundwater plume further. The plume is estimated to be 2 acres in size. In February 2006, abandoned sewer lines were removed to reduce/eliminate preferential exposure pathways.

Camp Bullis

***Open Burn/Open Detonation (OB/OD) Site (CC-CB-OBOD)*:** A hazardous waste permit (RCRA Part B Permit HW-50335) was issued to Camp Bullis in 1997, pertaining to the management of hazardous waste at the OB/OD unit (munitions site). This is the only regulated hazardous waste management unit at Camp Bullis. Groundwater monitoring results have indicated the presence of VOCs (acetone, benzene and carbon disulfide), explosives (octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine [HMX]; hexahydro-trinitro-triazine [RDX]; and nitrobenzene) and barium. In accordance with permit requirements, groundwater contaminated by the munitions site was sampled, and the results confirmed the presence of VOCs, SVOCs, metals, explosives, dioxins/furans, perchlorate and sulfide (U.S. Army, 2006).

The OB/OD site is less than 0.5 acre within a 4-acre tract known as the Heavy Demolition Range shown in Figure 4-39. It is located in the south-central portion of Camp Bullis, within a hilly area known as Otis Range. The OB/OD site is currently active and is a RCRA subpart permitted facility used to burn or detonate UXO. The area currently has three burn pans with lids for burning and detonating UXO. There is also a separate "detonation area" within which UXO is detonated (Camp Bullis Hazardous Waste Permit No. HW-50335 and Compliance Plan CP-50335).

Groundwater sampling at the site, required by the permit, showed a statistically significant increase (SSI) for various contaminants. The SSI determination required Camp Bullis to submit a compliance plan application and develop a Compliance Monitoring Program. Semiannual reports are prepared by Camp Bullis for this site, detailing compliance with all required permit conditions. The compliance plan was issued to Camp Bullis in October 2003. A RCRA Class 3 modification was issued in August 2005 to incorporate the OB/OD area into the compliance plan. The OB/OD area is identified in the hazardous waste permit and the compliance plan as Solid Waste Management Unit (SWMU) No. 1.

Non-compliance with the permit resulted in an enforcement action issued to Camp Bullis in 1999. One of the permit requirements is closure of the OB/OD SWMU in accordance with the permit and State regulatory requirements.

Other Areas with Known Environmental Conditions

Fort Sam Houston

***Pershing Firing Range*:** The Pershing Firing Range is south of the eastern portion of Pershing Field between the Missouri, Kansas and Texas railroad line and Petroleum Drive. Records indicate that the range was used between 1985 and 1996. The range was divided into a small arms firing range and an EOD area. The EOD portion now is identified as Landfill 8B (FTSH-26). In the 1998 Preliminary Assessment/Site Investigation (PA/SI) Report, lead was identified in surficial soil at concentrations greater than the media-specific background concentrations for metals. In 1999, the affected soil was excavated, and confirmation sampling indicated that the soil containing elevated lead concentrations was removed and disposed. FSH requested closure of this site to residential standards under the TRRP. This closure request has been accepted by TCEQ and will be removed from further studies (USACE, 2004).

***Former Medical Waste Incinerators (Facility 3824)*:** The former medical waste incinerator site is in the southeast-central portion of the installation within the borders of Landfill 6. The site consisted of a concrete structure with two incinerators and an office structure. The incinerators operated between 1976 and 1991 to dispose of medical waste generated at the various medical facilities on the installation (USACE, 2004). The incinerators were demolished in 1999. A radiological constituent, inorganics and SVOCs were identified in surface soil at concentrations greater than the media-specific background concentrations for metals and TCEQ's default closure criteria for SVOCs during the 1998 PA/SI. No other investigation or remedial efforts have been initiated at the site (USACE, 2004).

***Fire Training Facility (Facility 3826)*:** This active fire training facility is located in the southeast-central portion of the installation. The facility is located within the area that previously contained the former medical waste incinerator inside Landfill 6. According to the IAP, the facility consists of a four-story concrete facility and slab that is surrounded by a chain-link fence. During the 1998 PA/SI, several metals constituents were detected in surficial soil at concentrations greater than the media-specific background concentrations for metals. No other investigation or remedial efforts have been initiated at the site (USACE, 2004).

***Former Radioactive Waste Storage Facility (Facility 238) (FTSH-17)*:** According to installation documents, Facility 238 (FTSH-17) was used as a radioactive waste storage facility between 1975 and 1996. A radiation and contamination survey was conducted on the interior of the facility in April 1998, and no contaminants were detected above method detection levels. Following the survey, it was concluded that the facility did not present a radiological hazard to the public or to demolition/deconstruction workers, and the facility was recommended for decommissioning. To date, Facility 238 has not been decommissioned by NRC (USACE, 2004).

***Indoor Ranges – Facilities 605A and 606A (FTSH-12)*:** The indoor firing ranges are non-residential facilities within the infantry installation in the southwest portion of the installation. The ranges are currently inactive; however, they formerly were used for firing small arms (USACE, 2004). The 2006 IAP for FSH lists the site as active and as a site requiring action, but not addressable under the IRP or MMRP.

Oil/Water Separators

Fort Sam Houston

Six oil/water separators are located within FSH (USACE, 2004) (Figure 4-36). Two of the oil/water separators are on the east and west sides of the Hazardous Waste Storage Facility (Facility 4055), which is south of Wilson Street and north of Third Street. Three oil/water separators are located within the MedLog Motor Pool near Facility 2380 off Scott Road, and one is next to the Golf Cart Maintenance

Facility (Facility 3100). The oil/water separators are reported to be connected to the City of San Antonio sanitary sewer system (USACE, 2004).

Camp Bullis

Two oil/water separators were identified in the SWPPP for Camp Bullis (Figure 4-37). These oil/water separators are located at the motor pools near Facilities 6004 and 6104. They collect effluent from vehicle washing operations and from the concrete parking areas and discharge to the sanitary sewer system. No other separators were identified during visual inspections of Camp Bullis (PES, 1999).

Asbestos

Asbestos is the name for a group of natural minerals that separate into strong, fine, heat-resistant fibers. The material has long been used in a variety of forms for thermal protection, acoustical and decorative purposes, boiler and pipe insulation and in construction materials and appliances. When asbestos degrades into microscopic fibers, it becomes a health hazard. This can happen when ACM is disturbed, typically during renovation or demolition/deconstruction of older structures. Degraded or crumbled asbestos is termed "friable" asbestos. Once emitted to the atmosphere, asbestos fibers can remain suspended in the air for long periods and, when inhaled, easily can lodge in body tissues. Asbestos fibers cause asbestosis, a chronic disease of the lungs that makes breathing progressively more difficult, and mesothelioma, a cancer of the chest and abdominal membranes. Other cancers, primarily of the digestive tract and lungs, also have been associated with exposure to asbestos.

Facilities most likely to contain friable asbestos are those built or remodeled between 1945 and 1978, when asbestos and its impacts to the environment and human health were beginning to be understood. Further renovation or demolition/deconstruction of such facilities with asbestos has potential to release asbestos fibers into the air. Asbestos fibers could be released by disturbance or damage to building materials such as pipe and boiler insulation; acoustical ceiling; sprayed-on fire proofing; and other materials used for soundproofing, insulation, siding, roofing and flooring.

ACM remediation is regulated by USEPA and OSHA. Asbestos fiber emissions into the ambient air are regulated in accordance with Section 112 of the CAA. NESHAP regulations address the demolition/deconstruction or renovation of facilities with ACM. The Toxic Substances Control Act (TSCA), the Asbestos Hazard Emergency Response Act (AHERA) and the Asbestos School Hazard Abatement Reauthorization Act (ASHARA) provide the regulatory basis for handling ACM in kindergarten through 12th grade school facilities. ASHARA extended AHERA regulations to cover commercial and public buildings as well. AHERA and OSHA regulations cover worker protection for employees who work around or remediate ACM.

The Department of State Health Services (DSHS) regulates asbestos through 25 TAC §§295.31 to 295.71, *Texas Asbestos Health Protection Rules*. The State rules adopt existing OSHA and USEPA regulations and apply them to all public facilities in which activities involving the disturbance or removal of ACM may occur. The regulations also address remediation worker certification, training, notification and recordkeeping.

According to the 2003 Environmental Performance Assessment System (EPAS) report, approximately 65 percent of 1,500 facilities combined at FSH and Camp Bullis are identified to contain ACM (USACE, 2004). [20]

Fort Sam Houston

Army asbestos policy is established in Section 8.0 of AR 200-1, *Environmental Protection and Enhancement*. ACM is managed at FSH by the DPW. DPW maintains a current inventory of all facilities surveyed for ACM. Facility 2264 is known to contain ACM in interior pipe and water tank insulation, mastic and vibration dampers.

Camp Bullis

ACM is managed at Camp Bullis by the FSH DES in accordance with AR 200-1. DES maintains a current inventory of all facilities surveyed for ACM. All facilities constructed or renovated prior to 1978 have potential to contain ACM.

Lead-based Paint

Under the LBP Poisoning Prevention Act (42 USC 4822) (LBPPPA), as amended, public housing authorities were required, by 1994, to inspect their projects for LBP. Under the statute, LBP hazards equal to or greater than 1 microgram per cubic centimeter ($\mu g/cm^2$) must be abated. Although this does not pertain to military installations directly, USEPA, through the Residential LBP Hazard Reduction Act of 1992, has developed testing and abatement requirements for residential facilities, including military family housing (FSH, 1999).

[20] 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. Non-friable ACM is material that contains more than 1 percent asbestos and does not meet the criteria for friable ACM.

Current Army policy calls for controlling LBP using in-place management (as opposed to mandated removal procedures). In-place management is used to prevent deterioration over time of surfaces likely to contain LBP, followed by replacement as necessary. Maintenance staff are given instructions for routine cleaning procedures leading to capture of LBP fragments from suspected locations. Future renovation, construction and demolition/deconstruction projects at existing facilities will need to include LBP abatement.

RCRA environmental regulations require that demolition/deconstruction debris be characterized to determine proper disposal criteria. State regulations that require more stringent disposal criteria also may exist. The installation is responsible for ensuring that demolition/deconstruction debris, whether from entire structures or individual components from renovation projects, is disposed properly.

Suspected lead contamination and characterization activities should be carried out using the installation's Lead Hazard Management Plan. This plan also specifies sampling, abatement, storage, transportation, manifest and disposal procedures.

Fort Sam Houston

LBP data are available for Buildings 2264 and 2266 in the HQ and administrative support subareas. An *Environmental Survey for Building 2264* from February 2001 referenced LBP in bathrooms, doorframes, exterior concrete walls and load-bearing beams. An *Asbestos and Lead-in-paint Survey of Buildings 2264, 2265, and 2266 Mechanical Rooms*, February 1999, identified LBP in all mechanical rooms.

Buildings 890, 910 to 914, 961, 1222, 1278, 1279, 1281, 1290, 1105, 1111, 1462, 2263, 2264, 2266, 2270, 4168 and 4197 would be affected by the preferred alternative and would require an LBP survey.

Camp Bullis

LBP is not expected to be found in the areas affected by the preferred alternative, including the medical training facility location or the BN interrogation training range.

Polychlorinated Biphenyls

PCBs are used in electrical equipment, primarily in capacitors and transformers, because they are electrically non-conductive and stable at high temperatures. PCBs persist in the environment, accumulate in organisms and concentrate in the food chain.

The disposal of PCBs is regulated under TSCA, which banned the manufacture and distribution of PCBs except for those used in closed systems. By federal definition, "PCB equipment" is that which contains 500 ppm of PCBs or more. "PCB-contaminated equipment" is defined as containing PCB concentrations of 50 ppm or greater but less than 500 ppm. "Non-PCB equipment" is equipment with a PCB concentration less than 50 ppm. USEPA, under TSCA guidance, regulates the removal and disposal of all sources of PCBs containing 50 ppm or more. The regulations are more stringent for PCB equipment than for PCB-contaminated equipment.

Army PCB management policy is outlined in Section 4.4 of AR 200-1, *Environmental Protection and Enhancement.* PCBs are managed at FSH by the DES in accordance with AR 200-1 and the *Hazardous Waste Management Plan, Fort Sam Houston, Texas* (USACHPPM, 1999b). The DES maintains a current inventory of all equipment containing PCBs on each installation. Under the *Hazardous Waste Management Plan*, *Fort Sam Houston, Texas*, the DES is required to oversee the management of PCBs, including monitoring of storage procedures and maintenance of the installation PCB inventory. The Exterior Electric section (Operation and Maintenance [O&M] Division) of the DPW is responsible under the plan for updating the installation PCB inventory whenever a transformer or other electrical device is removed from service. Devices are sampled prior to being placed in a storage facility.

Fort Sam Houston

As of January 2000, the last three transformers containing PCBs were removed from FSH (PES, 1999). Buildings 890, 910 to 914, 961, 1222, 1278, 1279, 1281, 1290, 1105, 1111, 1462, 2263, 2264, 2266, 2270, 4168 and 4197 would be affected by the preferred alternative and would require a PCB survey or inspection to ensure that no PCB-containing materials would be affected.

Camp Bullis

No electrical transmission equipment is known to contain PCBs at Camp Bullis (PES, 1999). No existing facilities will be used in the preferred alternative at Camp Bullis.

Pesticide Usage

The Federal Insecticide, Fungicide, and Rodenticide Act (7 USC §136 *et seq.*) (FIFRA) of 1972 (amended in 1996 by the Food Quality Protection Act) regulates the registration and use of pesticides to protect applicators, consumers and the environment. Pesticide management activities are subject to federal regulations contained in 40 CFR Parts 162, 165, 166, 170 and 171. Texas regulations are promulgated under Act 171, the Pesticide Control Act of 1976 (as amended). FSH and Camp Bullis follow an

Integrated Pest Management Plan (IPMP) as mandated by public law (PL 104-170, Section 303). The control strategies in the IPMP include structural and procedural modifications to reduce food and habitat used by pests; non-pesticide technologies, including traps and monitoring devices; and application of chemical compounds that present the lowest potential hazard to human health and the environment.

Pest management is administered by the DPW Pest Control Shop (five certified applicators) and the FSH Golf Course (three certified applicators). Additionally, contractors may perform pest management activities through contracted services as needed (Green, 2004).

Pesticides are ordered as required to maintain at least a three-month supply, but not more than a one-year supply. Pesticide inventories (other than those authorized for self-help use and at retail sources) and pesticide application equipment are maintained by personnel at the DPW, the FSH Golf Course and the Veterinary Service Activity. Pesticides are stored and maintained in accordance with applicable DoD and Army regulations. Pesticides that are required for seasonal use are ordered in a timely manner to ensure effective application and minimal storage requirements. Pesticides used by the DPW are stored at Facility 4168 of FSH. Pesticides used by the FSH Golf Course are stored in prefabricated hazardous materials storage facilities adjacent to Facility 3100. These facilities have an emergency shower and eyewash as required by federal, State and local laws and regulations (Green, 2004). The normal application of pesticides is not regulated by TCEQ and is not considered a waste as defined by the SWDA, Texas Health and Safety Code §361.

Fort Sam Houston

No pesticides or herbicides have been stored or disposed on FSH beyond usable quantities. Pesticides were applied at FSH by contractors licensed to apply these products by the State of Texas.

Camp Bullis

No pesticides or herbicides have been stored or disposed on Camp Bullis beyond usable quantities. Pesticides were applied at Camp Bullis by contractors licensed to apply these products by the State of Texas. Pesticide usage at Camp Bullis is limited extremely by the IPMP due to the sensitive environment and bird species present. Typically, pesticide usage is a measure of last resort, with other methods being used first (*e.g.,* boiling water for fire ants).

Medical/Bio-hazardous Waste

Medical-related hazardous wastes are managed along with industrial hazardous wastes under the *Hazardous Waste Management Plan, Fort Sam Houston, Texas* (USACHPPM, 1999a). AMEDD has responsibility for properly managing and disposing of RMW. Healthcare facilities within the Army generally have their own regulations, which reflect State and local requirements. These regulations are reviewed, and the actions described are monitored regularly through various AMEDD inspections. Other medical-related wastes include waste photographic and X-ray materials, waste drugs, regulated biohazards and biological wastes and low-level radioactive waste (LLRW).

Fort Sam Houston

A significant quantity of medical-related hazardous waste is generated at FSH, primarily through BAMC and AMEDDC&S. A large portion of these wastes consists of laboratory packs. Laboratory packs are consolidated containers of appropriately labeled and segregated, expired or off-specification laboratory chemicals that are generated by various clinics and laboratories throughout FSH. Additional wastes can include contaminated linens, surgical equipment and other medical items.

All RMW is stored near the point of generation in containers with appropriate biohazard markings. Approximately twice weekly, the waste is collected by a licensed contractor and transported off-installation for disposal or destruction as appropriate. All RMW is treated as manifested waste and tracked from “cradle to grave” (U.S. Army, 2001a).

Camp Bullis

Small quantities of RMW are generated by the Camp Bullis clinic. Wastes can include contaminated linens, surgical equipment and other medical items. All RMW is stored near the point of generation in containers with appropriate biohazard markings. As required, Camp Bullis arranges for the waste to be collected by a licensed contractor and transported off-site for disposal or destruction as appropriate. The same contractor that collects RMW from BAMC on FSH also is used for waste generated at the Camp Bullis clinic. All RMW is treated as manifested waste and tracked from “cradle to grave” (U.S. Army, 2001a).

Ordnance

Inventories of closed, transferring and transferred (CTT) ranges and UXO, discarded military munitions and/or munitions constituents (UXO-DMM-MC) were conducted in January 2003 for FSH and Camp Bullis (USACE, 2003a). The CTT inventory includes all non-active/inactive areas within the installation boundaries, and areas that may have been used in the past for ordnance-related testing or training. The main driver for the CTT inventory is the DERP as amended by the Defense Authorization Act of 2002 (PL 107-107). The CTT inventory process involved mapping of CTT ranges, data collection for the Army Range Inventory Database (ARID), conducting a risk assessment for explosive hazards as specified by the Risk Assessment Code (RAC) and determination of sites that qualify for the MMRP. The RAC portion of the inventory ranks each range with UXO-DMM-MC on a scale of 1 to 5 that estimates explosives safety and risk. The ranking system for the RAC is as follows:

- RAC 1 – High Risk – Highest priority for further action
- RAC 2 – Serious Risk – Priority for further action
- RAC 3 – Moderate Risk – Recommend further action
- RAC 4 – Low Risk – Recommend further action
- RAC 5 – Negligible Risk – No DoD action necessary

Fort Sam Houston

Available evidence suggests that no former ordnance storage or range areas are at FSH. Because the installation has been used since the 1800s, there is a small possibility that UXO may be encountered. Much of the property has been disturbed during construction and maintenance activities over the years. U.S. Army EOD personnel will dispose of UXO, if discovered.

The results of the CTT inventory (USACE, 2003a) show the following estimated acreage for CTT military ranges and UXO-DMM-MC sites at FSH:

- Closed sites: 2,020 total acres, which includes 17 ranges (2,015 acres) and 1 UXO-DMM-MC (5 acres)
- No sites designated as transferring
- Transferred sites: 1,965 acres, which includes nine ranges

Eight of the 17 closed ranges are small arms ranges, while the rest were training areas that used a variety of munitions. The one closed UXO-DMM-MC site was used as a landfill (Landfill 8B) for the disposal of UXO and exploded ordnance. Eight of the nine transferred sites include parts of several small arms ranges that extended beyond installation boundaries. The remaining transferred site was given to the VA for use as a cemetery. Site details and current status are provided in Table 4-60.

Additional information on the MMRP sites has been provided previously in this report.

Table 4-60 CTT Range and Site Details for FSH

Range/Site	Classification	Area (acres)	Munitions Type(s)	Munitions Constituents	RAC Score	DERP Eligibility
1926 Pistol Range	Closed	31.8	Small Arms	Unknown	5	MMRP
1926 Pistol Range-TD	Transferred	1.2	Small Arms	Unknown	5	MMRP
200-yard Rifle Range	Closed	0.9	Small Arms	Unknown	5	MMRP
200-yard Rifle Range 2	Closed	417.3	Small Arms	Unknown	5	MMRP
200-yard Rifle Range-TD	Transferred	253.2	Small Arms	Unknown	5	MMRP
Chemical Defense Training Area	Closed	2.7	Riot Control Agents	Unknown	3	MMRP
Chemical Warfare Demonstration Area	Closed	128.8	Mortars (white phosphorus [WP], incendiary, illumination, smoke) and toxic chemical munitions	Unknown	2	MMRP
Closed Pershing Field	Closed	100.9	Demolition/deconstruction materials; flares, signals, simulators or screening smoke (other than white phosphorus); hand grenades (smoke, WP, incendiary); hand grenades (practice); small arms	Yes	3	MMRP
Dodd Field Small Arms Range	Closed	87.2	Small Arms	Unknown	5	MMRP
Dodd Field Small Arms Range-TD	Transferred	1,153.5	Small Arms	Unknown	5	MMRP
Fire Training Area	Closed	55.4	Riot control agents, small arms	Unknown	4	MMRP
Landfill 8B	Closed	4.9	Landmine, practice (with spotting charges), small arms	Yes	4	MMRP
Meade Field	Closed	114.8	Demolition/deconstruction materials; flares, signals, simulators or screening smoke (other than white phosphorus); hand grenades (smoke, WP, incendiary, practice); riot control agents; small arms	Unknown	2	MMRP
Old Pershing Field	Closed	4.9	Small Arms	Unknown	5	MMRP

Range/Site	Classification	Area (acres)	Munitions Type(s)	Munitions Constituents	RAC Score	DERP Eligibility
Pentathlon Range-TD	Transferred	7.7	Small Arms	Unknown	5	MMRP
Pershing Firing Range	Closed	5.2	Small Arms	Yes	5	IRP
Pistol Range	Closed	34.9	Small Arms	Unknown	5	MMRP
Pistol Range-TD	Transferred	36.3	Small Arms	Unknown	5	MMRP
Salado Creek Training Area	Closed	45.5	Flares, signals, simulators or screening smoke (other than white phosphorus); hand grenades; pyrotechnics; riot control agents; small arms	Unknown	1	MMRP
Staff Post Firing Range	Closed	615.1	Small Arms	Unknown	5	MMRP
Staff Post Firing Range 2	Closed	20.4	Small Arms	Unknown	5	MMRP
Staff Post Firing Range-TD	Transferred	317.2	Small Arms	Unknown	5	MMRP
Staff Post Firing Range-TD2	Transferred	118.9	Small Arms	Unknown	5	MMRP
Staff Post Firing Range-TD3	Transferred	0.8	Small Arms	Unknown	5	MMRP
Stonewall Jackson Field	Closed	283.8	Bombs (practice), landmine (practice), small arms	Unknown	2	MMRP
Trench Warfare Complex	Closed	65.8	Flares, signals, simulators or screening smoke (other than white phosphorus); hand grenades; pyrotechnics; riot control agents; small arms	Unknown	4	MMRP

MMRP Military Munitions Response Program
IRP Installation Restoration Program
Source: USACE, 2003a

The area mapped for the 1926 pistol range overlaps the location for the vehicle maintenance shop (Figure 3-3). The Directed Energy Laboratory location is in the eastern portion of the Closed Pershing Field (Figure 3-1). The Old Pershing Range and Trench Warfare Complex are beneath existing pavement adjacent to BAMC. The Fire Training Area is in the dormitory expansion footprint that would be considered as a minor siting variation for METC. The Chemical Warfare Demonstration Area includes some of the footprints for the METC barracks and GIBs.

Camp Bullis

Available evidence suggests that no former ordnance storage areas are at Camp Bullis. Much of the property has been disturbed during construction, maintenance and training activities over the years.

The results of the CTT inventory (USACE, 2003a) indicate the following estimated acreage for CTT military ranges and UXO-DMM-MC sites at Camp Bullis:

- Closed sites: 117.88 total acres
- No sites designated as transferring
- No sites designated as being transferred

The closed sites at Camp Bullis include two ranges (one machine gun range and one small arms range) totaling 15.4 acres, and two UXO-DMM-MC sites (102.5 acres) discovered during construction and maintenance activities. Site details and current status are provided in Table 4-61. These ranges are not close to the medical training facility or the BN training range.

Table 4-61 CTT Range and Site Details for Camp Bullis

Range/Site	Classification	Area (acres)	Munitions Type(s)	Munitions Constituents	RAC Score	DERP Eligibility
100 Target Range	Closed	8.0	Small Arms	Yes	5	MMRP
75-mm Munitions Site	Closed	1.0	Large-caliber (37 mm and larger) mortars, high-explosive (HE)	Yes	2	MMRP
8 Target Range	Closed	7.4	Small Arms	Yes	5	MMRP
Stokes Mortars Munitions Site	Closed	101.5	Large-caliber (37 mm and larger) mortars, HE mortars (WP, incendiary, illumination, smoke)	Unknown	5	MMRP

MMRP Military Munitions Response Program
Source: USACE, 2003a

The presence of UXO is unlikely, since much of the installation has been disturbed.

Radioactive Materials

LLRW is radioactive material that has a half-life of 35 years or less, or fewer than 10 nanocuries per gram of transuranics. LLRW is produced by nuclear power plants, hospitals, certain industries, research institutions and universities. LLRW includes uranium, thorium, cesium, tritium and other radioactive metals from industrial and medical processes; protective clothing used by workers; and machinery parts, tools and other contaminated equipment.

Disposal of LLRW is regulated federally under provisions of the Low-level Radioactive Waste Policy Act of 1980. This Act requires each state to dispose of LLRW generated within its borders by either constructing a disposal facility or entering into an interstate compact with another state for waste disposal. Texas created the Low-level Radioactive Waste Disposal Authority in 1981 to provide for the permanent disposal of LLRW generated in Texas. The authority's mission is to protect the environment and human health from unacceptable exposure to radioactive materials and to allow the continued beneficial uses of radioactive materials in Texas.

Fort Sam Houston

LLRW at FSH consists of a variety of items, including medical equipment, exit signs, smoke detectors, watches and other equipment with radioactive components. FSH compartmentalizes the storage of LLRW through BAMC Radiation Safety. As military equipment containing low-level radioactive components is removed from service (*e.g.,* during demolition/deconstruction), the equipment is manifested as waste and delivered to BAMC Radiation Safety, where it is stored in a designated containment area. Occasionally, small components such as watches with tritium face enhancements may be disassembled to store only the portion with the radioactive material. Based on quantity in the storage area, BAMC Radiation Safety will contact a licensed contractor used by FSH to pick up and deliver the waste to an off-installation, licensed storage facility. LLRW removed from civilian facilities, such as smoke detectors removed from family housing, is disposed directly in accordance with the Low-level Radioactive Waste Policy Act and Texas regulations.

Camp Bullis

There have been no known use or management of radioactive waste on Camp Bullis.

Radon

Radon is a naturally occurring, colorless and odorless radioactive gas that is produced by radioactive decay of naturally occurring uranium. Uranium decays to radium, producing radon gas as a byproduct. Radon is found in high concentrations in uranium-containing rocks, such as granite, shale, phosphate and pitchblende. Atmospheric radon is diluted to insignificant concentrations. Radon in soil, however, can enter a building through small spaces and openings and accumulate in enclosed areas such as basements. The cancer risk caused by exposure through the inhalation of radon is currently a topic of concern.

Radon is not known to be a problem in the FSH area of San Antonio or in the Camp Bullis area. According to USEPA's categorization of radon zones, Bexar County and Comal County are qualified as

Zone 3, where the predicted average indoor radon screening level is less than 2 pico curies per liter (pCi/L). This level is below USEPA's action level of 4 pCi/L for radon (USEPA, 1993a, 1993b).

4.13.2 Consequences

Realignment (Preferred) Alternative

Selection of the preferred alternative would require all current management plans to be updated with data for new facilities, storage locations, personnel and protection measures. Plans requiring update would include the SPCC Plan, SWPPP and ISCP. Specific impacts of the preferred alternative are addressed below. It is anticipated that an existing FSH hazardous waste storage facility would be expanded (U.S. Army, 2005b).

Uses of Hazardous Materials

Hazardous materials would continue to be used at FSH and Camp Bullis in similar types and quantities as those currently used, with expected increases in formalin and xylene usage at BAMC. Through waste reduction, hazardous materials usage is expected to decrease at BAMC in the long term. A slight, temporary increase in the types and quantities of hazardous materials may occur as part of planned construction and renovation activities. This increased usage, however, would occur over a short period during a specific construction activity. The quantities of these materials are expected to be small to moderate and would be managed in accordance with applicable Army regulations and the Oil and Hazardous Substances Emergency Contingency Plans for FSH and Camp Bullis, which include the proper contacts and procedures to be followed in the event of a hazardous substance spill.

All hazardous materials involved with the preferred alternative will be handled, managed, stored and used in accordance with applicable regulations and established installation protocols. Therefore, no significant impacts associated with hazardous material handling, management, storage or usage are expected under the preferred alternative.

Hazardous Waste Disposal and Reduction

Hazardous waste disposal and reduction are not expected to change from the plans currently in place. The Installation Hazardous Waste Management Plan still will govern disposal of waste through the DRMO. While quantities are expected to increase, no new chemicals are expected. Current xylene and formalin quantities are expected to increase by 25 percent after the BAMC expansion is completed (Bishop, 2006).

Special Hazards

Special hazards are expected to increase as the need for vehicle maintenance increases. Additionally, fluorescent light bulbs and other special wastes would increase as facility space increases. Tires, oil and oil filters, light bulbs and gas cylinders are expected to increase as vehicle maintenance facilities and office spaces are constructed and used. Processes are currently in place to dispose or reuse the wastes through the DRMO. Quantities are not expected to exceed the capacity of the DRMO or disposal facilities.

Storage Tanks

Under the preferred alternative, minor impacts to storage tank management could result from potential demolition/deconstruction activities. Tanks associated with buildings that are proposed for construction will be removed from the site under the management of the DPW, in accordance with applicable Army and State regulations. Construction of new facilities could increase fuel storage capacity requirements at FSH or Camp Bullis, primarily for facilities that require fuel for standby power generators, auxiliary power units or propane tanks. All new tank installations and operations would be managed in accordance with Army and State regulations. Therefore, no significant impacts to storage practices at FSH or Camp Bullis are expected under the preferred alternative.

IRP, MMRP, Compliance-related Cleanup and Other Areas with Known Environmental Concerns

Under the preferred alternative, no IRP sites, MMRP, compliance-related cleanup or other areas with known environmental concerns would be disturbed significantly or otherwise impacted by the proposed activities at either FSH or Camp Bullis. The IRP sites, MMRP, compliance-related cleanup and other areas with known environmental concerns at FSH and Camp Bullis would continue to be managed in accordance with applicable federal and State regulations until closure.

Oil/Water Separators

It is anticipated that an oil/water separator will be required between the vehicle maintenance facility and the sanitary sewer at FSH. This will be the only significant impact to oil/water separators at FSH.

Asbestos

When removal is required (*e.g.,* during demolition/deconstruction or renovation), FSH and Camp Bullis would follow industry and Army standards for the encapsulation, removal and disposal of ACM. No impact to the environment would be expected as long as appropriate ACM abatement and removal procedures are followed.

LBP

When removal is required (*e.g.,* during demolition/deconstruction or renovation), FSH and Camp Bullis would follow industry and Army standards for the encapsulation, removal and disposal of LBP. No impact to the environment would be expected as long as appropriate LBP abatement and removal procedures are followed.

PCBs

PCB-containing ballasts have been identified in Facility 2264 at FSH. Affected ballasts will be removed and disposed properly during renovation activities.

Pesticide Usage

Pesticide usage is not expected to increase because of the preferred alternative. Pesticide usage will continue under the same guidance provided by the IPMP. No significant long-term impacts are evident.

Medical/Bio-hazardous Waste

Under the preferred alternative, medical and bio-hazardous wastes would increase with the increase in bed space at BAMC. The increase in waste generation is not expected to exceed the capabilities of the disposal contractor or the storage facilities at BAMC. Slightly increased medical and bio-hazardous waste can be expected at Camp Bullis with increased training and students, but would not pose a significant impact to the current operations.

Ordnance

No environmental impacts are anticipated from the presence of UXO within BRAC-related construction footprints on FSH or Camp Bullis. If UXO were encountered during site development, U.S. Army EOD support personnel would be available to eliminate a potential explosive hazard prior to the resumption of construction activities.

Presence of UXO at Camp Bullis appears to be unlikely; however, UXO surveys will need to be completed for the BN interrogation training range and the medical training facility.

Radioactive Material

LLRWs are expected to increase slightly as the FSH medical facilities are constructed and placed in use. The LLRW disposal authority will continue to regulate LLRW medical waste disposal and reuse. The DRMO will continue to dispose of LLRW through licensed disposal facilities. No environmental impact is expected from BAMC operations that produce LLRW. No mitigation is necessary.

Radon

Radon levels are not expected to increase, because both FSH and Camp Bullis are not in radon-prone areas of Texas.

Minor Siting Variations

Minor siting variations would have the same expected consequences as the preferred alternative, as minimal changes in resources would be realized from minor siting variations.

No Action Alternative

Under the no action alternative, hazardous waste management actions would continue under the current plans with no changes or impacts, significant or beneficial.

4.14 CUMULATIVE EFFECTS SUMMARY

4.14.1 Preferred Alternative

The environmental analysis revealed that implementation of the preferred alternative will have no long-term significant impacts on the environment of FSH or Camp Bullis, or their surrounding areas. Potential minor impacts to cultural and visual resources from implementation of the preferred alternative generally would occur within the physical boundaries of FSH. No long-term significant impacts to earth (geology, topography, caves, karst features or soils) or wetlands are expected at either installation. Potential land use impacts are expected on FSH. There would be an increase in the use of utilities, including water, and generation of hazardous and non-hazardous wastes at both installations. Cultural resources might be significantly impacted and hazardous wastes might be increased with the removal or renovation of existing facilities on FSH, some of which are potentially eligible for registration as historic facilities and could contain asbestos materials or LBP. Minor air, noise and transportation impacts also would occur during the short-term construction activities under the preferred alternative at both installations, and continue after final construction and occupancy. No significant impacts to biological resources (vegetation, wildlife and threatened and endangered species) are expected due to the implementation of the preferred alternative.

4.14.2 No Action Alternative

The no action alternative would be in violation of BRAC, but it provides the baseline conditions for comparison to the preferred alternative.

4.14.3 Cumulative Effects Overview

Cumulative effects are defined as the "impacts on the environment that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions (40 CFR 1508.7)." To address potential cumulative impacts, there needs to be a determination of spatial and temporal boundaries of the impact area. One function of scoping is to discover potential cumulative actions and effects. From the scoping for the FSH BRAC EIS, the major concerns were impacts on neighborhoods. The scoping process revealed that the major concerns centered around past changes in the use of FSH ACPs, and potential improvements to adjacent properties by infrastructure improvements primarily centered on vehicle and pedestrian movement to and from the installation. There were no concerns regarding the training at Camp Bullis.

Obviously, the magnitude of the actions is important in determining the significance of the collective or cumulative impacts. Another concern of CEQ is the splitting of a federal organization's actions into smaller increments that would have insignificant environmental impacts individually but might have a significant impact collectively. For this EIS, it was therefore important to examine the general (other than DoD) collective regional actions and the DoD actions cumulatively from a historical perspective, as well as to analyze the impacts of the foreseeable future in the resource areas of concern. From the results of the FSH EIS analysis, the resource areas in which cumulative effects could be a concern are air quality, water use, traffic and cultural resources.

4.14.4 Historical, Regional and DoD Installation Changes

The histories of FSH and Camp Bullis were addressed in this EIS, but there are other DoD installations in the San Antonio MSA that need to be addressed as well as potential sources of cumulative effects. These are Lackland AFB and Randolph AFB. Also, the history of the surrounding City of San Antonio and the MSA must be considered in determining the setting or baseline against which potential cumulative effects are measured.

Historical Regional Changes

San Antonio: Native Americans first lived along the San Antonio River. A band of Spanish explorers and missionaries came upon the river in 1691, and because it was the feast day of St. Anthony, they named the river "San Antonio." Beginning in 1718, five Spanish missions were located along the river. In 1778, the settlement had a population of 2,060, including mission Indians. The missions were secularized by 1795, and San Antonio de Valero Mission (later, the Alamo) became a military barracks. During the Texas Revolution, San Antonio was the site of several battles, including the siege of Bexar (December 1835) and the battle of the Alamo (6 March 1836). After the evacuation of Mexican forces, Bexar County was organized by the Republic of Texas in December 1836. San Antonio was seized twice in the Mexican invasions of 1842, and the population was reduced to approximately 800 in 1846. After Texas entered the Union, growth became rapid, as the city became a servicing and distribution center for the western movement of the United States. The census showed 8,235 in 1860. Germans made up a large part of this growth. In 1861, local militia forced the surrender of the federal arsenal at San Antonio and San Antonio served as a Confederate depot.

After the Civil War, San Antonio prospered as a cattle, distribution, mercantile and military center serving the border region and the Southwest. The city was the southern hub and supplier of the cattle trail drives. An important wool market developed with the importation of merino sheep to the adjacent Hill Country. With the coming of the Railway in 1877, San Antonio entered a new era of economic growth. The population reached 20,550 in 1880. The new immigration continued, and five railroads had been built into the city by 1900. Civic government, utilities, street paving and maintenance, water supply, telephones, hospitals and a power plant were established or planned. San Antonio was once again the largest city in the state in 1900, with a population of 53,321. Each period of growth produced characteristic and often distinguished architecture. Peculiarly, San Antonio succeeded in merging its past into the new in each generation. Old Spanish walls remain beside modern glass towers, with rows of Victorian mansions a block away.

After a period of slow growth during the 1930s, San Antonio's population increased by 61 percent during the wartime boom of the 1940s, to reach 408,442 in 1950. In both World Wars, San Antonio was an important military center for the Army and USAF. FSH and Kelly, Randolph, Brooks and Lackland AFBs were the city's leading economic generators for many years. In the 1950s, the city grew by almost 44 percent to reach 587,718 in 1960. Thereafter, it continued to grow at a more sedate pace of 10 to 20 percent per decade. In 1990, San Antonio was the third largest city in Texas, with a population of

935,933. In 2005, San Antonio was the 8th largest city in the country, with a population of 1.4 million (Texas State Historical Association [TSHA], 2005).

Historical DoD Installation Changes

Lackland AFB: Lackland AFB dates from 4 July 1942. With general mobilization following Pearl Harbor, the San Antonio Aviation Cadet Center grew rapidly. Approximately 90,000 candidates for flying training passed through the preflight school. On 5 November 1942, it received the first raw recruits for enlisted basic military training. On 1 January 1959, it became the Lackland Military Training Center. Officer Candidate School produced reserve officers from the enlisted corps until July 1962; the Officer Training School (OTS) activated on 1 July 1959 and commissioned college graduates with no prior service and airmen who had earned undergraduate degrees.

Training surged for the Vietnam War between mid-1965 and mid-1966, when the military training center regularly handled recruit populations of 20,000 and more. With the closure of Chanute AFB, IL, in 1993 and Lowry AFB, CO, in 1994, Lackland gained a number of training programs. Teaching English to military personnel from foreign countries is one of Lackland's other principal missions. The squadron gave way to the USAF Language School, activated on 1 January 1960. DoD took over the mission in July 1966 and gave it to the Defense Language Institute under the executive agency of the U.S. Army. Finally, in October 1976, USAF became the executive agent for the Defense Language Institute English Language Center.

Until the beginning of the 1990s, the base retained the appearance of a World War II temporary training camp. Facilities erected initially (1941) and in two great mobilizations (1942 to 1943 and 1951) continued to dominate the Lackland landscape. When the Korean War began in June 1950, manpower needs greatly exceeded the physical plant's capacity. The result was another mobilization building project, including 129 I-type dormitories to increase the base's trainee/student capacity. The last of the 129 barracks were dismantled after the cryptographic equipment maintenance school moved out in 1961. In 1957, a new 9-story, 500-bed hospital dominated the north rim of the base, displacing most of the 94 temporary buildings that had made up the hospital complex. The hospital added a 500-bed wing in 1961. Between 1966 and 1971, contractors razed or moved 109 World War II barracks from the east (or permanent party) side of Lackland. The main Base Exchange complex took their place in 1971. At the same time, on the west (or training) side of Lackland, contractors built more facilities for recruit housing and training.

New construction in the 1980s was almost exclusively for unaccompanied permanent personnel quarters and technical trainee dormitories. In June 1997, USAF activated the Force Protection Battle Laboratory at Lackland. Later in the year, a new Security Forces Center opened to house Security Forces HQ, which had moved to Lackland from Kirtland AFB, NM. On 1 April 2001, the 37th Training Wing took over airfield operations of the oldest active airfield in USAF (Kelly Field). With the activation of the 37th Operations Support Squadron, USAF transferred the airfield operations mission and real property west of Kelly Field's hangar line to the wing and Lackland AFB (USAF, 2006e).

Randolph AFB: Randolph AFB was dedicated as a flying training base on 20 June 1930 and continues in that mission today. The idea for Randolph began soon after the establishment of the Air Corps Act in 1926. Lahm established the Air Corps Training Center and set up its HQ at Duncan Field, next to Kelly Field, Texas. He soon learned that the facilities at Kelly and Brooks Fields were not sufficient for proper training. The buildings, erected during World War I and with a life expectancy of five years, had no suitable areas for ground training, and the living quarters were inadequate. San Antonio's rapid growth also was beginning to interfere with flying training operations. The Air Corps soon decided that an additional training field was needed, and a site north of San Antonio was chosen for the new field.

Randolph Field was dedicated on 20 June 1930. Early in 1931, the School of Aviation Medicine from Brooks Field and the first cadets from the Air Corps Flying School at Duncan Field, then a part of Kelly AFB, began relocating to Randolph. On October 1, the Air Corps Training Center moved its HQ from Duncan Field to Randolph. The flying school at Brooks Field transferred to Randolph on October 20, while the school at March Field transferred on October 25. The School of Aviation Medicine also transferred from Brooks Field during 1931.

Basic flying training continued until March 1943, when the central instructor's school took over. For the next two years, training instructors for the Air Corps ground training and primary, basic and advanced flying training constituted the main mission. Randolph produced 15,396 instructor graduates from this course before it moved to Waco Field in 1945. When the central instructor's school moved to Waco Field, it was replaced by the Army Air Force pilot school, which specialized in transition training for B-29 bomber pilots, copilots and engineers. Primary pilot training returned to Randolph from Goodfellow Field in December 1945.

The Army Air Force also planned to return basic pilot training to Randolph on 1 February 1946. Even though basic training transferred from Goodfellow Field in February 1946, the Army Air Force suspended all pilot training when it found itself desperately short of maintenance personnel. The suspension later was lifted, and Randolph concentrated on its pilot training mission. USAF reshaped pilot training into two separate four-month phases in March 1948. Primary pilot training moved on in December 1950. Basic pilot training changed over to nine new contract schools in July 1951.

Since its beginning in 1930, Randolph has been a flying training base. Pilots had been trained in the basic and primary phase of flying, had returned for instructor training or had gone through combat crew training. From 1967 to 1971, 1,269 pilots earned their wings at Randolph. Also, Randolph produced pilots in two unique classes. During World War II, Class 42-X gave 235 pilots their wings in an experimental course. Class 62-FZ produced 25 pilots who completed their training in the new T-38A, still undergoing test and evaluation.

After USAF became a separate service on 18 September 1947, Randolph Field officially was renamed Randolph AFB on 13 January 1948. Before the current 12th Flying Training Wing (FTW), the 3510th FTW was the host unit at Randolph. The 3510th FTW began as the 3510th Basic Pilot Training Wing on 28 August 1948. This unit became the 3510th Combat Crew Training Wing on 1 January 1952 and then the 3510th FTW on 11 June 1952. The 12th FTW replaced the 3510th FTW on 1 May 1972. Randolph AFB is also the home of HQ Air Education and Training Command and the Air Force Personnel Center (AFPC) (USAF, 2006d).

4.14.5 Future Regional and DoD Installation Changes

Future Regional Changes

San Antonio: According to the Texas Real Estate Center at Texas A&M University *Real Estate Center Market Overview 2006, San Antonio, Texas,* (TAMU, 2006) the population in the San Antonio MSA is expected to increase from 1.89 million in 2006 to 1.95 million in 2010. Within San Antonio:

- Single-family housing permits averaged approximately 8,000 per year from 1998 to 2001 and grew to 10,000 per year in 2002 and to 14,000 per year in 2005.
- Multi-family housing permits for 5-plus units rose from 2,000 per year in 2003 to 5,000 per year in 2005.
- Retail space absorption rose from nearly 500,000 sf in 2002 to 2.2 million sf in 2005, ending with an inventory of 36 million sf of retail space.
- Hotel space rose from 33,500 rooms in 2003 to 34,200 rooms in 2005.
- Office space increased by 490,000 sf in 2004 and 360,000 sf in 2005, ending with an inventory of 23 million sf of office space.

- Industrial space absorption rose from 564,000 sf in 2004 to 773,000 sf in 2005, with an ending inventory of 22.4 million sf of industrial space.

In addition to the above, San Antonio has had growth in construction and facility renovations in medical facilities, public and private schools, public facilities and utility systems. With the increase in population and employment, the traffic volume in San Antonio has increased greatly, as shown in Section 4.11. According to the Texas Transportation Institute, travel in San Antonio that was classified as "congested" rose from 12 percent in 1982 to over 50 percent in 2003. Rush hours increased from 3 to 7 hours per day during the same time. To help relieve some of the congestion, the Texas Department of Transportation has a capital improvement program for San Antonio that includes:

- Potential toll roads for 1604, 281 and IH-35.
- A total of $400 million to $450 million in highway improvement projects for IH-10, Loop 410 and 281 to be completed by 2008 to 2009. This work includes major interchange work at Loop 410 and IH-10, San Pedro Avenue and 281.
- A $116-million project to widen Loop 410 from Nacogdoches Road to Austin Highway from 2006 to 2010.
- A $20-million project to elevate IH-10 over Boerne Stage Road and convert the fronting road to one way from Camp Bullis to Dominion Drive from 2006 to 2010 (SA Express News, 2006).

The construction and related utilities and road improvement projects listed in Section 2.0 for FSH and Camp Bullis are dwarfed by the magnitude of the past development in the San Antonio area, which is expected to continue with an average of 2 percent or more annual increase in population and employment. The level of construction is difficult to predict, but current indications are strong for the San Antonio region. The construction permits in San Antonio in 2004 were $2.4 billion. Historically, the permits have been in the range of $1.4 billion to $1.6 billion per year (City of San Antonio, Economic Development Department, 2006).

Future DoD Installation Changes

Lackland AFB: BRAC actions at Lackland AFB include:

- Relocating the Apprentice and Craftsman Traffic Management Courses from the base and vacating 60,550 sf of building space
- Constructing a 52,400-sf facility and demolishing 15,000 sf of existing space to support the consolidation of installation support services

- Constructing a 148,400-sf administrative facility to accommodate the BRAC 2005 realignment of the Air Force Center for Environmental Excellence (AFCEE), the Air Force Real Property Agency and the Air Force Outreach Program
- Constructing a 15,000-sf dental clinic and demolishing 15,700 sf of unusable space
- Renovating 134,000 sf of WHMC to support an ambulatory care center and realigning WHMC to FSH BAMC
- Constructing a 46,600-sf medical administrative center
- Vacating a 14,400-sf maintenance facility with the relocation of one-third of the current mission
- Constructing a 40,000-sf skeet range and potential cleanup of lead from a former range site
- Constructing an RV and boat storage area of 100,000 sf of paved surface
- Vacating 67 munitions facilities of a total 210,400 sf
- Vacating four facilities with a total of 16,000 sf with the relocation of a correctional facility
- Vacating a culinary management training facility of 22,000 sf with the transfer of this function from Lackland AFB

In addition to the BRAC requirements, Lackland AFB has a master plan to improve the installation with relocation and renovation of construction to modernize through 2011. The total program, which is subject to refinement and funding availability and includes the BRAC projects outlined above, is the construction of 3,762,722 sf of facilities, demolition of 855,032 sf of facilities and vacating an additional 407,450 sf of facilities, along with the construction of 1,241,970 sf of pavements and demolition of 365,120 sf of pavements.

The overall population change by 2011 is +117 persons. The estimated cost of the program is approximately $93 million per year from 2006 to 2011 (USAF, 2006c).

Randolph AFB: The BRAC Commission identified the bed-down of 24 additional T-38 aircraft at Randolph AFB. The decision will be supported by a new sound suppressor support facility, improvements to the aircraft parking ramp and renovation of Hangar 6.

In addition to the BRAC requirements, Randolph AFB plans to continue renovation and replacement of facilities. The current plan calls for the following:

- Renovating Buildings 738, 737 and B38 for flight line activities

- Consolidating the Civilian Personnel Office by constructing a 35,600-sf facility
- Renovating Building 745 for the relocation of a 73-person USAF audit agency from Brooks City-Base
- Renovating the AFPC Building B499 (A, B, C, D and E wings) (four projects for a total of 426,000 sf)
- Renovating B491 for AFPC of 66,000 sf
- Constructing an AFPC parking garage
- Constructing a high-intensity light system for the runway
- Constructing a new Remote Pilot Training course facility of 5,000 sf
- Constructing a new child development center of 23,723 sf
- Constructing several projects for paving and utility systems
- Constructing an unspecified-size fire station, Base Exchange, Command and Control Facility, car wash, Air Force Services Agency (AFSVA) facility, 40-space family camping area and munitions storage area facility

The overall population change by 2011 is +182 persons. The estimated cost of the program is approximately $8.9 million per year from 2006 to 2011 (USAF, 2006b).

Other DoD Facilities: The Army proposes to construct an approximately 260,000-sf Armed Forces Reserve Center (AFRC) on approximately 80 acres of existing Army property on Camp Bullis. The AFRC would include multi-use classrooms, barracks, a vehicle maintenance shop, organization unit storage buildings and parking, to accommodate the increase in personnel resulting from the proposed action. The Army also proposes to close the Boswell Street USARC and the Callaghan Road USARC, both located in San Antonio, and the National Guard Armory located in Hondo, Texas. Other projects and changes at Camp Bullis are included in this EIS with FSH.

4.14.6 Summary of Cumulative Effects

As stated previously, the history of FSH has revealed that this installation has transformed since its birth in the late 1880s and is continuing in that vein in the 21st century. The preferred action does not deviate from the core use of FSH. It expands the HQ and administrative nature of the installation as well as the medical services and medical training. The community services projects directly support these mission transitions. Likewise, the histories of Lackland AFB and Randolph AFB show their transformations over time as they adjusted to DoD requirements. Both are continuing their missions to provide training for USAF.

The magnitude of construction potential for Lackland AFB and Randolph AFB in terms of dollars noted above, compared to the FSH program that is estimated at $298 million per year from 2006 to 2011, indicates that the potential environmental impacts from the construction of the two AF installations would be much less than expected for FSH. Also, a comparison of the population increases for Lackland AFB and Randolph AFB, noted above, with FSH's programmed increase of 10,152 indicates that the potential environmental impacts from the relatively stable populations at the two installations would be much less than those expected for FSH. Therefore, the expected cumulative environmental effects of the collective DoD actions in the San Antonio area are not significant.

Additionally, as noted previously, the magnitude of the DoD actions compared with the actions in the region due to its projected growth is relatively insignificant. Therefore, additional site-specific NEPA requirements will be required during the five-year period from 2006 to 2011 to ensure that any unexpected changes in the development programs or baseline environmental conditions are evaluated. However, the current analysis indicates that there should not be any significant environmental consequences from the DoD development programs in San Antonio.

From the history of the San Antonio MSA and the military installations within it, the military has been a presence from early on in the development of the region. However, within the perspective of the region, the military installations, although at one time very prominent in terms of population and economic contributions to the region, have consolidated and stabilized on fewer land areas and are nestled within one of the most populous areas in the country. By comparison, the collective land area of the DoD installations in the region is less than 75 square miles, including the 44 square miles of Camp Bullis, while Bexar County alone is approximately 1,250 square miles. Similarly, the DoD population in the MSA is approximately 104,000 in 2006, while the total population in the MSA is approximately 1.9 million (FSH, 2006).

The preferred alternative, in combination with other planned activities in the region, will not affect any natural resources, cultural resources, social or economic units or ecosystems significantly, or contribute to levels of pollutants to cause regional, national or global public concern. As with any growth, there will be increased energy use and utilities consumption, waste increases, added traffic and other results of increased activity in the community. Implementation of the preferred alternative within the context of the San Antonio metropolitan area is minor considering the general evolution of the regional growth. FSH's small contribution to air pollution; stormwater runoff; historical, cultural and natural resource impacts; and added water consumption is evaluated in this EIS. With continued implementation of the FSH master plan using environmental awareness as an integral planning factor, the overall cumulative impacts are insignificant regionally.

The only issues of public health and safety would be the minor increases in helicopter flights to BAMC; however, these will be offset by the decrease to WHMC within the same region. Similarly, the laser range relocation from Brooks City-Base in south San Antonio to FSH would not increase public health or safety risks, nor will the minor increase in military field training at Camp Bullis. The Camp Bullis master plan provides the necessary buffer space with the surrounding areas. The increase in flying activity at Randolph AFB is separated geographically from the helicopter flights related to FSH and Camp Bullis such that cumulative noise impacts would not be a concern.

Air quality, primarily the ozone parameter, is of concern regionally. Air quality issues must continue to be addressed regionally through cooperative efforts. FSH participates fully with these regional initiatives. Significant contributors to ozone production are vehicles, which generally correlates with population. The only installation with significant growth in the San Antonio region is FSH, which was analyzed in this EIS, and the contributions to the region were found to be insignificant.

The increase in solid waste generation temporarily during construction would be reduced by the Army policy of avoiding the demolition of existing usable structures in the master planning process. The DoD activities to be relocated to FSH due to the BRAC actions are primarily administrative and institutional activities that would not be categorized as major waste generators. San Antonio is not land-locked like many other major urban regions in the country and has the capacity to handle increased waste generation due to regional growth. However, recycling initiatives have been added and will continue to reduce existing and limit new solid waste generation. FSH and Camp Bullis fully participate in waste minimization and recycling opportunities.

San Antonio is one of the older cities in the United States and has a rich history, as summarized in this document. San Antonio's history and culture are key elements of the city's value to the human environment. FSH and Camp Bullis likewise have histories that parallel the region and have been an integral part of its history and culture. Therefore, significant impacts to the historic and cultural assets at FSH and Camp Bullis would have a significant impact on the overall community. Fortunately, FSH and Camp Bullis have in place strong programs to comply with legal requirements concerning cultural resources and have strong master planning and facility design criteria to preserve the historic and cultural assets on each installation. Both Lackland AFB and Randolph AFB have historic and other cultural resources that require management. Each has implemented a program to comply with the law. As with

FSH, each project will be evaluated to determine the proper course of action in coordination with the State Historic Preservation Office (SHPO).

Federally and State-listed threatened and endangered species, or federally designated critical habitats, are of a concern from an environmental perspective. Camp Bullis has habitats that support bird species and karst caverns that support other endangered life forms. Again, the Camp Bullis natural resources planning and land management have been an integral part of the military use of the installation. From knowledge of the species and their habitats of concern, the preferred alternative will pose no impacts on the areas.

The DoD population is not expected to grow collectively for Lackland AFB and Randolph AFB from 2006 to 2010. The population gain for DoD is at FSH, which was used to analyze potential environmental impacts. However, Lackland AFB and Randolph AFB are not static, and both have programs with planned construction projects. Separate NEPA documents are being prepared for these installations because they are unrelated site-specific and should have insignificant cumulative effects on the region in the areas of environmental concern.

Of particular concern is use of water derived from the Edwards Aquifer. FSH has promoted conservation measures and has implemented the use of recycled water produced by SAWS. New construction is designed using the Unified Building Criteria and will meet or exceed international building code requirements for water-saving design. The DoD installations belong to a San Antonio Military Water Working Group, as discussed in Section 4.7.1. The imposed cap on pumpage is used as a planning tool by the military. The current projected water use from the Edwards Aquifer for all DoD installations in San Antonio in 2011 is 7,200.3 acre-feet, which is below the last four years' average of 7,603.47 acre-feet per year, and both are below the current cap of 8,400 acre-feet per year. The Camp Bullis water is drawn from the Trinity Aquifer. The planned increase in water withdrawal is within its system's planned capacity, and usage per acre on this 44-square-mile installation is minimal compared to developed areas surrounding the site.

A separate EA for the Camp Bullis Reserve Center was completed in October 2006 (USACE, 2006c). Insignificant air, noise and transportation impacts would occur during the short-term construction activities under the preferred alternative.

4.15 BEST MANAGEMENT PRACTICES

Land Use

Fort Sam Houston:

- Consider incompatible neighboring uses when designing the non-medical research facility and vehicle maintenance facilities and the potential addition of screening with berms, landscaping or other means.
- Provide screening for the relocatable modular facilities where sited near the Quadrangle. Relocate to an area on FSH that would not adversely impact historic facilities and districts for more than five years.
- Provide a berm to screen the laser from portions of the golf course east of Salado Creek.

Camp Bullis:

- No land use measures would be needed as a result of implementing the preferred alternative.

Aesthetics and Visual Resources

Fort Sam Houston:

- To the maximum extent practicable, follow procedures in the IDG, Appendix D; historic review requirements; and the HPC of the FSH ICRMP for alterations and replacement of historic facilities.

Camp Bullis:

- No measures are needed because there would be no significant impacts to aesthetic and visual resources.

Air Quality

Fort Sam Houston and Camp Bullis:

- Dust suppression BMPs during construction and demolition/deconstruction.
- Selection of energy-efficient systems in new construction.
- Selection and use of equipment per TCEQ air quality measures.
- Update air quality permit.

Noise

- No noise reduction measures would be required at FSH and Camp Bullis.

Geology and Soils

- Erosion and sediment control, grading and reseeding would be required during construction at FSH and Camp Bullis.

Water Resources

Fort Sam Houston:

- Engineered design of stormwater management structures, including retention ponds if needed, would be required to prevent flooding on portions of FSH and prevent significant impacts on downstream, off-installation properties.
- Increased pumping at FSH would be offset partially by decreased pumping at Lackland AFB due to the transfer of medical activities from WHMC to BAMC.
- Continued implementation of water conservation measures during design of facilities would be required.
- Increased pumping will be within the pumping limits set in the 1999 USFWS BO.
- Continued utilization of reuse water for landscaping and other approved uses should be considered.
- The existing SWPPP, SPCC Plan and the P2 Plan would be updated to include new construction.
- Update NPDES permits.
- A construction site TCEQ SWPPP would be required for sites greater than 1 acre.

Camp Bullis:

- The existing SWPPP, SPCC Plan and the P2 Plan would be updated to include new construction.

Biological Resources

Fort Sam Houston:

- None would be required at FSH.

Camp Bullis:

- Follow procedures of existing karst management activities outlined in the KMP and ESMP, which are included in the INRMP.

Cultural Resources

Fort Sam Houston:

- To the maximum extent practicable, follow procedures in the IDG and the SOPs in the HPC of the FSH ICRMP for alterations and replacement of historic facilities.

Camp Bullis:

- No mitigation for cultural resources would be needed because no significant impacts are anticipated. Inadvertent discoveries of archaeological material would be mitigated in accordance with the HPC.

Socioeconomics

Fort Sam Houston:

- Expansion of law enforcement personnel would be needed to avoid potential significant impacts on the quality of life.

Camp Bullis:

- No mitigation measures would be needed due to the absence of anticipated significant impacts.

Transportation

- Selected roadway widening and intersection traffic control to reduce congestion of FSH.
- Continued permanent improvements inside and outside FSH ACPs.

Utilities

Fort Sam Houston:

- Integrate water and energy conservation into the design of facilities.
- Use reuse water for irrigation requirements at new facilities or xeriscape.

Camp Bullis:

- The lift station requires an increased capacity.

Hazardous and Toxic Substances

Fort Sam Houston:

- Include recycling incentives in demolition/deconstruction contracts.

- Comply with existing procedures for tracking, handling, storage and use of hazardous and toxic materials.
- Implement P2 product substitutions and waste reduction.
- Comply with existing procedures for contract disposal of hazardous and biomedical wastes.
- Survey for LBP and ACM before demolition/deconstruction.
- Survey for UXO.
- Update RCRA permits.
- Update EPCRA reporting.

Camp Bullis:

- Perform UXO clearance prior to construction activities.

4.16 MITIGATION SUMMARY

Mitigation measures are actions required to reduce the significant environmental impacts of implementing a proposed or alternative action. None of the environmental impacts discussed in this EIS are expected to be significant, with the potential exception of cultural resources. If the demolition of historic structures within the NHLD cannot be avoided, mitigations would be determined per the HPC SOPs. For all other environmental resources and programs, no mitigation measures are necessary for the proposed action beyond the BMPs that will be conducted in accordance with long-established environmental programs and requirements.

4.17 UNAVOIDABLE SIGNIFICANT ENVIRONMENTAL IMPACTS

Implementing the preferred alternative at FSH would not result in unavoidable significant environmental impacts. Nevertheless:

- Increased runoff would occur due to the increase in impervious surfaces.
- Substantial development for the METC would affect the flood discharge level along Salado Creek and intensify erosion and sedimentation throughout and downstream of FSH.
- Construction activities would result in temporary, localized minor impacts to existing air quality, noise levels and traffic and parking patterns.

In the HQ and administrative support subarea, the Army would be able to use existing facilities to accommodate incoming HQ and administrative functions. The size and number of facilities needed to accommodate the BRAC-directed actions in the medical training, medical and non-medical RDTE and patient care subareas could not be met using existing facilities, so the development of additional impervious surface areas could not be avoided. The rapid runoff characteristics of FSH soils and the need to convey drainage away from structures, equipment and people also make the impact on existing flood levels along Salado Creek unavoidable to some degree. Proper design, location and construction of a stormwater detention facility and the development and implementation of an updated SWPPP in accordance with the TCEQ Construction General NPDES Permit would minimize these effects.

The construction activities at Camp Bullis also would result in temporary, minor, localized unavoidable impact to air quality and noise levels, but are not considered an environmental concern.

4.18 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Irreversible and irretrievable resource commitments are related to the use of non-renewable resources and how this use may affect future generations. Irreversible effects usually result from the use or destruction of specific resources that cannot be replaced within a reasonable time. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action.

The preferred alternative action would require the use of fuels for vehicles and construction equipment. This fuel would be used as long as military activities occur at FSH and Camp Bullis. Construction, alteration and renovation activities would require the use of electrical power and construction materials. There would be irreversible or irretrievable commitments of construction materials, such as concrete, sand, bricks, steel, insulation, wiring and paint. Demolition/deconstruction activities would generate demolition/deconstruction debris. If demolition/deconstruction techniques are not used or recyclable facility materials are not recovered, the demolition/deconstruction debris would be considered irretrievable once it is disposed in a landfill. The use of human resources for facility construction and design is considered an irretrievable loss in that it would preclude such personnel from engaging in other work.

The potential irreversible or irretrievable negative impacts upon threatened or endangered species from overuse of the Edwards Aquifer in the San Antonio area are a major concern. This concern is addressed through management actions undertaken pursuant to the USFWS BO, the FSH Drought Management Plan and reuse of recycled water provided by the SAWS. Significant impacts to threatened and endangered species that depend on discharge from the Edwards Aquifer are not expected if the water conservation efforts specified in Section 4.7 are continued.

The Secretary of the Interior's Standards for Rehabilitation and Renovation will be followed for the repair, alteration and conversion of Facilities 258, 2000, 2001, 2263, 2264, 2266 and 2270, which have been designated as contributing elements of the NHLD.

During the implementation of the preferred alternative to avoid potential loss of cultural resources at FSH, the Secretary of the Interior's Standards for Architectural and Engineering Documentation will be followed prior to the demolition/deconstruction of Facilities 1222, 1281, 2007, 2008 and 2010. These facilities have been designated as contributing elements of the NHLD during the implementation of the preferred alternative.

4.19 SHORT-TERM USES OF MAN'S ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

In the short term, implementing the preferred alternative will require substantial increases in fuels and building materials to demolish and/or demolish/deconstruct approximately 620,000 sf of existing facilities and to construct or renovate approximately 4.9 million sf of space. The long-term impacts of implementing the preferred alternative would be lessened by the use of sustainable building practices as described below.

The Army will construct all new facilities to meet the Silver level in the Leadership in Energy and Environmental Design (LEED) rating system, beginning with the FY 2008 military construction program. The LEED standard, which is maintained by the U.S. Green Building Council, will take the place of the DoD Sustainable Project Rating Tool (SPiRiT). Projects begun before FY 2008 will continue to be built to the SPiRiT Gold standard (AEC, 2006c).

LEED is a voluntary, consensus-based national standard for developing high-performance buildings. LEED emphasizes state-of-the-art strategies for sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality. The LEED for New Construction and Major Renovations is designed to guide the development of high-performance commercial and institutional projects, with a focus on office buildings (U.S. Green Building Council, http://www.usgbc.org/DisplayPage.aspx?CategoryID=19).

The Energy Policy Act of 1992 and AR 11-27 (*Army Energy Program*) govern most aspects of energy conservation throughout MEDCOM. MEDCOM has established an energy conservation goal of reducing energy usage by 30 percent from a 1985 baseline. To attain this goal, FSH has set up Energy Savings Performance Contracts (ESPCs). Under an ESPC, a private contractor evaluates, designs, finances, acquires, installs and maintains energy-saving equipment and systems for FSH. ESPC systems typically include boilers, chillers, lighting, gas lines, steam traps and utility controls (USACHPPM, 2000).

FSH purchases EnergyStar™-compliant computer equipment in accordance with EO 12844. Computers, monitors and printers with EnergyStar™ features can go into a sleep mode after not being used for a certain period (USACHPPM, 2000).

The Army would incorporate all reasonable energy-efficient designs into construction projects to comply with its LEED directive. Energy-efficient designs potentially would include solar applications and waste heat recovery. Both active (such as heating systems) and passive (such as building orientation and shading from the sun) approaches would be considered. Recovery of heat from air conditioning, equipment and lighting loads, and body heat from facility occupants, also would be considered for construction during the implementation of the preferred alternative (1391 construction data).

5.0 FINDINGS AND CONCLUSIONS

5.1 FINDINGS

5.1.1 Consequences

Realignment (Preferred) Alternative

The consequences of implementing the preferred alternative and recommended best management practices are summarized as follows (Table 5-1).

Land Use and Aesthetics

Although there would be demolition/deconstruction and alteration of historic facilities at FSH, quality of facilities would increase due to renovation and new construction. Impacts on aesthetics would depend on the design decisions. Siting of a non-medical research facility would be in conflict with the FSH Land Use Plan, and siting of vehicle maintenance facilities within view of residential neighborhoods outside FSH might result in degradation of the views. Likewise, temporary siting of relocatable modular facilities during renovation and construction at FSH would not be compatible with the nearby historic properties if left in place more than five years. BMPs for these impacts could include:

1. Strictly following the procedures in the IDG, Landscape Design Guide and the HPC of the FSH ICRMP for alterations and replacement of historic facilities
2. Adding screening through the use of berms, landscaping or fencing

Air Quality

Although there would be an overall increase in activity and a related increase in stationary emissions sources, no significant impacts to local or regional air quality would be expected. BMPs such as dust suppression during construction and demolition/deconstruction and selection of energy-efficient systems in new construction would help reduce the potential impact on air quality.

Noise

The preferred alternative would not create a significant increase in noise resulting from an increase in weapons training and use of ground burst simulators during training exercises at Camp Bullis. Noise from vehicle traffic and construction equipment would increase slightly but should not be considered an environmental concern. The MEDEVAC helicopter flights in the BAMC area would double with the preferred alternative, but this would not create a significant noise impact, and mitigation measures appear to be unnecessary.

Table 5-1 Summary of Potential Impacts and Mitigation Measures

Resource Area	No Action Alternative	Preferred Alternative	Best Management Practices	Mitigation Measures if Needed
Land Use	No change to existing conditions.	• No effect on airspace, management or use on FSH or Camp Bullis. • Improved quality of facilities on FSH. • Loss of historic facilities on FSH. • Alteration of historic facilities on FSH. • Siting of non-medical research facility in conflict with FSH Land Use Plan and potential impact on nearby RV park. • Siting of vehicle maintenance facilities within view of residential neighborhoods outside FSH. • Temporary siting of relocatable modular facilities during the renovation and construction period is not compatible with nearby historic properties. Build-out schedule may require longer than a five-year use.	• Strictly follow procedures in the IDG, Landscape Master Plan and the HPC of the FSH ICRMP for alterations and replacement of historic facilities. • Consider incompatible neighboring uses when designing the non-medical research facility and the vehicle maintenance facilities and potential addition of screening with berms, landscaping or other means. • Provide screening for the relocatable modular facilities where sited near the Quadrangle. Relocate to an area on FSH that would not impact the historic facilities and districts significantly for more than five years.	• Not applicable
Aesthetics and Visual Resources	No change to existing conditions. Older facilities remain and continue to age.	• Potential positive or negative impact on aesthetics with new facilities and deconstruction of aged facilities. • Potential significant impact on historic viewscapes.	• Strictly follow procedures in the IDG, Landscape Master Plan and the HPC of the FSH ICRMP for alterations and replacement of historic facilities.	• Not applicable
Air Quality	No change to existing conditions.	• Potential short-term increase in criteria pollutants during construction and deconstruction activities. • Increased mobile and stationary emissions sources. • No significant impacts to local or regional air quality.	• Dust suppression BMPs during construction and deconstruction. • Selection of energy-efficient systems in new construction. • Selection and use of equipment per TCEQ air quality measures.	• Not applicable

Resource Area	No Action Alternative	Preferred Alternative	Best Management Practices	Mitigation Measures if Needed
Noise	No change to existing noise environment.	• No significant increase in noise resulting from increase in weapons training and use of ground burst simulators during training exercises at Camp Bullis. • Slight increase in noise from vehicle traffic and construction equipment. • Double the MEDEVAC helicopter flights in the BAMC area. Nevertheless, no significant noise impact.	• No noise reduction measures required.	• Not applicable
Geology and Soils	No change to existing conditions.	• No significant effects to geologic resources or karst features would occur. • Improved control of erosion after facility construction and paving. • Increased potential for erosion during construction at FSH and Camp Bullis sites.	• Erosion control and silt control required during construction.	• Not applicable
Water Resources	No change to existing environment. Water consumption would remain the same. The existing SWPPP, SPCC Plan and P2 Plan would remain in force.	• Potential effects of increased stormwater runoff due to increased impervious surfaces on FSH and Camp Bullis. • Increased pumping from the Edwards Aquifer at FSH. • Increased pumping from the Trinity Aquifer at Camp Bullis. • No impact on wetlands.	• Engineered design of stormwater management structures, including retention ponds if needed, is required to prevent flooding on portions of FSH and prevent significant impacts on downstream off-installation properties. • Increased pumping at FSH would be offset partially by decreased pumping at Lackland AFB due to the transfer of medical activities from WHMC to BAMC. • Implementation of water conservation measures during design of facilities is required. • Reuse water for landscaping and other approved uses should be considered. • The existing SWPPP, SPCC Plan and the P2 Plan would be updated to include new construction. • No measures are recommended for Camp Bullis.	• Not applicable
Biological Resources	No changes to existing biological resources.	• No significant effects on biological resources at FSH or Camp Bullis. • Noise during construction not expected to impact endangered species at Camp Bullis. • Karst protected species not found in construction areas at Camp Bullis.	• Adhere to procedures in KMP.	• Not applicable

Resource Area	No Action Alternative	Preferred Alternative	Best Management Practices	Mitigation Measures if Needed
Cultural Resources	No change to existing conditions. No deconstruction or alteration of potentially eligible historic facilities.	• Deconstruction or alteration of several facilities on FSH potentially eligible for listing on the NRHP. • Potential significant impact on viewscapes of historic districts. • No impact to identified archaeological resources.	• Strictly follow procedures in the IDG, Landscape Master Plan and the HPC of the FSH ICRMP for alterations and replacement of historic facilities.	• Not applicable at this time; mitigations for demolition within the NHLD would be determined per the HPC SOP
Socioeconomics	No change to baseline socioeconomic conditions.	• No significant effects on demographics, employment or income potential anticipated. • Substantial increase in construction-related spending would create substantial beneficial economic effects throughout the San Antonia MSA. • No environmental justice concerns.	• None identified.	• Not applicable
Transportation	No change in current traffic conditions.	• Increase in vehicular traffic in southwestern and eastern areas of FSH. • Increased waiting time at ACPs in southwestern and eastern areas of FSH. • Decreased LOS on several intersections and road segments on FSH.	• Continued permanent improvements inside and outside FSH ACPs. • Selected roadway widening and intersection traffic control to reduce congestion of FSH.	• Not applicable
Utilities	No change in current consumption or wastewater and solid waste generation.	• Increase in water and energy consumption. • Increase in wastewater generation and solid waste tonnage. • Utility systems and regional landfills are adequate to meet increased demands.	• Integrate water and energy conservation into the design of facilities. • Use reuse water for irrigation requirements at new facilities or xeriscape.	• Not applicable
Hazardous Materials and Waste Management	No change to existing conditions.	• Increased storage and use of hazardous materials for vehicle maintenance and medical services. • Increased quantities of hazardous wastes would be generated, primarily petroleum products and construction debris. • Increased quantities of biomedical wastes would be generated at the expanded patient care facilities.	• Included recycling incentives in deconstruction contracts. • Comply with existing procedures for tracking, handling, storage and use of hazardous and toxic materials. • Implement P2 product substitutions and waste minimization. • Comply with existing procedures for contract disposal of hazardous and biomedical wastes. • Survey for LBP and ACM before demolition. • Perform UXO clearance before construction.	• Not applicable

Geology and Soils

There would be no significant effects on geologic resources or karst features, and the control of erosion after facility construction and paving is anticipated to be improved. Due to increased potential for erosion at the FSH and Camp Bullis sites, erosion and silt control would be required during construction.

Water Resources

There would be potential impacts of increased stormwater runoff due to increased impervious surfaces on FSH. Pumping from the Edwards Aquifer at FSH would increase under levels identified in the1999 BO with USFWS. Pumping from the Trinity Aquifer at Camp Bullis also would increase; however, the overall increased pumping from the Trinity Aquifer would not be significant. There would be no impacts on wetlands at either installation. Engineered design of stormwater management structures, including retention ponds if needed, would be required to control flooding of portions of FSH and minimize impacts on downstream, off-installation properties. Increased pumping at FSH would be offset partially by decreased pumping at Lackland AFB due to the transfer of medical activities from WHMC to BAMC. Water conservation measures should be incorporated into the design of facilities, and reuse water for landscaping and other approved uses should be considered. The existing SWPPP, SPCC Plan and the P2 Plan would be updated to include new construction activities.

Biological Resources

No significant effects on biological resources at FSH or Camp Bullis are expected. Noise during construction should not impact endangered bird species at Camp Bullis. Karst protected species are not found in construction areas at Camp Bullis and therefore should not be affected significantly.

Cultural Resources

Demolition/deconstruction or alteration of several facilities that are potentially eligible for listing on the NRHP is expected at FSH. New construction also could affect viewscapes of historic districts significantly. FSH would be required to follow procedures in the IDG, Landscape Master Plan and the HPC of the FSH and Camp Bullis ICRMPs strictly for alterations and replacement of historic facilities to reduce significant impacts.

Socioeconomics

No significant effects on demographics, employment or income potential are expected. There would be no environmental justice concerns.

Transportation

Transportation concerns were limited to vehicular traffic generated by the increased population at FSH and increases in the workforce and students at FSH and Camp Bullis. The increase in vehicular traffic in the southwestern and eastern areas of FSH would decrease the LOS on several road segments in this area. Increased waiting time would be expected at ACPs in this area and at the ACPs in the eastern area of FSH that support BAMC. No major increase in traffic is expected at Camp Bullis. Continued permanent improvements to roadways and intersections inside and outside FSH ACPs are recommended. Selected roadway widening and intersection traffic control would reduce congestion in the southwestern portion of FSH.

Utilities

An overall increase in utilities consumption and waste generation at both FSH and Camp Bullis is expected. The utility systems and regional landfills are adequate to meet the increased demands. Integration of water and energy conservation into the design of new and renovated facilities at FSH and Camp Bullis is recommended. Reuse water to meet irrigation needs for new facilities at FSH or xeriscaping also is recommended.

Hazardous Materials and Toxic Substances

Storage and use of hazardous materials for vehicle maintenance and medical services would increase. Increased quantities of hazardous wastes, primarily petroleum products and construction debris, would be generated. Increased quantities of biomedical wastes also would be generated at the expanded patient care facilities on FSH. BMPs could include recycling incentives in demolition/deconstruction contracts; strict compliance with existing procedures for tracking, handling, storage and use of hazardous and toxic materials; implementation of P2 product substitutions; and waste reduction and compliance with existing procedures for disposal of hazardous and biomedical wastes.

Cumulative Effects

Cumulative effects would be minimal in all resource categories discussed above. The only areas of concern would be cultural resources and water resources. In cultural resources, historic property alteration or demolition/deconstruction would be of concern; however, strict adherence to the HPC of the FSH ICRMP would minimize or negate significant impacts to these resources. The concern for potential flooding impacts due to increased stormwater at FSH would be negated by proper engineering design of stormwater conveyance structures and the addition of retention ponds, as required.

5.1.2 Consequences of Minor Siting Variations

Minor siting variations would have similar consequences as the preferred alternative.

5.1.3 Consequences of the No Action Alternative

Under the no action alternative, there would be no changes to existing conditions concerning land use, air quality, biological resources, socioeconomics, noise, geology and soils, transportation, utilities or water resources. In the areas of aesthetics, visual resources and cultural resources, the absence of new construction and alteration would preclude the destruction of potentially eligible historic facilities. The absence of new construction and alteration, however, might result in further deterioration of existing structures and the loss of potential enhancements to the existing landscape and architectural themes in the southwestern area of FSH.

5.2 CONCLUSIONS

The preferred alternative would support the BRAC requirements and other concurrent Army initiatives to reconfigure and reposition its assets to meet 21st century mission requirements related to FSH and Camp Bullis. Overall, there would be no significant effects of implementing the preferred alternative at both installations. Commitment to the recommended BMPs would decrease environmental impacts.

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9.0 PERSONS CONSULTED

Mr. Ray Acuña, Fort Sam Houston Police

Mr. Charles Alfonso, Director of Plans, Training, Mobilization and Security Garrison

Mr. John Bann, U.S. Army Garrison – BRAC Team

Mr. Brian Barthelme, Preventative Medicine

Mr. Ron Bishop, BAMC Fort Sam Houston

Mr. David Brigham, Fort Sam Houston Cultural Resources

Mr. Ronald Brown, U.S. Air Force

Algie B. Byrd, USAG, RMO

Mr. Jim Cannizzo, Office of Staff Judge Advocate, Fort Sam Houston

Mr. Lucas Cooksey, Wildlife Biologist, Camp Bullis

Mr. Norman Dolski, Fort Sam Houston Resource Management Office

Ms. Christy Halder, BAMC/Institute for Surgical Research

Mr. Roy Hirchak, BAMC/Institute for Surgical Research

LTC Barb Holcomb, BITL/USAE/STB, Garrison

Mr. Rod Hudson, Office of Staff Judge Advocate, Fort Sam Houston

Mr. Richard Juarez, Director of Public Works Real Property Branch, Master Planner

Mr. Michael E. Main, Human Resources Specialist, Fort Sam Houston Directorate of Human Resources

Mr. Robert Martin, Fort Sam Houston DOIM Information Management Specialist/BRAC

Mr. Quincy Meade, Director of Public Works Engineering Division, Civil Engineer

Mr. Mark Merrell, JM Waller

Ms. Mellisse Morgan, Camp Bullis BRAC Analyst

Mr. Rodolfo Morono, USAG – Fort Sam Houston IR

Mr. Simon Muench, IMA SWRO

1LT Stephanie Nelson, Fort Sam Houston, BRAC Admin

Mr. Stuart Nelson, HQAETC/A7CCP

Dr. Peter Pagoulatos, Historic Preservation Officer, Fort Sam Houston/Camp Bullis

Mr. Burwell Pike, Fort Sam Houston Environmental Protection Specialist

Mr. Michael Pumphry, DES Historical Architect

Mr. Mahalingam Ravichandran, U.S. Air Force

Mr. Phil Reidinger, Public Affairs

Mr. James Riley, BAMC/Institute for Surgical Research

Mr. Roberto Rivera, Camp Bullis Directorate of Safety, Environment, and Fire Environmental Engineer

Mr. Dan Ryan, Essex Corporation, GIS

Mr. Gerardo Salazar, Fort Sam Houston Utilities Services

Ms. Jackie Schlatter, Fort Sam Houston Environmental

Mr. Allen Schramek, Fort Sam Houston Safety

Ms. Patricia Seader, Fort Sam Houston Public Works Analyst

Mr. Scott Spencer, BAMC Safety

Ms. Heather Stewart, TCEQ Monitoring Operations Division

Mr. Irwin Stuart, Director of Public Works

Mr. Charles W. Tholen, U.S. Air Force Training/LAFB

Mr. Larry Toman, Director of Public Works, Fort Sam Houston

Mr. John Travis, HFPA

Mr. Jeff Tripe, USACE SWF

Mr. Mark Trudzinski, METC Executive IPT

Mr. Tom Uncles, Installation Management Agency, South West Regional Office

Mr. David P. Walker, Fort Sam Houston Environmental

Ms. Pamela Watts, ISR Property Log

10.0 ACRONYMS AND ABBREVIATIONS

AAA	Army Audit Agency
AACOG	Alamo Area Council of Governments
AADT	Annual Average Daily Traffic
AAFES	Army and Air Force Exchange Service
AAP	Army Alternative Procedures
AASHTO	American Association of State Highway and Transportation Officials
ACA	Army Contracting Agency
ACFSC	Army Community and Family Support Center
ACHP	Advisory Council on Historic Preservation
ACM	Asbestos-containing Materials
ACP	Access Control Point
ACSIM	Assistant Chief of Staff for Installation Management
A.D.	*Anno Domini*
AD	Active Duty
Adj	Adjusted
ADSL	Average Daily Student Load
ADT	Average Daily Traffic
AEC	Army Environmental Center
AECOT	Aeromedical Evacuation Contingency Operations Training
AEDB-R	Army Environmental Database for Restoration
AEI	Air Emissions Inventory
af	Acre-feet
AFB	Air Force Base
AFCEE	Air Force Center for Environmental Excellence
AFLO	Army Family Liaison Office
AFPC	Air Force Personnel Center
AFRC	Armed Forces Reserve Center
AFSVA	Air Force Services Academy
AGL	Above Ground Level
AHERA	Asbestos Hazard Emergency Response Act
AHPA	Archaeological and Historic Preservation Act
AIRFA	American Indian Religious Freedom Act

AMEDD	Army Medical Department
AMEDDC&S	Army Medical Department Center and School
AMF	Army Modular Force
amsl	Above Mean Sea Level
APAR	Affected Property Assessment Report
AR	Army Regulation
ARID	Army Range Inventory Database
ARNG	Army National Guard
ARPA	Archaeological Resources Protection Act
ASHARA	Asbestos School Hazard Abatement Reauthorization Act
AST	Aboveground Storage Tank
AVN TNG	Aviation Training
B.C.	Before Christ
BA	Biological Assessment
BAMC	Brooke Army Medical Center
BASOPS	Base Operations Support
BC3	Basic Combat Convoy Course
BCV	Black-capped Vireo
BDE	Brigade
BEA	Bureau of Economic Analysis
bgs	Below Ground Surface
BMP	Best Management Practices
BN HQ	Battalion Headquarters
BN	Battalion
BO	Biological Opinion
BOD	Biochemical Oxygen Demand
BRAC Commission	Base Realignment and Closure Commission
BRAC	Base Realignment and Closure
BSL	Bio-safety Level
Btu	British Thermal Unit
Btu/sf	British Thermal Unit per Square Foot
C4	Combat Casualty Care Course
CAA	Clean Air Act
CAIS	Chemical Agent Identification Sets

CALS	Combat Assault Landing Strip
CAMS	Continuous Air Monitoring Station
CAP	College of American Pathologists
CASF	Contingency Aeromedical Staging Facility
CC	Compliance Cleanup
CDC	Centers for Disease Control
CDMP	Community Development Management Plan
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
cfs	Cubic Feet per Second
CHPPM-South	U.S. Army Center for Health Promotion and Preventative Medicine, CONUS Subordinate Command South
CLIP	Clinical Laboratory Improvement Program
cM	The Capacity for This Movement
CO HQ	Company Headquarters
Confl	Conflicted
CO OPS	Company Operations
CO	Carbon Dioxide
COBRA	Cost of Base Realignment Actions
COC	Contaminants of Concern
COD	Chemical Oxygen Demand
CONUS	Continental United States
Council	Advisory Council on Historic Preservation
CPS	City Public Service
cSH	The Capacity for Each Lane Considering the Effects of Sharing and Flared Right Turns
CSM	Conceptual Site Model
CTT	Closed, Transferring and Transferred
CWA	Chemical Warfare Agent
CWA	Clean Water Act
DA PAM	Department of the Army Pamphlet
DA	Department of the Army
DANC	Decontamination Agent, Non-corrosive

dB	Decibel
dBA	"A" Weighting
DCI	Department of Clinical Investigations
DECON	Contingency Counterterrorism Casualty Decontamination Course
DEPMED	Deployable Medical
DERP	Defense Environmental Restoration Program
DES	Directorate of Emergency Services
DF-2	No. 2 Diesel Fuel
DMM	Discarded Military Munitions
DMRTI	Defense Medical Readiness Training Institute
DMSET	Deployable Medical Systems Equipment for Training
DNL	Day-night Level
DoD	Department of Defense
DOIM	Directorate of Information Management
DOL	Directorate of Logistics
DOPAA	Description of Proposed Action and Alternatives
DOT	Department of Transportation
DPW	Directorate of Public Works
DRMO	Defense Reutilization and Marketing Office
DS	Directional Split
DSCA	Defense Support to Civil Authorities
DSHS	Department of State Health Services
EA	Environmental Assessment
EAA	Edwards Aquifer Authority
EAC	Early Action Compact
EB	East Bound
EBL	East Bound Left
EBR	East Bound Right
EBT	East Bound Through
EIFS	Economic Impact Forecast System
EIS	Environmental Impact Statement
EMEDS	Expeditionary Medical Support
EMRC	Expeditionary Medical Readiness Course
EMS	Emergency Medical Services

EO	Executive Order
EOC/SCIF	Emergency Operations Center/Sensitive Compartmented Information Facility
EOD	Explosive Ordnance Detonation and Disposal
EPAS	Environmental Performance Assessment System
EPCRA	Emergency Planning and Community Right-to-Know Act
ERA	Ecological Risk Assessment
ESA	Endangered Species Act
ESMP	Endangered Species Management Plan
ESPC	Energy Savings Performance Contract
ESTARS	Expeditionary Sustainment Training to Advance Readiness Skills
ETZ	Extraterritorial Zone
EUL	Enhanced Use Leasing
F	Fahrenheit
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
Fifth Army/ARNORTH	Fifth Army/U.S. Army North
FIP	Federal Implementation Plan
Flpb	Pedestrian and Bike Adjustment Factor for Left Turn Movement
Flt	Adjustment Factor for Left Turns in the Lane Group
FNSI	Finding of No Significant Impact
FOC	Full Operating Capability
FONPA	Finding of No Practicable Alternative
FORSCOM	Forces Command
FPEIS	Final Programmatic Environmental Impact Statement
FR	Federal Register
FRP	Fiberglass, Reinforced Plastic
Frpb	Pedestrian and Bike Adjustment Factor for Right Turn Movement
Frt	Adjustment Factor for Right Turns in the Lane Group
FSH	Fort Sam Houston
FSHFH	Fort Sam Houston Family Housing
FTW	Flying Training Wing
FUDS	Formerly Used Defense Site
FY	Fiscal Year

GBS	Ground Burst Simulators
g/C	Green Time/Signal Cycle Length Ratio
GCW	Golden-cheeked Warbler
GIB	General Instruction Building
GIS	Geographic Information System
gpd	Gallons per Day
gpm	Gallons per Minute
Grp	Group
GVW	Gross Vehicle Weight
GWOT	Global War on Terrorism
HAP	Hazardous Air Pollutant
HCM	Highway Capacity Manual
HCP	Habitat Conservation Plan
HE	High Explosives
HHC CO OPS	Company Headquarters/Special Troops Battalion
HI	Hazard Index
HLD	Homeland Defense
HM	Hazardous Material
HMA	Housing Market Analysis
HMMWV	High-mobility, Multi-wheeled Vehicle
HMX	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
HPC	Historic Properties Component
HQ	Headquarters
HSMS	Hazardous Substance Management System
HWMP	Hazardous Waste Management Plan
IAP	Installation Action Plan
IATA	International Air Transport Association
ICRMP	Integrated Cultural Resources Management Plan
ICU	Intersection Capacity Utilization
IDG	Installation Design Guide
IGPBS	Integrated Global Presence and Basing Strategy
IH	Interstate Highway
IMA SWRO	Installation Management Agency – Southwest Region Office
IMA	Installation Management Agency

IMPAC	International Merchant Purchase Authorization Card
INRMP	Integrated Natural Resources Management Plan
IO	Input-output
IP	Individual Permit
IPMP	Integrated Pest Management Plan
IRP	Installation Restoration Program
ISCP	Installation Spill Contingency Plan
ISD	Independent School District
ISR	Institute of Surgical Research
ITAM	Integrated Training Area Management
ITE	Institute of Transportation Engineers
JDAAF	Joint Defense Air Force
JOC	Joint Operations Center
JP-8	Jet Propellant
KHz	Kilohertz
KMP	Karst Management Plan
K-therms	Kilotherms
kVA	Kilovolt-amperes
kW	Kilowatt
LBP	Lead-based Paint
LBPPPA	Lead-based Paint Poisoning Prevention Act
LEED	Leadership in Energy and Environmental Design
LEP	Limited English Proficiency
LLRW	Low-level Radioactive Waste
LMTVs	Light Medium Tactical Vehicles
LOS	Level of Service
LUC	Land Use Control
LUS	Lacustrine Unconsolidated Shores
MA	Maneuver Area
MACOM	Major Command
MC	Munitions Constituents
MCA	Military Construction Army
MCL	Maximum Contaminant Level
MD	Mid-day

MED	Medical
MEDCOM	Medical Command
MEDEVAC	Medical Evacuation
MEDLOG	Medical Logistics
METC	Medical Education Training Center
mg/L	Milligrams per Liter
MGD	Million Gallons per Day
MI	Military Intelligence
Mission EA	*Final Environmental Assessment of Current and Proposed Mission Activities at Camp Bullis, Bexar and Comal Counties, Texas*
mm	Millimeter
MMRP	Military Munitions Response Program
MOGAS	Motor Vehicle Gas
MOU	Memorandum of Understanding
MOUT	Military Operations on Urbanized Terrain
MRPC	Medical Readiness Planners Course
MSA	Metropolitan Statistical Area
MSGP	Multisector General Permit
MWh	Megawatt Hour
MWR	Morale, Welfare and Recreation
N/A	Not Applicable
NAAQS	National Ambient Air Quality Standards
NAF	Non-appropriated Fund
NAGPRA	Native American Graves Protection and Repatriation Act
NAS	Naval Air Station
NB	North Bound
NBC	Nuclear, Biological and Chemical
NBL	North Bound Left
NBR	North Bound Right
NBT	North Bound Through
NCA	Noise Control Act
NCO	Non-commissioned Officer
nda	No Data Available
NEPA	National Environmental Policy Act

NESHAP	National Emissions Standards for Hazardous Air Pollutants
NETCOM	Army Network Enterprise Technology Command
NGVD	National Geodetic Vertical Datum
NHLD	National Historic Landmark District
NHP	Non-human Primate
NHPA	National Historic Preservation Act
NO_2	Nitrogen Dioxide
NO_x	Oxides of Nitrogen
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NRCS	Natural Resource Conservation Service
NRDC	Natural Resources Defense Council
NRHP	National Register of Historic Places
NWP	Nationwide Permits
O&M	Operation and Maintenance
O_3	Ozone
OB/OD	Open Burning/Open Detonation
OSHA	Occupational Safety and Health Administration
OTS	Officer Training School
P2	Pollution Prevention
PA/SI	Preliminary Assessment/Site Investigation
PAM	Pamphlet
Pb	Lead
PCB	Polychlorinated Biphenyl
PCE	Perchloroethylene
pCi/L	Pico Curies/Liter
PCL	Protective Concentration Limits
PCPI	Per Capita Personal Income
PCS	Permanent Duty Station
Peds	Pedestrians
Perm	Permitted
PES	Pacific Environmental Services, Inc.
PEW	Percent Emergent Wetlands
PFO	Palustrine Forested

PFW	Percent Forested Wetlands
PL	Public Law
PM	Particulate Matter
PM_{10}	Particulate Matter Measuring Less than 10 Microns in Diameter
$PM_{2.5}$	Particulate Matter Measuring Less than 2.5 Microns in Diameter
pO	The Probability of a Queue Free State for the Movement
ppb	Parts per Billion
ppm	Parts per Million
Prot	Protected
psi	Pounds per Square Inch
PSS	Palustrine Scrub/Shrub
PUB	Palustrine Unconsolidated Bottoms
PUS	Palustrine Unconsolidated Shores
PVC	Polyvinyl Chloride
PX	Post Exchange
RAC	Risk Assessment Code
RAP	Response Action Plan
RCI	Residential Communities Initiative
RCRA	Resource Conservation and Recovery Act
RDTE	Research, Development, Testing and Evaluation
RDX	Hexahydro-trinitro-triazine
RFI	RCRA Facility Investigation
RIMS II	Regional Input-output Modeling Systems
RMW	Regulated Medical Waste
ROD	Record of Decision
ROI	Region of Influence
RONA	Record of Non-applicability
RPMP	Real Property Master Plan
RV	Recreational Vehicle
SA IAP	San Antonio International Airport
SAEMS	San Antonio Emergency Medical Services
SAER	San Antonio EAC Region
SAFD	San Antonio Fire Department
SAMBIO	San Antonio Medical BRAC Integration Office

SAMMC	San Antonio Military Medical Center
SAMMC-N	San Antonio Military Medical Center – North, at FSH
SAMMC-S	San Antonio Military Medical Center – South, at Lackland AFB
SAPD	San Antonio Police Department
SARA	San Antonio River Authority
SARA	Superfund Amendments and Reauthorization Act
Satd	Saturated
SAWS	San Antonio Water System
SB	South Bound
SBL	South Bound Left
SBR	South Bound Right
SBT	South Bound Through
SCIF	Sensitive Compartmented Information Facility
SDWA	Safe Drinking Water Act
sf	Square Feet
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
Sixth Army/USARSO	Sixth Army/U.S. Army South
SO_2	Sulfur Dioxide
SOP	Standard Operating Procedure
SO_X	Oxides of Sulfur
SPCC	Spill Prevention, Control and Countermeasures
SPiRiT	Sustainable Project Rating Tool
SRCC	Southern Region Contracting Command
SSI	Statistically Significant Increase
SSSA	Soil Science Society of America
SVOC	Semivolatile Organic Compound
SW ARISC	Southwest Army Reserve Intelligence Support Center
SWDA	Solid Waste Disposal Act
SWMU	Solid Waste Management Unit
SWPPP	Stormwater Pollution Prevention Plan
sy	Square Yards
TABS	The Army Basing Study
TAC	Texas Administrative Code

tC	The Critical Gap Time for Single Stage Crossing
TCA	Tactical Concealment Area
TCE	Trichloroethylene
TCEQ	Texas Commission on Environmental Quality
TCP	Traditional Cultural Property
TDS	Total Dissolved Solids
TDWR	Texas Department of Water Resources
TEA	Texas Education Agency
tF	The Follow-up Time
THC	Texas Historical Commission
TMDL	Total Maximum Daily Load
TNRCC	Texas Natural Resource Conservation Commission
TPDES	Texas Pollutant Discharge Elimination System
TPH	Total Petroleum Hydrocarbons
TPWD	Texas Parks and Wildlife Department
TRRP	Texas Risk Reduction Program
TRS	Training Squadron
TSCA	Toxic Substances Control Act
TSS	Total Suspended Solids
TSWQS	Texas Surface Water Quality Standards
TWC	Texas Water Commission
UPH	Unaccompanied Personnel Housing
USACE	U.S. Army Corps of Engineers
USACHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
USAF	U.S. Air Force
USARC	U.S. Army Reserve Center
USC	U.S. Code
USCB	U.S. Census Bureau
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	Underground Storage Tank
UXO	Unexploded Ordnance

UXO-DMM-MC	Unexploded Ordnance, Discarded Military Munitions and/or Munitions Constituents
VA	Veterans Administration
Veh/h	Vehicles/Hour
v/C	Volume/Capacity Ratio
v/s	Volume/Saturated Flow Rate Ratio
VOC	Volatile Organic Compound
Vph	Vehicles/Hour
Vphpl	Vehicles per Hour/Lane
VZ	Visual Zone
WBU	Water Bearing Unit
WET	Weekend Training
WHMC	Wilford Hall Medical Center
WP	White Phosphorus
WRAIR	Walter Reed Army Institute of Research
$\mu g/cm^2$	Micrograms per Square Centimeter
$\mu g/cm^3$	Micrograms per Cubic Centimeter
$\mu g/m^3$	Micrograms per Cubic Meter

APPENDIX A

PUBLIC PARTICIPATION AND AGENCY COORDINATION MATERIALS

A.1 AGENCY COORDINATION AND SCOPING COMMENTS

Fort Sam Houston, Texas

Base Realignment and Closure (BRAC) Actions

Environmental Impact Statement

SCOPING REPORT

May 2006

Fort Sam Houston, Texas
Base Realignment and Closure (BRAC) Actions
Environmental Impact Statement

SCOPING REPORT

Prepared for:
US Army Corps of Engineers
Mobile District
and
Fort Sam Houston, Texas

by:
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Kennesaw, GA 30144

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ATTACHMENTS

ACRONYMS

BRAC	Base Realignment and Closure
EIS	Environmental Impact Statement
FNSI	Finding of No Significant Impact
FSH	Fort Sam Houston

1.0 GENERAL

A public scoping meeting for the Base Realignment and Closure (BRAC) actions Environmental Impact Statement (EIS) at Fort Sam Houston (FSH) was held on Tuesday 2 May 2006, at the St. Patrick's Community Center. Two sessions were conducted from 2:00 PM to 4:00 PM and again from 7:00 PM to 9:00 PM. Public notification was published in the 26 April 2006 edition of the San Antonio Express News and the 30 April 2006 edition of La Prensa. Specific agencies were mailed invitations to attend the 2:00 to 4:00 PM scoping meeting. The meeting notice is included in Attachment 1 and the mailing list is provided in Attachment 2. The public notices not only invited interested parties to attend but also requested the submission of comments or questions concerning the proposed action or scope of issues.

The meeting format was an information fair with experts from FSH attending display booths to answer questions and speak with the interested public about the proposed action and environmental areas of concern. Photographs of the two meetings are found in Attachment 3. Those that attended were afforded the opportunity to better understand the proposed action through the visual presentations at the display tables and interactions with knowledgeable individuals available to provide more details concerning the proposed action and to discuss resource areas that would be studied for environmental impacts during the environmental impact statement preparation process.

2.0 SUMMARY

There were no major concerns or issues not previously contemplated that will require additional Government commitments that surfaced during the scoping meetings.

A few commenters were interested in the scope of the FSH development and requested the inclusion of consideration for improvements on or off post in conjunction with the proposed action development. However, none of these areas of interest are specifically linked to the proposed action and alternatives being studied in the EIS and there are no formal plans, designs or funding that would characterize them as reasonably foreseeable actions that would be considered in the EIS.

Additionally, a few commenters raised concerns about the potential of environmental impacts in the areas of traffic congestion, air quality, stormwater management (retention) and socioeconomics. All of these areas of potential impacts are included in the scope of analyses studied in the EIS.

Therefore, the public scoping meeting did not bring to light any additional alternatives to the proposed action that would require additional environmental analyses or any areas of environmental analyses that should be added to the EIS, at this time. The scope of the proposed EIS was developed very thoroughly prior to the scoping meeting by experts from many fields, including installation personnel to ensure that local issues were included. The scoping meeting validated this work.

3.0 PUBLIC COMMENTS AND RESPONSES

The two public scoping meeting sessions were held to accommodate the schedules of interested individuals and government officials. Because an information fair format was used, no testimonies were presented and therefore no transcripts were recorded. Instead, attendees were given handouts and comment cards (See Attachment 4). The scoping sessions not only provided forums for other agencies and the general public to gain information about the FSH proposed action and areas of environmental study, but also served as opportunities for the EIS preparers to gain insight about: 1) issues that potentially could be overlooked due to unawareness of the concerns or values of other parties or the FSH neighbors, and 2) those that could be eliminated that were not significant. The scoping sessions also showed the public what the proponents of the proposed action thought the issues and concerns would be, and explained how these would be addressed in the EIS.

Forty-four people attended the afternoon session while 19 attended the evening session. Twenty-one comment cards were returned with 14 comments. Original comment cards were scanned and are provided in Attachment 5. The 14 comments received were reviewed by FSH personnel with their response provided below. The six comment cards submitted only for the purpose of requesting to be added to the mailing list are not detailed below, but are included in the list found in Attachment 6.

Comment Card #1: Our neighborhood association is very concerned about traffic and air quality impact of Wilson/Cunningham Gate. We are also interested in Playland Property (currently owned by SAWS) @ N. Alamo/Cunningham/Broadway to be included in socioeconomic study along with maybe the property between Avenue B and Broadway/Cunningham/Millrace/ Brackenridge Streets in socioeconomic study.

Response to Comment Card #1: The issues of air quality, traffic, and socioeconomic will be addressed in the EIS.

Comment Card #2: 1. Cultural resources should have been represented so the public would know what to expect in regards to potential impact/changes. 2. N. New Braunfels is a major historic North/South road and should be reopened – if not to the public – at least to base personnel to reduce traffic and congestion along Broadway.

Response to Comment Card #2: 1. Ms. Jackie Schlatter of FSH was available to address pertinent cultural resource issues. 2. Comments about opening N. New Braunfels are not in the scope of this environmental documentation. This was previously addressed in an environmental assessment in 2003 entitled "Access Control Measures at Fort Sam Houston and Camp Bullis, Texas". The Finding of No Significant Impact (FNSI) was signed on 6 May 2004.

Comment Card #3: Will Salado Creek through the Fort Sam Area have hike and bike trails similar to those in San Antonio; will they be accessible to the public?

Response to Comment Card #3: This issue will not be addressed in this EIS as it is not pertinent to the BRAC actions being studied. Also, security requirements preclude opening this area to the public.

Comment Card #4: While this format did provide information, I was really expecting a formal presentation with Q & A. Also, where are your partners? Where was the City, Red Cross, etc., entities that also forge partnerships with the military to create an EIS. I hope this is considered for future meetings.

Response to Comment Card #4: Comment noted. While there are several proven formats for conducting a public scoping meeting, FSH elected to use an information fair format to present the proposed BRAC actions. The Army regulation on environmental impact analysis states a preference for an informal meeting forum for scoping meetings. For presentation of the draft

EIS, a more formal forum will be used. FSH invited several City of San Antonio departments, community organizations, and neighborhood associations (listed in Attachment 2) to participate and display at the scoping meeting, however only the Texas Department of Transportation and the Arena Area Neighborhood Association elected to participate. Because the Red Cross is not pertinent to the proposed BRAC actions, they were not invited to participate. FSH will continue to reach out to city and local organizations to participate during future public meetings.

Comment Card #5: Government Hill Alliance requests the support of Ft. Sam Houston in getting the zoning on both sides of Walters changed from heavy industrial to commercial (where appropriate) and mixed residential.

Response to Comment Card #5: This issue will not be addressed in this EIS as it is not pertinent to the BRAC actions being studied.

Comment Card #6: Careful consideration should be paid to the future use of Playland Park area – It abuts Ft. Sam Houston & 3 neighborhoods – substandard housing should not be allowed in the area.

Response to Comment Card #6: This issue will not be addressed in this EIS as it is not pertinent to the BRAC actions being studied.

Comment Card #7: Every Spurs game the access road off IH-35 S. to Walters Street is being closed by the AT&T Center & Spurs Sheriffs – They close it about 1 hour before the game is over & leave it closed for about 1 – 1½ hours after the game. Councilman Williams called a meeting. with the Sheriffs & Govt. Hill Alliance Board members – all they said was they will study it – no resolution to date – HELP!

Response to Comment Card #7: This issue will not be addressed in this EIS as it is not pertinent to the BRAC actions being studied.

Comment Card #8 (submitted on two cards): 1. Reevaluate Walters St. cross section to include street trees & planting strip between curb & sidewalk. 2. Opportunity for COSA to realign Funston per Mahncke Park Neighborhood Plan. 3. Opportunity to reconstruct Broadway into a “signature” boulevard, address drainage issues, improve sidewalks, add street trees from Josephine to Hildebrand. 4. Opportunity to address a comprehensive rezoning of Broadway to encourage community commercial pedestrian oriented uses – currently zoned “I1 & I2”. 5.

Opportunity to infill development (townhomes, condos) east of Walters and south of Funston and encourage rehabilitation of historic buildings located at FSH. 6. Ensure onsite retention to address storm water drainage that flows. 7. Keep open space along drainage on Ft. Sam property & develop recreational trails for personnel (interface w/ Playland Park area and old acequia) – document & interpret acequia that runs through Playland Park ground. 8. Consult the following neighborhood plans to determine possible socioeconomic impacts & potential joint capital improvement projects that benefit the quality of life in adjacent neighborhoods: Government Hill Plan; Westfort Alliance; Arena/Eastside Community Plan; Mahncke Park Neighborhood Plan; Northeast Inner loop Community Plan; Austin Highway Revitalization Guidelines. 9. Protect Salado Creek greenway/wetlands w/ buffer zone. 10. Assess need for additional public transit near gates.

Response to Comment Card #8: Socioeconomics and adaptive re-use of buildings on Ft. Sam Houston will be addressed in the EIS. Stormwater drainage impacts will also be addressed in the EIS.

Comment Cards #9 - #14: Six additional comment cards were received that pertained to re-opening the closed Ft Sam Houston N. New Braunfels access gate.

Response to Comment Cards #9 - #14: The decision to permanently close the N. New Braunfels gate for security was made after the environmental impacts were analyzed and addressed in an environmental assessment in 2003 entitled “Access Control Measures at Fort Sam Houston and Camp Bullis, Texas”. The FNSI was signed on 6 May 2004. Changes to the access control points are not within the scope of the Ft Sam Houston BRAC EIS.

4.0 CONCLUSIONS AND RECOMMENDATIONS

PROPOSED ACTION ALTERNATIVES

There were no comments that directly addressed any alternatives to the proposed action as presented at the scoping meetings. However, there were a limited number of comments concerning the scope of the development and potential inclusion of consideration for improvements in conjunction with the proposed action requirements. These included:

1) Salado Creek area enhancements for recreation, such as hike and bike trails, and avoidance of new construction along the creek

2) Improvements around Walters Street Access Gate, as it has become one of the remaining opened gates, to include road improvements outside the gate to include street trees, planting strip, curb and sidewalk

3) Zoning issues along the Ft Sam Houston perimeter and access routes compatibility

4) Additional public transit opportunities near the open access gates

The proposed action resulting from the BRAC decisions and other changes anticipated at FSH resulting from other than BRAC initiatives are addressed as individual or multiple projects. Community facility improvements or additions, roadways and utility system upgrades are addressed only as supported by direct impacts related to the added mission elements. These initiatives may be considerations for the Ft. Sam Houston master plan and may be considered in future enhancement projects by the Army through normal funding or possibly through other programs such as the Department of Defense Office of Economic Adjustment Joint Land Use Studies to mitigate or prevent incompatible community development; Defense Access Road Program for public highway improvements to military installations; or the Intermodal Surface Transportation Efficiency Act for improvements in traffic congestion and air quality, or public or intermodal transportation.

However, none of these areas of interest are specifically linked to the actions being studied in the EIS and there are no formal plans, designs or funding that would characterize them as reasonably foreseeable actions that would be considered in the EIS.

Therefore, the scoping process did not surface any additional alternatives to the proposed action, as of the date of this report.

ENVIRONMENTAL IMPACTS

A few commenters raised concerns about the following areas of potential environmental impacts:

1) Traffic congestion
2) Air quality
3) Stormwater management (retention)
4) Socioeconomic impacts

All of these areas of potential impacts are to be studied in the EIS. However, some of the comments are very specifically focused on particular off-post pieces of property, road intersections or neighborhoods. The level or precision of the environmental and socioeconomic impact analyses will vary by resource area and be affected by the availability of data, accuracy of baseline conditions, stability of the variables, and a variety of other factors, as well as the models themselves. For example, a concern about the socioeconomic impacts on a particular small property located within a mile radius of the post is unlikely to be revealed through the models to be used in EIS. These are primarily driven by population migration estimates and various statistical factors used to predict job creation, housing demands, impacts on municipal services, and the like. Likewise, air quality impacts will be modeled for the air quality region monitored by Texas Commission on Environmental Quality.

Therefore, although some of the scoping comments focused on environmental impacts in various resource areas, none of these areas fall outside of those that will be analyzed in the Ft. Sam Houston EIS. However, there may be a level of expectation in precision that will not be developed in some areas of analysis due to realistic constraints in the predictive abilities of the models. Yet, in any resource area where either significant or minimal impacts are predicted on a larger scale, these outputs should provide qualitative impact information of some usefulness to the commenters that are interested in more focused results.

ATTACHMENT 1: ANNOUNCEMENTS

San Antonio Express-News WEDNESDAY, APRIL 26, 2006

in the pickup.

Marquez came to the scene to survey the damage but declined to speak to reporters.

The shooting was similar to an April 18 incident in which gunmen opened fire on two officers guarding a home that had been searched by federal forces. One

) of state investigators: "Go , light a white candle and our name on it. Place it next glass of water. And pray for *compadre*, so he will look af- ou."

There have been more than 87 slayings in Nuevo Laredo this year, most believed to be linked to a war between rival drug cartels fighting for control of the region's smuggling corridors.

mcastillo@express-news.net
The Associated Press contributed to this report.

ico back on track," Madrazo said.

Televised debates are not new in presidential politics, but this year is the first in which each of the th political parties has a real chance

The candidates were asked to ad nomic issues Tuesday, including n discussion of taxes, poverty and s development.

At one point, Madrazo slapped t ministration after Calderón mad about the need to tighten tax loopl legal and illegal.

"You guys didn't lack money," said. "You lacked talent, imagin creativity."

Venezuela to sell more oil to U.S.

ASSOCIATED PRESS

WASHINGTON — Venezuela will expand its discounted oil program for poor New Englanders next winter under a politically sensitive new deal.

"It will be a considerable expansion," said U.S. Rep. William Delahunt, D-Mass., who helped broker the deal with Venezuelan President Hugo Chávez.

The new arrangement is also likely to stoke controversy since Chávez is one of President Bush's harshest critics.

"A hidden agenda? You people know we don't have one," Chávez said Monday in Venezuela.

Chávez agreed to make more oil available at lower prices during a meeting Monday in Venezuela, Delahunt said, but no details were provided on how much.

Chávez also agreed to steer aid toward redeveloping poor U.S. neighborhoods and similar projects as part of a new social fund.

Houston-based Citgo Petroleum Corp., a subsidiary of Venezuela's state-owned oil company, last winter provided nearly 40 million gallons of discounted oil for some 181,000 households and hundreds of homeless shelters, according to the company.

Public Notice

Notice of Intent To Prepare an Environmental Impact Statement and to Conduct a Public Scoping Meeting for the Realignment of Missions at Fort Sam Houston, TX

Pursuant to the National Environmental Policy Act (NEPA), and the 2005 Base Realignment and Closure (BRAC) Commission's recommendation for Fort Sam Houston, Texas under provisions of the Defense Base Closure and Realignment Act of 1990 (Public Law 101-510) the Mobile District, U.S. Army Corps of Engineers (COE) will prepare an Environmental Impact Statement (EIS). The EIS will evaluate potential direct, indirect and cumulative impacts to the natural, physical, and human environment resulting from the construction actions required for the realignment of agencies/activities to Fort Sam Houston, Texas. The decision to prepare an EIS is, in part, contingent upon the complexity of issues identified during and following the scoping phase of the NEPA process. As part of this process, a Public Scoping Meeting (Information Fair) will be held to gain input from interested agencies, organizations, and the general public concerning the content of the EIS, issues and impacts to be addressed in the EIS, and alternatives that should be analyzed. The Public Scoping Information Fair is scheduled for May 2, 2006 at St. Patrick's Church Community Center, 1801 IH-35 North San Antonio, TX, from 7 until 9 p.m.

The COE invites full public participation to promote open communication and better decision- making. All persons and organizations in the community are urged to participate in this NEPA environmental analysis process. Assistance will be provided upon request to anyone having difficulty with learning how to participate.

Send comments and suggestions concerning this proposed action to: Environmental and Natural Resources Division, Attn: Jackie Schlatter, 2202 15th Street, Suite 36, Fort Sam Houston, TX 78234-5036, email: Jackie.Schlatter@samhouston.army.mil, Phone: (210) 221-5093 or Fax: (210) 221-5419.

We can't guarantee your comments or suggestions will be addressed in the draft EIS, unless they are received by May 9, 2006.

For more information contact: Jeffry A. Tripe BRAC NEPA Support Team, U.S. Army Corps of Engineers, Fort Worth District, 819 Taylor Street, RM 3A14, P.O. Box 17300, Fort Worth, TX 76102-0300, e-mail: Jeffry.A.Tripe@swf02.usace.army.mil, Phone (817) 886-1716 Or Fax: (817) 886-6499.

BIDS / LEGAL NOTICE / HELP WANT

Public Notice

Notice of Intent To Prepare an Environmental Impact Statement and to Conduct a Public Scoping Meeting for the Realignment of Missions at Fort Sam Houston, TX

Pursuant to the National Environmental Policy Act (NEPA), and the 2005 Base Realignment and Closure (BRAC) Commission's recommendation for Fort Sam Houston, Texas under provisions of the Defense Base Closure and Realignment Act of 1990 (Public Law 101-510) the Mobile District, U.S. Army Corps of Engineers (COE) will prepare an Environmental Impact Statement (EIS). The EIS will evaluate potential direct, indirect and cumulative impacts to the natural, physical, and human environment resulting from the construction actions required for the realignment of agencies/activities to Fort Sam Houston, Texas. The decision to prepare an EIS is, in part, contingent upon the complexity of issues identified during and following the scoping phase of the NEPA process. As part of this process, a Public Scoping Meeting (Information Fair) will be held to gain input from interested agencies, organizations, and the general public concerning the content of the EIS, issues and impacts to be addressed in the EIS, and alternatives that should be analyzed. The Public Scoping Information Fair is scheduled for May 2, 2006 at St. Patrick's Church Community Center, 1801 IH-35 North San Antonio, TX, from 7 until 9 p.m.

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We can't guarantee your comments or suggestions will be addressed in the draft EIS, unless they are received by May 9, 2006.

For more information contact: Jeffry A. Tripe BRAC NEPA Support Team, U.S. Army Corps of Engineers, Fort Worth District, 819 Taylor Street, RM 3A14, P.O. Box 17300, Fort Worth, TX 76102-0300, e-mail: Jeffry.A.Tripe@swf02.usace.army.mil, Phone (817) 886-1716 0r Fax: (817) 886-6499.

W.G. YATES & SONSCONSTRUCTION CO.
(210) 497-3973 FAX: (210) 497-3978

REQUEST FOR SUB PROPOSAL QUOTES FOR:
The University of Texas at San AntonioThermal Energy Plant No.2Proposal
Due: April 27, 2006 @ 2:00 pm
PLEASE HAVE SCOPE SHEETS FAXED IN ADVANCE

MBE/SBE/AABE/HUB/FIRMS ARE INVITED TO SUBMIT BIDS.W.G. YATES IS AN EQUAL EMPLOYMENT OPPORTUNITY (EEO) EMPLOYER

W.G. YATES & SONSCONSTRUCTION CO.
(210) 497-3973 FAX: (210) 497-3978

REQUEST FOR SUB PROPOSAL QUOTES FOR:
The University of Texas at San AntonioUniversity Center Expansion, Phase III
Proposal Due: May 4, 2006 @ 2:00 pm
PLEASE HAVE SCOPE SHEETS FAXED IN ADVANCE

MBE/SBE/AABE/HUB/FIRMS ARE INVITED TO SUBMIT BIDS.W.G. YATES IS AN EQUAL EMPLOYMENT OPPORTUNITY (EEO) EMPLOYER

Invitation for Bids
AMD-06-86-1760

San Antonio Housing Authority will receive Bids for:

Environmental Abatement at Cassiano Homes, TEX6-06.

Plans and Specifications: Will be obtained at Environmental Occupational Solutions, 17425 Redland Rd., San Antonio, Texas 78247. $50 deposit per set is required.

Due Date/Bid Time: Thursday, may 4, 2006 at 4:00 p.m. CST at SAHA, 818 S. Flores St., Real Estate Services Dept., San Antonio, Texas 78205.

Pre-Bid Meeting: Tuesday, April 18, 2006 at 2:00 p.m. at Cassiano Homes Administrative Bldg., 2919 S. Laredo, San Antonio, Texas 78207.

Contact Person: Jon Jackson, at (210) 495-9009.

NOTICE: The resulting contract will be funded through Section 3 covered assistance and will be subject to Section 3, 24 CFR Part 135.

Henry A. Alvarez III
President & CEO

REQUEST FOR PROPOSALS
HASA-0604-112-1752
FOR
PLUMBING SERVICES AND REPAIRS

San Antonio Housing Authority (hereafter "SAHA") will receive proposals for: Plumbing Services and Repairs, until **2:00p.m.** local time **24 May 2006** at SAHA's Central Office, located at 818 S. Flores, San Antonio, Texas 78204.

Availability of Specifications Packages:

Ordering Instructions: The package can be requested from Onvia on our website at http://www.demandstar.com, or http://www.saha.org. or by calling 210-477-6166.

Henry A. Alvarez III
President & CEO

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questionr
2nd floor,
consult
regarding

Leticia M.
CITY CLE

ATTACHMENT 2: MAILING LIST

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Joven
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San Antonio, TX 78214

Liza Meyer
Keep San Antonio Beautiful
1940 Grandstand
San Antonio, TX 78238

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League of Inner-City Neighborhoods
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San Antonio, TX 78210

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Government List

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Senate Russell Bldg, Court Yard No. 5
Washington, DC 20510

Honorable Kay Bailey Hutchison
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San Antonio, TX 78226-1898

UNITED STATES

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Honorable Charles A Gonzalez
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Honorable Ruth Jones McClendon
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Honorable Robert R. Puente
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San Antonio, TX 78223

Honorable Carlos Uresti
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Alamo Heights, TX 78209

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101 Central Avenue
Mescalero, NM 88340

Wallace Coffey, Chairman
Comanche Tribe
PO Box 908
Lawton, OK 73502

Mark Chino, President
Mescalero Apache and Affiliated Tribes
PO Box 227
Mescalero, NM 88340

Carl Martin, President
Tonkawa Tribe
PO Box 70
Tonkawa, OK 74653

Gary McAdams, President
Wichita and Affiliated Tribes
PO Box 729
Anadarko, OK 73005

Theodosa Herrera, Tribal Leader
Tap Pilam Coahuiltecan Nation
PO Box 460346
San Antonio, TX 78246

Mr. Robert T. Pine
Supervisor
U.S. Fish and Wildlife Service
10711 Burnet Road, Suite 200
Austin, TX 78758

Mr. Robert Cook
4200 Smith School Rd.
Austin, TX 78744

Ms. Abbi Power
14250 Judson Road
San Antonio, TX 78233-4480

Ms. Marilynn Grossman
Office of the Director
301 Tarrow, Suite 364
College Station, TX 77840-7896

Mr. George Ozuna
U.S. Geological Survey
5563 De Zavala Road,
Suite 290
San Antonio, TX 78249

Mr. David Chardavoyne
President/CEO
San Antonio Water System
2800 U.S. Hwy 281
PO Box 2449
San Antonio, TX 78298-2449

Mr. Robert J. Potts
General Manager
Edwards Aquifer Authority
1615 N. St. Mary St.
San Antonio, TX 78215

Aquifer Guardians in Urban Areas
PO Box 15618
San Antonio, TX 78212

Mr. Gregg Rothe
General Manager
San Antonio River Authority
100 East Guenther St.
San Antonio, TX 78204

MEDIA CONTACTS

PRINT

San Antonio Express News
Associated Press
La Prensa
SA Business Journal
Dallas Morning News
The Herald Prime Time
Houston Chronicle
Rumbosa

TELEVISION

KABB (Fox)
KENS (CBS) Channel 5
WOAI Channel 4
WSAT Channel 12
KVDA Channel 60 (Spanish)
KWEX Channel 41 (Spanish)

RADIO

KTSA/KTFM
WOAI

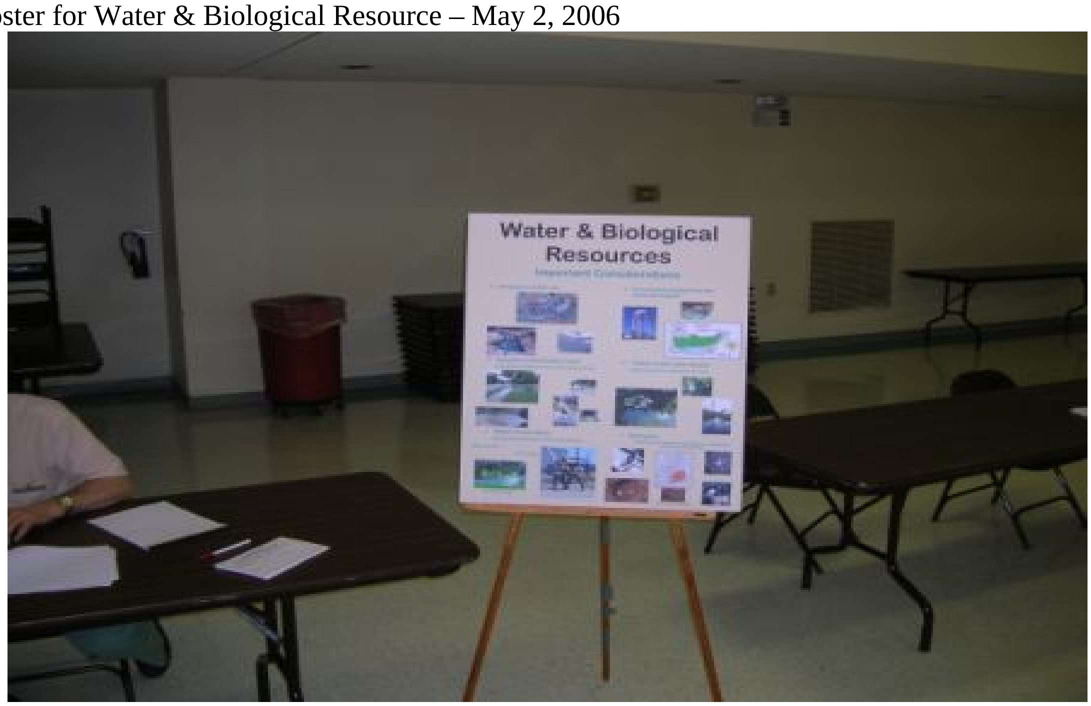
ATTACHMENT 3: PHOTOGRAPHS - SCOPING MEETINGS

Afternoon Scoping Meeting – May 2, 2006

Evening Scoping Meeting – May 2, 2006

Evening Scoping Meeting – May 2, 2006

Poster for Water & Biological Resource – May 2, 2006



ATTACHMENT 4: HANDOUT MATERIAL

Scoping Meeting for the Environmental Impact Statement for Base Realignment and Closure (BRAC) Realignment Actions at Fort Sam Houston, Texas

May 02, 2006
2:00 p.m.—4:00 p.m. and 7:00 p.m.—9:00 p.m.
Saint Patrick's Church, San Antonio, Texas

What is the purpose of this scoping meeting?

Scoping is a part of the environmental impact statement (EIS) preparation process through which a federal agency describes a proposed action and possible alternatives and seeks input from other agencies, organizations, and the public on potentially affected resources, environmental issues to be considered, and the agency's planned approach to the analysis to be conducted. We hope that you will share with us your thoughts on what issues we should consider as we develop the scope of the EIS for the realignment of Fort Sam Houston, Texas.

This meeting is open-house style, with information stations available to help attendees identify potential issues and concerns to be addressed in the EIS. The stations provide information on topics such as population, economics, and the proposed action; traffic and air quality; noise; natural resources; historic and archeological resources; and the National Environmental Policy Act of 1969 (NEPA), EIS, and public involvement processes. Representatives are available for questions.

Written comments concerning the EIS may be submitted at the scoping meeting or sent by regular mail or by e-mail (see public notice). Oral comments may be submitted at the scoping meeting.

What is the National Environmental Policy Act?

NEPA requires the analysis of potential environmental effects associated with major federal actions. NEPA ensures that social and environmental factors are considered along with the technical and economic components of a decision and requires that potential environmental impacts, and any adverse effects that cannot be avoided, be identified and alternatives to the proposed action be considered. NEPA also requires consultation with all relevant federal agencies to determine these impacts.

NEPA is a "full disclosure" law with provisions for public access to, and full participation in, the federal decision-making process. The act's intent is to protect, restore, and enhance the environment through well-informed federal decisions.

Two NEPA documents will be created in the course of this action:

- An EIS that analyzes any potential significant environmental and socioeconomic impacts.
- A Record of Decision (ROD) that documents the final decision on the proposed action and specifies mitigation measures (methods to lessen negative impacts) and monitoring programs to be undertaken.

What is an Environmental Impact Statement?

An EIS is a summary of a detailed study that analyzes the environmental impacts of a proposed action and its alternatives. It also includes an extensive public involvement process. The potential for significant environmental effects or high public interest associated with a proposed action is usually the basis for preparing an EIS.

An EIS analyzes the potential effects of a proposed action and alternatives on the human, socioeconomic, and natural environments. It describes the baseline (affected environment) against which effects are evaluated and then identifies potential consequences and appropriate mitigation measures.

Why does Fort Sam Houston need an EIS for the BRAC Action?

While the decision to realign Fort Sam Houston is not subject to NEPA, NEPA is required to analyze the potential environmental effects of how the realignment of Fort Sam Houston will be accomplished. Title 32 of the *Code of Federal Regulations* Part 651, Environmental Analysis of Army Actions, also requires a NEPA analysis.

What was the BRAC Commission's recommendation pertaining to Fort Sam Houston?

The 2005 BRAC Commission recommended that the following activities occur as part of the realignment of Fort Sam Houston:

- Close Fort McPherson, GA and relocate the Army Contracting Agency Southern Region Headquarters to Fort Sam Houston.
- Close Air Force Research Lab, Mesa City, AZ and relocate Air Force and Navy directed energy research labs to Fort Sam Houston.
- Realign the Zachary Taylor Building, a leased installation in Arlington, VA, by relocating the Army Installation Management Agency headquarters to Fort Sam Houston.
- Realign Rock Island Arsenal, Illinois, as follows: relocate the Army Installation Management Agency Northwest Region headquarters to Fort Sam Houston, and consolidate it with the Army Installation Management Agency Southwest Region headquarters to form the Army Installation Management Agency Western Region; and relocate the Army Network Enterprise Technology Command Northwest Region headquarters to Fort Sam Houston, and consolidate it with the Army Network Enterprise Technology Command Southwest Region headquarters to form the Army Network Enterprise Technology Command Western Region.
- Realign Seven Corners Corporate Center, a leased installation in Falls Church, VA, and 4700 King Street, a leased installation in Alexandria, VA, by relocating the Army Community and Family Support Center to Fort Sam Houston.
- Realign Rosslyn Metro Center, a leased installation in Arlington, VA, by relocating the Army Family Liaison Office to Fort Sam Houston.
- Realign Skyline Six, a leased installation in Falls Church, VA, by relocating the Army Contracting Agency headquarters to Fort Sam Houston.
- Realign the Hoffman 1 Building, a leased installation in Alexandria, VA, by relocating the Army Contracting Agency E-Commerce Region headquarters to Fort Sam Houston.
- Realign Fort Buchanan, Puerto Rico, by relocating the Army Contracting Agency Southern Hemisphere Region headquarters to Fort Sam Houston.
- Realign Aberdeen Proving Ground, MD, by relocating the Army Environmental Center to Fort Sam Houston.
- Realign Walter Reed Army Medical Center, Washington, DC, as follows: relocate enlisted histology technician training to Fort Sam Houston; relocate the Combat Casualty Care Research sub-function (with the exception of those organizational elements performing neuroprotection research) of the Walter Reed Army Institute of Research (Forest Glen Annex) and the Combat Casualty Care Research sub-

function of the Naval Medical Research Center (Forest Glen Annex) to the Army Institute of Surgical Research, Fort Sam Houston.

- Close Brooks City Base, San Antonio, TX and relocate the Army Medical Research Detachment to the Army Institute of Surgical Research, Fort Sam Houston.

- Realign Naval Air Station Great Lakes, IL, Sheppard Air Force Base, TX, Naval Medical Center Portsmouth, Naval Medical Center San Diego, CA, by relocating basic and specialty enlisted medical training to Fort Sam Houston.

- Realign Building 42, 8901 Wisconsin Ave, Bethesda, MD, by relocating the Combat Casualty Care Research sub-function of the Naval Medical Research Center to the Army Institute of Surgical Research, Fort Sam Houston.

- Realign Naval Station Great Lakes, IL, by relocating the Army Dental Research Detachment, the Air Force Dental Investigative Service, and the Naval Institute for Dental and Biomedical Research to the Army Institute of Surgical Research, Fort Sam Houston.

- Realign Fort Sam Houston, and Randolph AFB, by relocating the installation management functions to Lackland AFB, TX.

What will be evaluated in the EIS?

The EIS will evaluate the potential impacts of realigning Fort Sam Houston on land use, aesthetics, air quality, noise, biological resources, water resources, cultural resources, traffic and transportation, socioeconomics and quality of life, environmental justice, utility system infrastructure and capacity, and hazardous and toxic materials and wastes. The EIS will consider a range of alternatives to accommodate the realignment of Fort Sam Houston. The EIS will also evaluate locations for training activities at Camp Bullis, Texas.

What are the opportunities for public involvement?

This scoping meeting is the first formal opportunity for sharing your thoughts and concerns regarding issues to be evaluated in the EIS. In addition, the public will have two other formal opportunities to comment: after the Draft EIS and the Final EIS are published.

The Draft EIS is expected to be available for public review in October 2006. At that time, a Notice of Availability of the Draft EIS will be published in the *Federal Register*, notices will appear in local newspapers, and a public meeting will be held to facilitate public comment. Written and oral comments will be accepted for a period of 45 days from the date the Draft EIS is made available.

The Final EIS is scheduled to be available in March 2007. At that time, a Notice of Availability will be published in the *Federal Register*, and the Final EIS will be available for public review for 30 days.

Projected EIS Timeline

Public Scoping Meeting	May 02, 2006
Scoping Comments Deadline	May 09, 2006
Draft EIS Available for Review	October 2006
Draft EIS Public Meeting	November 2006
Draft EIS Comments Due	45 days from publication of the Notice of Availability in the Federal Register
Final EIS Available for Review	March 2007
Record of Decision	April 2007

Commenting on the EIS

The Army welcomes your input on the issues and concerns that should be addressed in the Fort Sam Houston BRAC EIS. If you would like to submit a written comment, please complete a Comment Card and give it to one of the representatives at the scoping meeting. If you would like to mail your comments later, please send them to:

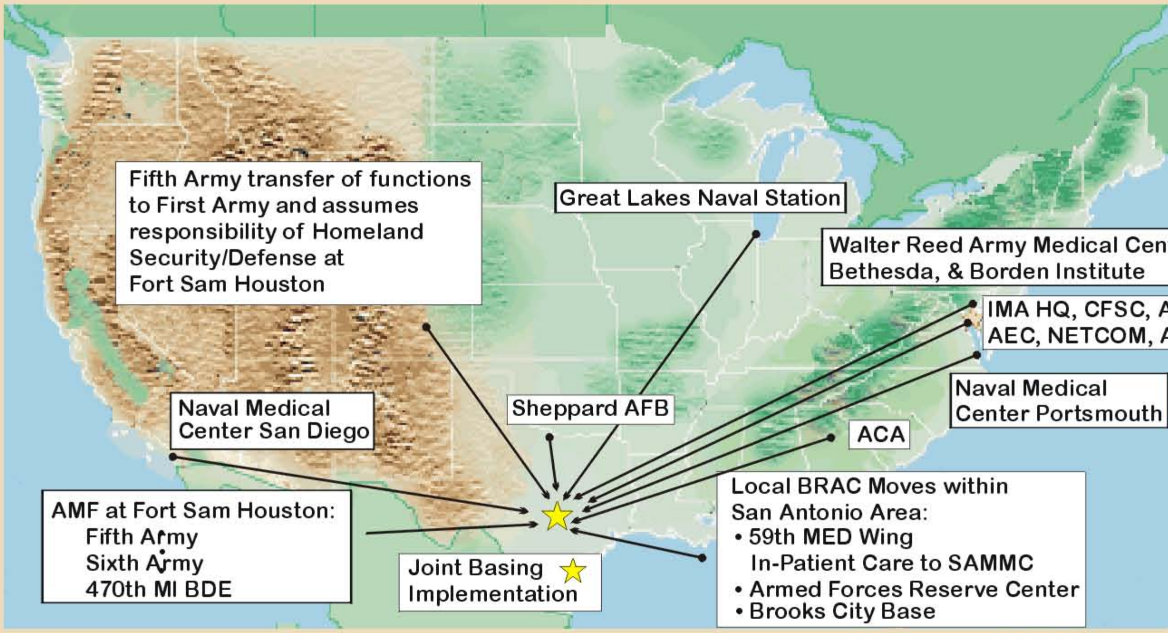
Environmental and Natural Resources Division
ATTN: Jackie Schlatter
BLDG 4196
2202 15th Street, STE 36
Fort Sam Houston, TX 78236
Fax: 210/221-5419
e-mail: jackie.schatter@samhouston.army.mil

or

U.S. Army Corps of Engineers
ATTN: Jeffry A. Tripe
819 Taylor Street, RM 3A14
P.O. Box 17300
Fort Worth, Texas 76102-0300
Fax: 817/886-6499
e-mail: Jeffry.A.Tripe@swf02.usace.army.mil

Cumulative Effects

The Environmental Impact Study helps us understand how all these moves affect us.



POPULATION

BRAC Directed Moves (Student Growth-5,266) *Does not include AFRC growth	10,269
Army Modular Force Growth	980
Base Operations Plus up (Garrison Staff Estimate)	200
Base Operations Plus up (COBRA)	174
Family Members	5,717
TOTAL	17,340

Construction

SQUARE FOOTAGE	9,541,385
New Construction	8,473,616
Renovation	1,067,769
DOLLARS (Estimate)	$1.54 B
New Construction	$1.39 B
Renovation	$153 M

What we are studying

Air/Hazardous
Waste/Noise/Geology/Utilities
Biological/Water Resources
Cultural Resources/Land Use
Planning
Socioeconomics
Traffic

CURRENT MISSION EXPANSION

- Medical Training
- Patient Care
- Headquarters / C2

Army Modular Force

- Fifth U.S. Army
- Sixth U.S. Army
- 470th Military Intelligence Brigade

NEW BRAC MISSIONS

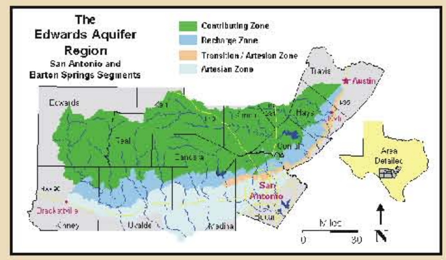
- MEDICAL TRAINING: Medical Educational Training Campus
- PATIENT CARE: San Antonio Military Medical Center
- HEADQUARTERS: IMA, ACA, AEC, CFSC, AFLO
- MEDICAL RESEARCH: Joint Center of Excellence Battlefield Health/Trauma
- NON-MED RESEARCH: Joint Directed Energy Lab
- USAR / ARNG UNIT: Armed Forces Reserve Center at Camp Bullis

Water & Biological Resources

Important Considerations

✓ Increase in water use

✓ Increased pumping from the Edwards Aquifer



✓ Increase in stormwater runoff

Look at how to reduce erosion and flooding potential

✓ Salado Creek water quality

Address the Post's segment of the creek

✓ Water Conservation

We will examine the Post's water reuse program

Water reuse for :

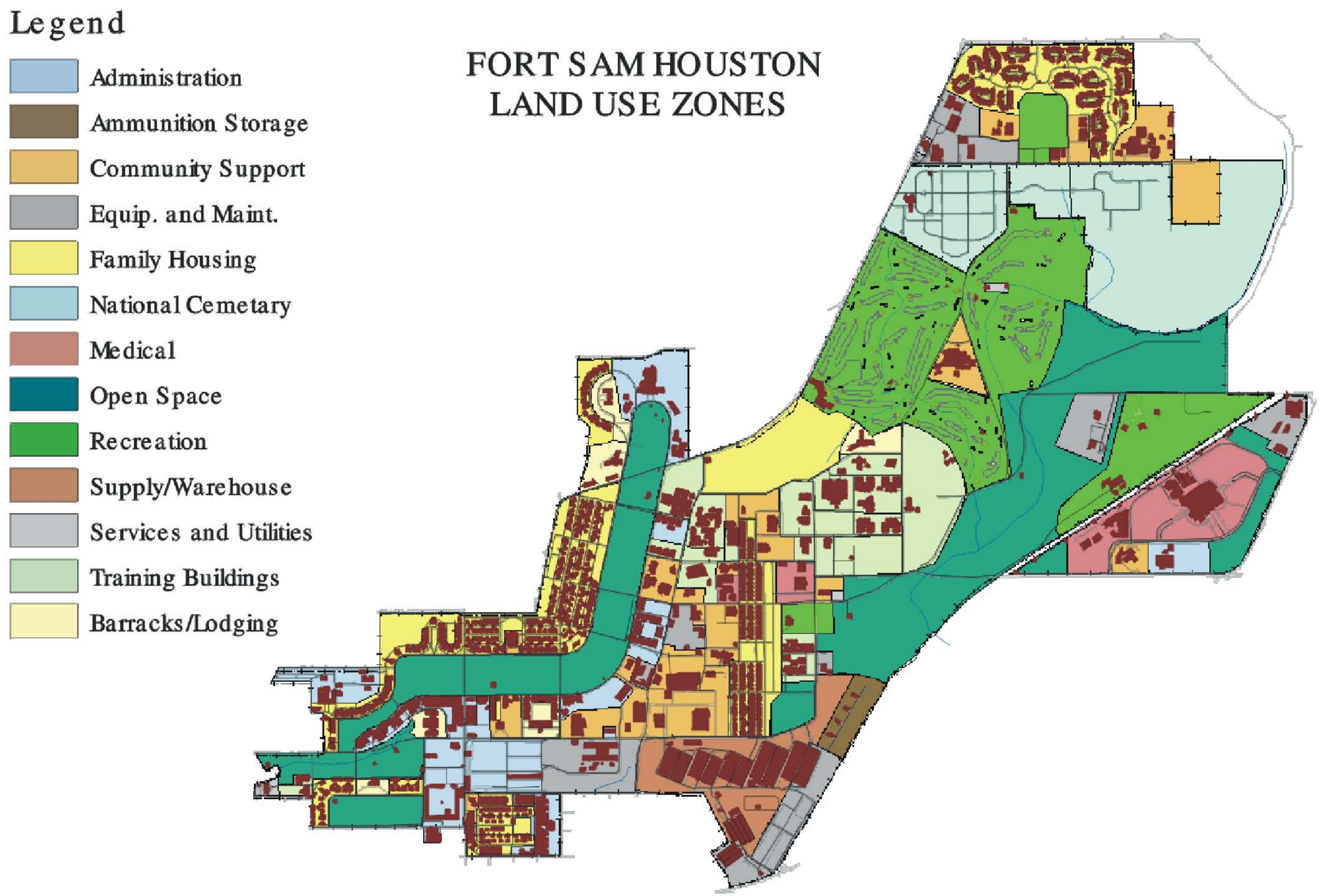
Fire Training

The Golf Course

✓ Biological

Determine the status of threatened or endangered species at Camp Bullis

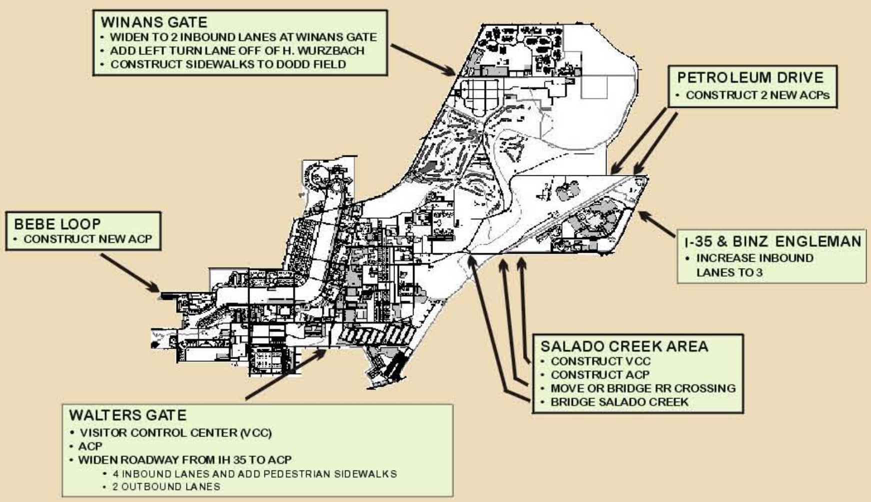
Photos Courtesy of Jean Kreica


FORT SAM HOUSTON
LAND USE ZONES
Legend
Administration
Ammunition Storage
Community Support
Equip. and Maint.
Family Housing
National Cemetary
Medical
Open Space
Recreation
Supply/Warehouse
Services and Utilities
Training Buildings
Barracks/Lodging

Traffic

What the Environmental Impact Statement studies

- ✓ Predicted changes in post and local traffic patterns
- ✓ Assess traffic conditions at off-post intersections located near the entry gates
- ✓ Determine potential changes in traffic volume and the impacts to Ft. Sam Houston gates and nearby off-post intersections
- ✓ Indicate where traffic problems may occur

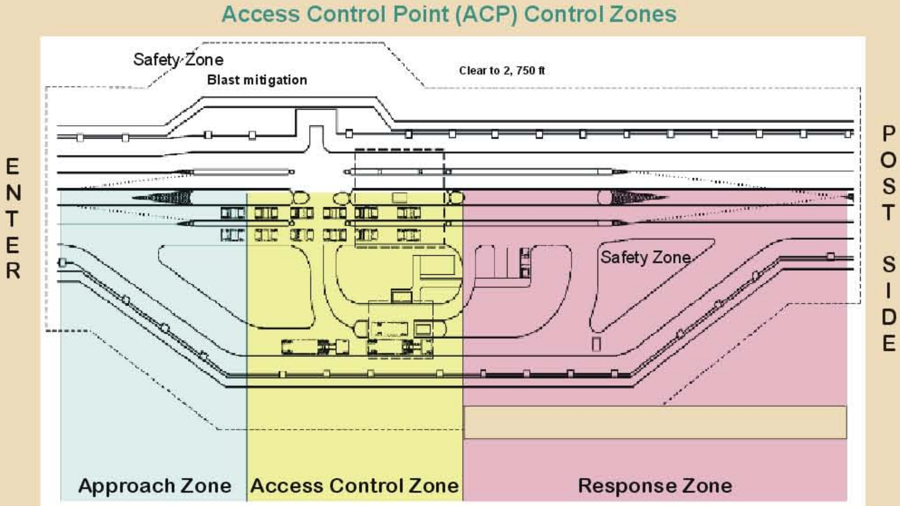


Weekly ACP Inbound Traffic

Week 3-9 APR 06

Notes:
1. New Braunfels outbound traffic only.
2. Counts affected by construction.

Access Control Point (ACP) Control Zones



Approach Zone	Access Control Zone	Response Zone
• Reduce speed • Sort traffic • Queuing • Stand- Off	• Determine authorization • Inspection • RAM	• Security force response • Final active barriers • Speed and distance • Containment

Main Gate
N. Walters

Socioeconomics

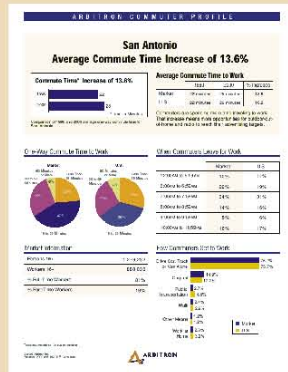
Important Considerations

Local Housing Demand

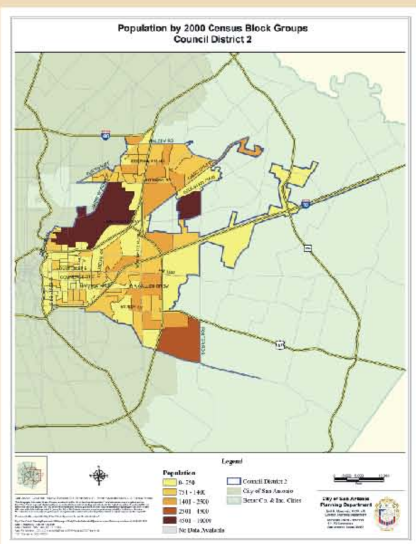
San Antonio is now the 19th largest housing market in the country

Fortune magazine declared San Antonio the nation's strongest housing market

Commuting

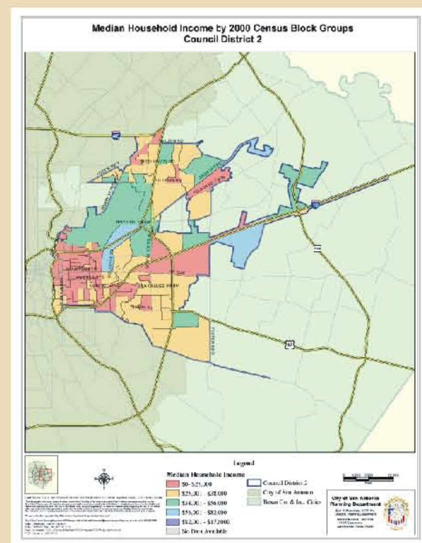


Traffic and commuting patterns will be studied



A Regional Economic Impact Analysis using the Economic Impact Forecast System (EIFS)will be completed

The EIFS uses data such as construction cost, number of military and civilian employees and their average salaries to assess potential impacts on the areas business volume, employment, personal income, and population.



Medical Services

Effects on hospital and patient services

University Health System

CHRISTUS SANTA ROSA Health Care

Southwest GENERAL HOSPITAL

Schools

Effects on available of educational services

Air Quality, Noise, Geology, and Utilities

Important Considerations

Air Quality

- ✓ Potential air pollutant levels due to new or increased activities

Boiler photos courtesy of Parker Industrial Boilers

National Ambient Air Quality Standards

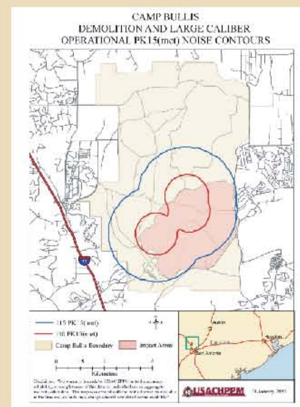
Carbon Monoxide - 1 Hr Ave	35 ppm
Nitrogen Dioxide -	0.053 ppm
Ozone - 8 hr ave	0.08 ppm
Lead - Quarterly Ave	1.5 µg/m³
Particulate Matter	50 µg/m³
Sulfur Dioxide	0.03 ppm

ppm= parts per million

µg/m³= micro grams per cubic meter

Noise

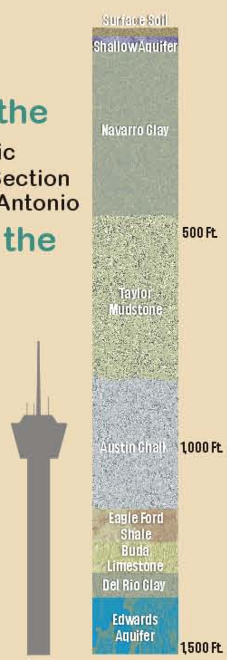
- ✓ Noise impacts from weapons practice, and aircraft operations in the vicinity of Camp Bullis
- ✓ Flight corridors used by Life Flights to the BAMC helipad



Geology

- ✓ Potential for changes in permeability and recharge of the Edwards Aquifer
- ✓ Potential geotechnical limitations for construction of the Camp Bullis Medical Training Facility

Geologic Cross Section of San Antonio



Utilities

- ✓ Requirements for Natural Gas, Electricity, and Sanitary Sewers
- ✓ Requirements for communications and fiber optic cabling

Comment Card

Fort Sam Houston welcomes your input!

If you would like to provide a comment on the Post's
Base Realignment and Closure (BRAC) actions please use this card.

Your name and address is not required. However, If you would like to be added to the mailing list please PRINT the following information.

MRS.
MS.
MR. ____

(First Name) (Last Name)

____

Address City State Zip Code

Comment: ____

____

____

____ **Over**

Comment Card

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If you would like to provide a comment on the Post's
Base Realignment and Closure (BRAC) actions please use this card.

Your name and address is not required. However, If you would like to be added to the mailing list please PRINT the following information.

MRS.
MS.
MR. ____

(First Name) (Last Name)

____

Address City State Zip Code

Comment: ____

____

____

____ **Over**

Comments continued

Privacy Advisory: As the United States Army undertakes the preparation of an environmental impact statement (EIS) on the realignment of Fort Sam Houston, Texas, we invite you to participate. Your information in identifying important issues that need to be studied will assist the U.S. Army in formulating alternatives and carrying out our responsibilities under the National Environmental Policy Act. Comments, names, and addresses are generally made available for public review although personal home addresses and phone numbers will not be published in the final EIS. **Individuals wishing to have their name, address and phone number withheld from public disclosure to the extent allowed by law, should check this box** ☐

Comments continued

Privacy Advisory: As the United States Army undertakes the preparation of an environmental impact statement (EIS) on the realignment of Fort Sam Houston, Texas, we invite you to participate. Your information in identifying important issues that need to be studied will assist the U.S. Army in formulating alternatives and carrying out our responsibilities under the National Environmental Policy Act. Comments, names, and addresses are generally made available for public review although personal home addresses and phone numbers will not be published in the final EIS. **Individuals wishing to have their name, address and phone number withheld from public disclosure to the extent allowed by law, should check this box** ☐

ATTACHMENT 5: COMMENTS

Comment Card

Fort Sam Houston welcomes your input!

If you would like to provide a comment on the Post's Base Realignment and Closure (BRAC) actions please use this card.

Your name and address is not required. However, if you would like to be added to the mailing list please PRINT the following information.

MRS.
MS.
MR. Kirsten Pelsor (Westfort Alliance Neighborhood Association

(First Name) (Last Name)

[redacted]

Address City State Zip Code

Comment: Our neighborhood association is very concerned about traffic and air quality impact of Wilson/Cunningham Gate. We are also interested in Playland Property (currently

Comment Card #1

Over

Kirsten Pelsor (back)

Comments continued

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owned by SAWS) @ N. Alamo/Cunningham/Broadway to be included in Socioeconomic Study along with maybe the property between Avenue B and Broadway/Cunningham, Millrace, Brackenridge Streets in Socioeconomic Study

Comment Card #1

Comment Card #2

Comment Card

Fort Sam Houston welcomes your input!

If you would like to provide a comment on the Post's Base Realignment and Closure (BRAC) actions please use this card.

Your name and address is not required. However, If you would like to be added to the mailing list please PRINT the following information.

MRS.
MS.
MR. Cherise Bell

(First Name) (Last Name)

[redacted]

Address City State Zip Code

Comment:

① Cultural Resources should have been represented so the public would know what to expect in regards to **Over**

Cherise Bell comment back

Comment Card #2

Comments continued

Privacy Advisory: As the United States Army undertakes the preparation of an environmental impact statement (EIS) on the realignment of Fort Sam Houston, Texas, we invite you to participate. Your information in identifying important issues that need to be studied will assist the U.S. Army in formulating alternatives and carrying out our responsibilities under the National Environmental Policy Act. Comments, names, and addresses are generally made available for public review although personal home addresses and phone numbers will not be published in the final EIS. **Individuals wishing to have their name, address and phone number withheld from public disclosure to the extent allowed by law, should check this box** ☐

potential impact/changes

2. N New Braunfels is a major historic North/south road and should be reopened - if not to the public - at least to base personnel to reduce traffic and congestion along Broadway.

~~Comment Card #3~~

Comment Card

Fort Sam Houston welcomes your input!

If you would like to provide a comment on the Post's Base Realignment and Closure (BRAC) actions please use this card.

Your name and address is not required. However, if you would like to be added to the mailing list please PRINT the following information.

MRS.
MS.
MR. William Barman

(First Name) (Last Name)

[redacted]

Address City State Zip Code

Comment: Will Salado Creek through the Fort Sam area have hike and Bike Trails similar to those in San Antonio Will they be assessible to the publi **Over**

Comments continued

Privacy Advisory: As the United States Army undertakes the preparation of an environmental impact statement (EIS) on the realignment of Fort Sam Houston, Texas, we invite you to participate. Your information in identifying important issues that need to be studied will assist the U.S. Army in formulating alternatives and carrying out our responsibilities under the National Environmental Policy Act. Comments, names, and addresses are generally made available for public review although personal home addresses and phone numbers will not be published in the final EIS. **Individuals wishing to have their name, address and phone number withheld from public disclosure to the extent allowed by law, should check this box** ☐

Comment Card #4

Comment Card

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Your name and address is not required. However, if you would like to be added to the mailing list please PRINT the following information.

MRS.
MS.
MR. Comments on Back of Card.

(First Name) (Last Name)

(No name)

Address City State Zip Code

Comment:

Over

(No name), (Comments) back

Comment Card #4

Comments continued

Privacy Advisory: As the United States Army undertakes the preparation of an environmental impact statement (EIS) on the realignment of Fort Sam Houston, Texas, we invite you to participate. Your information in identifying important issues that need to be studied will assist the U.S. Army in formulating alternatives and carrying out our responsibilities under the National Environmental Policy Act. Comments, names, and addresses are generally made available for public review although personal home addresses and phone numbers will not be published in the final EIS. **Individuals wishing to have their name, address and phone number withheld from public disclosure to the extent allowed by law, should check this box** ☐

While this format did provide information, I was really expecting a formal presentation with Q & As. Also, where are your partners? Where was the City, Red Cross etc., entities that also forge partnerships with the military to create an EIS. I hope this is considered for future meetings.

Comment Card

Fort Sam Houston welcomes your input!

If you would like to provide a comment on the Post's Base Realignment and Closure (BRAC) actions please use this card.

Your name and address is not required. However, If you would like to be added to the mailing list please PRINT the following information.

MRS. / MS. / MR. Marlene Hawkins
(First Name) (Last Name)

[redacted]
Address City State Zip Code

Comment:

Government Hill Alliance requests the support of Ft. Sam Houston in getting the zoning on both sides of Walters changed from Heavy industrial

Comment Card #5

Over

Marlene Hawkins (back)

Comments continued

Privacy Advisory: As the United States Army undertakes the preparation of an environmental impact statement (EIS) on the realignment of Fort Sam Houston, Texas, we invite you to participate. Your information in identifying important issues that need to be studied will assist the U.S. Army in formulating alternatives and carrying out our responsibilities under the National Environmental Policy Act. Comments, names, and addresses are generally made available for public review although personal home addresses and phone numbers will not be published in the final EIS. **Individuals wishing to have their name, address and phone number withheld from public disclosure to the extent allowed by law, should check this box** ☑

President of Government Hill Alliance

Comment Card #5

Comment Card #6

Comment Card

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If you would like to provide a comment on the Post's Base Realignment and Closure (BRAC) actions please use this card.

Your name and address is not required. However, If you would like to be added to the mailing list please PRINT the following information.

MRS. MS. MR. MARIE STOUT
(First Name) (Last Name)

[redacted]
Address City State Zip Code

Comment: Careful consideration should be paid to the future use of Playland Park area - It abuts Ft. Sam Houston + 3 neighborhoods - Substandard **Over**

Marie Stoot coments (back)
Comment Card #6

Comments continued

Privacy Advisory: As the United States Army undertakes the preparation of an environmental impact statement (EIS) on the realignment of Fort Sam Houston, Texas, we invite you to participate. Your information in identifying important issues that need to be studied will assist the U.S. Army in formulating alternatives and carrying out our responsibilities under the National Environmental Policy Act. Comments, names, and addresses are generally made available for public review although personal home addresses and phone numbers will not be published in the final EIS. **Individuals wishing to have their name, address and phone number withheld from public disclosure to the extent allowed by law, should check this box** ☐

housing should not be allowed in the area.

Comment Card

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If you would like to provide a comment on the Post's Base Realignment and Closure (BRAC) actions please use this card.

Your name and address is not required. However, If you would like to be added to the mailing list please PRINT the following information.

(Board member Govt Hill neighborhood Alliance)

MRS. MS. MR. HEIDI Mummau
(First Name) (Last Name)

[redacted]

Address City State Zip Code 78208

Comment: Every Spurs Game the Access Road off IH 35 S. to Walters Street is being closed by the AT&T Center & Spurs Sheriffs - they close it about 1 hour before the game is over & leave it closed for about 1-1½ hrs. after the game

Comment Card #7

Over

Heidi Mummau comments (back)

Comments continued

Privacy Advisory: As the United States Army undertakes the preparation of an environmental impact statement (EIS) on the realignment of Fort Sam Houston, Texas, we invite you to participate. Your information in identifying important issues that need to be studied will assist the U.S. Army in formulating alternatives and carrying out our responsibilities under the National Environmental Policy Act. Comments, names, and addresses are generally made available for public review although personal home addresses and phone numbers will not be published in the final EIS. **Individuals wishing to have their name, address and phone number withheld from public disclosure to the extent allowed by law, should check this box** ☐

Councilman Williams called a mtg. with the Sheriffs & Govt Hill Alliance Board members - all they said was they will study it - no resolution to date - HELP!!

Comment Card #7

1

Comment Card

Fort Sam Houston welcomes your input!

If you would like to provide a comment on the Post's Base Realignment and Closure (BRAC) actions please use this card.

Your name and address is not required. However, If you would like to be added to the mailing list please PRINT the following information.

MRS. MS. MR. Nina Nixon-Mendez
(First Name) (Last Name)

[redacted]
Address City State Zip Code

Comment: ① Reevaluate Walters St. cross section to include street trees + planting strip btwn curb + sidewalk.
② Opportunity for COSA to realign Funston per Mahncke Park Neighborhood Plan

Comment Card #8 Over

2 Nina Nixon Mendez (back)

Comments continued

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③ Opportunity to reconstruct Broadway into a "signature" boulevard, address drainage issues, improve sidewalks, add street trees from Josephine to Hildebrand
④ Opportunity ~~of~~ to address a comprehensive rezoning of Broadway to encourage community commercial, pedestrian oriented uses - currently zoned "I-1 + I-2"
⑤ Opportunity for infill development (townhomes, condos)

Comment Card #8

(3) Comment Card #8

Comment Card - comments continued

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Your name and address is not required. However, if you would like to be added to the mailing list please PRINT the following information.

MRS.
MS.
MR. Nina Nixon-Mendez
(First Name) (Last Name)

[redacted]
Address City State Zip Code

Comment: (6) Ensure onsite retention to address storm water drainage that flows

(7) Keep open space along drainage on Ft Sam property & develop recreational trails for personnel & interface **Over**

w/ Playland Park area (old acequia) - Document &

Comment Card #8

(4)

Comments continued

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interpret acequia that runs thru Playland park grounds

(8) Consult the following Neighborhood Plans to determine possible socio-economic impacts & potential joint capital improvement projects that benefit the quality of life in adjacent neighborhoods: Government Hill Plan; Westfort Alliance; Arena/Eastside Community Plan; Mahncke Park Neighborhood Plan; Northeast Inner Loop Community Plan; Austin Highway Revitalization Guidelines.

(9) Protect Salado Creek greenway/wetlands w/ buffer zone

(10) Assess need for additional Public Transit near gates.

~~Comment Card #9~~

Comment Card

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Your name and address is not required. However, If you would like to be added to the mailing list please PRINT the following information.

MRS.
MS.
MR. Tracy Calvert

(First Name) (Last Name)

[redacted]

Address City State Zip Code

Comment: We would like to see the New Braunfels street gate re-opened. The Army is strangling Development in the area and the justification for the continued closure wasn't presented today. This set up for public comment was totally unhelpful

Over

Comments continued

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Comment Card

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Base Realignment and Closure (BRAC) actions please use this card.

Your name and address is not required. However, if you would like to be added to the mailing list please PRINT the following information.

~~MRS.~~
~~MS.~~
MR. ANDRES CORTEZ

(First Name) (Last Name)

[redacted]

Address City State Zip Code

Comment: Alot of Bus people would like to see New Braunfels St. Open, Just like Lackland and Wilford Hall has.

Comment Card #10 **Over**

Comments continued

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Comment Card #11

Comment Card

Fort Sam Houston welcomes your input!

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Your name and address is not required. However, If you would like to be added to the mailing list please PRINT the following information.

MRS. / MS. / MR. William Burman

(First Name) (Last Name)

[redacted]

Address City State Zip Code

Comment: Please consider re-opening New Braunsfels Avenue to both Public Transit and the general public

Over

Comments continued

Privacy Advisory: As the United States Army undertakes the preparation of an environmental impact statement (EIS) on the realignment of Fort Sam Houston, Texas, we invite you to participate. Your information in identifying important issues that need to be studied will assist the U.S. Army in formulating alternatives and carrying out our responsibilities under the National Environmental Policy Act. Comments, names, and addresses are generally made available for public review although personal home addresses and phone numbers will not be published in the final EIS. **Individuals wishing to have their name, address and phone number withheld from public disclosure to the extent allowed by law, should check this box** ☐

Comment Card

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Your name and address is not required. However, If you would like to be added to the mailing list please PRINT the following information.

MRS. MS. MR. William Burman

(First Name) (Last Name)

Address City State Zip Code

Comment: Please consider in your traffic study, the re-opening of New Braunsfels Avenue

Over

~~Comment Card #12~~

Comments continued

Privacy Advisory: As the United States Army undertakes the preparation of an environmental impact statement (EIS) on the realignment of Fort Sam Houston, Texas, we invite you to participate. Your information in identifying important issues that need to be studied will assist the U.S. Army in formulating alternatives and carrying out our responsibilities under the National Environmental Policy Act. Comments, names, and addresses are generally made available for public review although personal home addresses and phone numbers will not be published in the final EIS. **Individuals wishing to have their name, address and phone number withheld from public disclosure to the extent allowed by law, should check this box** ☐

Comment Card

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If you would like to provide a comment on the Post's Base Realignment and Closure (BRAC) actions please use this card.

Your name and address is not required. However, If you would like to be added to the mailing list please PRINT the following information.

MRS. MS. MR. William Byrman

(First Name) (Last Name)

[redacted]

Address City State Zip Code

Comment: Please consider re-opening New Braunfels Avenue to both Public transit and the general public

Comment Card #13

Over

Comments continued

Privacy Advisory: As the United States Army undertakes the preparation of an environmental impact statement (EIS) on the realignment of Fort Sam Houston, Texas, we invite you to participate. Your information in identifying important issues that need to be studied will assist the U.S. Army in formulating alternatives and carrying out our responsibilities under the National Environmental Policy Act. Comments, names, and addresses are generally made available for public review although personal home addresses and phone numbers will not be published in the final EIS. **Individuals wishing to have their name, address and phone number withheld from public disclosure to the extent allowed by law, should check this box** ☐

Comment Card #14

Comment Card

Fort Sam Houston welcomes your input!

If you would like to provide a comment on the Post's Base Realignment and Closure (BRAC) actions please use this card.

Your name and address is not required. However, if you would like to be added to the mailing list please PRINT the following information.

MRS.
MS.
MR. Brian Chandler

(First Name) (Last Name)

[redacted]

Address City State Zip Code

Comment: Please consider reopening N. New Braunfels Ave. to public traffic. The closure has had a negative impact on Broadway traffic, as well as adjacent commercial corridors, such as the Govt. **Over**

Comment Card #14 (Brian Chandler back)

Comments continued

Privacy Advisory: As the United States Army undertakes the preparation of an environmental impact statement (EIS) on the realignment of Fort Sam Houston, Texas, we invite you to participate. Your information in identifying important issues that need to be studied will assist the U.S. Army in formulating alternatives and carrying out our responsibilities under the National Environmental Policy Act. Comments, names, and addresses are generally made available for public review although personal home addresses and phone numbers will not be published in the final EIS. **Individuals wishing to have their name, address and phone number withheld from public disclosure to the extent allowed by law, should check this box** ☐

Hill neighborhood business section ~~along~~ b/t I-35 & Ft. Sam.

Comment Card

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Your name and address is not required. However, if you would like to be added to the mailing list please PRINT the following information.

MRS.
MS.
MR. Arena District Neighborhood Assoc. (AJ Garcia)
(First Name) (Last Name)

[redacted]
Address City State Zip Code

Comment: We appreciate the invitation and hope to be informed of any future events. Thank you.

Over

Comments continued

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Comment Card

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Your name and address is not required. However, If you would like to be added to the mailing list please PRINT the following information.

~~MRS.~~ MS. ~~MR.~~ Stella Ashley
(First Name) (Last Name)

[redacted]
Address City State Zip Code

Comment:

Comments continued

Privacy Advisory: As the United States Army undertakes the preparation of an environmental impact statement (EIS) on the realignment of Fort Sam Houston, Texas, we invite you to participate. Your information in identifying important issues that need to be studied will assist the U.S. Army in formulating alternatives and carrying out our responsibilities under the National Environmental Policy Act. Comments, names, and addresses are generally made available for public review although personal home addresses and phone numbers will not be published in the final EIS. **Individuals wishing to have their name, address and phone number withheld from public disclosure to the extent allowed by law, should check this box** ☐

Comment Card

Fort Sam Houston welcomes your input!

If you would like to provide a comment on the Post's
Base Realignment and Closure (BRAC) actions please use this card.

Your name and address is not required. However, if you would like to be added to the mailing list please PRINT the following information. OWNS DROP ZONE CAFE

MRS.
MS.
MR. ESPERANZA FERNANDEZ

(First Name) (Last Name)

[redacted]

Address City State Zip Code

Comment: ______________________________

____

____

______________________________ **Over**

Comments continued

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Comment Card

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If you would like to provide a comment on the Post's Base Realignment and Closure (BRAC) actions please use this card.

Your name and address is not required. However, if you would like to be added to the mailing list please PRINT the following information.

MRS. MS. MR. Kirsten Pelsor

(First Name) (Last Name)

[redacted]

Address City State Zip Code

Comment: Westfort Alliance Neighborhood Association

Over

Comments continued

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Comment Card

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If you would like to provide a comment on the Post's
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Your name and address is not required. However, If you would like to be added to the mailing list please PRINT the following information.

MRS.
MS.
~~MR.~~ ANITA A. ORNELAS

(First Name) (Last Name)

[redacted]

Address City State Zip Code

Comment:

Comments continued

Privacy Advisory: As the United States Army undertakes the preparation of an environmental impact statement (EIS) on the realignment of Fort Sam Houston, Texas, we invite you to participate. Your information in identifying important issues that need to be studied will assist the U.S. Army in formulating alternatives and carrying out our responsibilities under the National Environmental Policy Act. Comments, names, and addresses are generally made available for public review although personal home addresses and phone numbers will not be published in the final EIS. **Individuals wishing to have their name, address and phone number withheld from public disclosure to the extent allowed by law, should check this box** ☐

(NO COMMENTS ON back)

Comment Card

Fort Sam Houston welcomes your input!

If you would like to provide a comment on the Post's
Base Realignment and Closure (BRAC) actions please use this card.

Your name and address is not required. However, If you would like to be added to the mailing list please PRINT the following information. [redacted]

MRS.
MS.
MR. David GARZA / [redacted]

(First Name) (Last Name)

[redacted]

Address City State Zip Code

Comment: ______________________________

____

____

______________________________ **Over**

Comments continued

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ATTACHMENT 6: INDIVIDUALS PROVIDING COMMMENTS AND MAILING LIST ADDITIONS

Addresses to be Added to Mailing List

Ms. Heidi Mummau
401 Stafford Street
San Antonio, TX 78208

Mrs. Marie Stout
PO Box 8399
San Antonio, TX 78208

Ms. Marlene Hawkins
601 E. Carson
San Antonio, TX 78208

William Burman
12002 Rose Blossom
San Antonio, TX 78247

Ms. Cherise Bell
1901 S Alamo
San Antonio, TX 78204

Ms. Kirsten Pelsov
203 Cunningham
San Antonio, TX 78215

Mr. Andres Cortez
2106 N. Panam, IH 35
San Antonio, TX 78208

Mr. Tommy Calvert
3607 Tuscany
San Antonio, TX 78219

Mr. Brian Chandler
1901 S. Alamo St.
San Antonio, TX 78204

Arena District Neighborhood Association
AJ Garcia
1706 Nevada
San Antonio, TX 78203

Ms. Stella Ashley
130 Banbridge
San Antonio, TX 78223

Ms. Esperanza Fernandez
8446 Timber Bridge
San Antonio, TX 78250

Mr. David Garza
1400 S. Flores
San Antonio, TX 78204

Ms. Anita A. Ornelas
311 Coleman St.
San Antonio, TX 78208

Note: One comment in Attachment 5 was received with no name

A.2 DRAFT EIS PUBLIC PARTICIPATION, COMMENTS AND RESPONSE TO COMMENTS

PUBLIC NOTICES

Legals/
Public Notices

PUBLIC MEETING TUESDAY 24 OCTOBER

Fort Sam Houston Environmental and Natural Resources Division will present the Draft Environmental Impact Statement for the Base Realignment and Closure Actions at Ft Sam Houston, Texas. You are invited to attend and provide comments.

St Patrick's Church
Community Center
1801 IH-35 North
San Antonio, Texas

AGENDA
- 7:00 to 7:30 p.m. - Sign-in & Information Booths
- 7:30 to 8:00 p.m. - Welcoming Remarks and DEIS Presentation
- 8:15 p.m. to Closing - Public Oral Comment Session

On October 24, 2006, the Fort Sam Houston Environmental and Natural Resources Division will hold a public meeting at St Patrick's Church Community Center, 1801 IH-35 North, San Antonio, TX, to present and receive inputs on the contents of the Draft Environmental Impact Statement for the 2005

Legals/
Public Notices

Base Realignment and Closure (BRAC) Commission's recommendations for realignment of missions to Ft Sam Houston. The doors will be open to the public at 7:00 p.m. to sign in, view informational displays, read fact sheets and discuss the study with installation personnel. Welcoming remarks and a 30-minute presentation will begin promptly at 7:30 p.m., followed by an oral comment period starting at 8:15 p.m. Each commenter will be given four minutes to speak. The time limit ensures that everyone who desires to speak will be able to do so. A court reporter will record all oral comments. There also will be opportunities to provide written comments in lieu of or in addition to oral comments. Written comments will also be accepted through 19 November 2006 by mail , e-mail or facimile. Mail comments to: Environmental and Natural Resources Division, Attn.: Jackie Schlatter, 2202 15th Street, Suite 36, Fort Sam Houston, Texas 78234-5036; or send email to: Jackie. Schlatter@sam houston.army.mil; or Fax to: (210) 221-5419. If you have questions about commenting please call (210) 221-5093. The Draft Environmental Impact Statement can be viewed on the internet at: www.samhouston. army.mil or www.hqda. army.mil/acsim/brac/ braco.htm. Printed copies are available for review at the address above, or at the Government Section of the San Antonio Central Library, 600 Soledad, San Antonio, Texas.

Notice of Availability
Notice of Public Meeting

Draft Environmental Impact Statement for Base Realignment and Closure Actions at Fort Sam Houston, Texas.

The U.S. Army is publishing this notice to announce the availability of the Draft Environmental Impact Statement (DEIS) for the Base Realignment and Closure (BRAC) actions at Fort Sam Houston (FSH), Texas.

On Tuesday, October 24, 2006, the Mobile District, U.S. Army Corps of Engineers (COE) in conjunction with the FSH Environmental and Natural Resources Division will hold a public meeting at St. Patrick's Church Community Center, 1801 IH-35 North San Antonio, Texas. The purpose of the public meeting is to present and receive input on the contents of the DEIS for the 2005 BRAC Commission's recommendations for realignment of missions to FSH. The doors will be open to the public at 7:00 p.m. to sign in, view informational displays, read fact sheets, and discuss the study with installation personnel.

Welcoming remarks and a 30-minute presentation by the FSH Garrison Commander will begin promptly at 7:30 p.m., followed by an oral comment period until 9:00 p.m. Each commenter will be given up to four minutes to speak. The time limit ensures that everyone who desires to speak will be able to do so. A court reporter will be available to record oral comments. There also will be opportunities to provide written comments in lieu of or in addition to oral comments.

Written comments will also be accepted 45 days from the publication of this announcement (through November 19, 2006) by mail, e-mail or facsimile. Mail comments to:

Public Affairs Office, (Mr. Phil Reidinger)
Building 124, 1212 Stanley Road, Fort Sam Houston, TX 78234
210-221-1099, Fax 210-221-1198

The DEIS can be viewed at www.samhouston.army.mil or www.hqda.army.mil/acsim/brac/braco.htm.

Printed copies are available for review at the FSH Public Affairs Office, Building 124, 1212 Stanley Road, Fort Sam Houston, Texas or at the Government Section of the San Antonio Central Library, 600 Soledad, San Antonio, Texas.

For more information contact the Public Affairs office or:

Jeffry A. Tripe BRAC NEPA Support Team, U.S. Army Corps of Engineers, Fort Worth District, 819 Taylor Street, RM 3A14, P.O. Box 17300, Fort Worth, Texas 76102-0300, e-mail: Jeffry.A.Tripe@swf02.usace.army.mil, Phone (817) 886-1716, Fax: (817) 886-6499.

Notice of Availability
Notice of Public Meeting

Draft Environmental Impact Statement for Base Realignment and Closure Actions at Fort Sam Houston, Texas.

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Building 124, 1212 Stanley Road, Fort Sam Houston, TX 78234
210-221-1099, Fax 210-221-1198
The DEIS can be viewed at www.samhouston.army.mil or www.hqda.army.mil/acsim/brac/braco.htm.

Printed copies are available for review at the FSH Public Affairs Office, Building 124, 1212 Stanley Road, Fort Sam Houston, Texas or at the Government Section of the San Antonio Central Library, 600 Soledad, San Antonio, Texas.

For more information contact the Public Affairs office or:
Jeffry A. Tripe BRAC NEPA Support Team, U.S. Army Corps of Engineers, Fort Worth District, 819 Taylor Street, RM 3A14, P.O. Box 17300, Fort Worth, Texas 76102-0300, e-mail: Jeffry.A.Tripe@swf02.usace.army.mil, Phone (817) 886-1716, Fax: (817) 886-6499.

HANDOUTS

FAQs on the Draft EIS for Fort Sam Houston, TX (cont.)

► ***What is scoping?***

A major component of NEPA is encouraging and facilitating public involvement in decisions that could affect the quality of the human environment. Initially, the Federal agency, in this case the Army, invites the public to participate in defining the important environmental quality issues to be evaluated through a process called "scoping." The public may also identify alternatives to the Proposed Action during the scoping process. The public will also have the opportunity to comment on the manner in which the Army considered the potential for impacts on the human environment through opportunities to review both a draft and final EIS. The scoping process was completed on May 2, 2006 for the EIS, and the Army has considered and addressed the public comments in the draft EIS.

► ***What specific environmental concerns were identified in the DEIS?***

Fort Sam Houston is located in the northeastern portion of the city of San Antonio, Texas. During initial planning efforts, the Army recognized numerous resource areas and issues that would require consideration in the DEIS. These included, but were not limited to: air quality; surface water quality; cultural resources; transportation system; environmentally sensitive areas such as wildlife corridors, wetlands, and floodplains; biological resources, to include, in particular, protected fauna and flora species; site topography and soils; socioeconomic conditions; land use; traffic; community facilities and services; and cumulative impacts.

► ***What environmental or socio-economic concerns were identified in the DEIS?***

Implementation of the preferred alternative would have no long-term, significant impacts on the environmental resources of Fort Sam Houston, Camp Bullis or their surrounding areas. Potential minor impacts to cultural and visual resources from implementation of the preferred alternative would generally occur only within the physical boundaries of Fort Sam Houston. No long-term significant impacts to earth (geology, topography, caves, karst features or soils) or wetlands would occur at either installation. Potential land use impacts are expected at Fort Sam Houston. Use of utilities and generation of hazardous and non-hazardous wastes will likely increase at both installations, but not in significant amounts. Cultural resources and hazardous wastes would be impacted with the removal or renovation of existing facilities on Fort Sam Houston, some of which are potentially eligible for registration as historic properties. Minor air, noise, and transportation impacts would also occur during short-term construction activities under the preferred alternative at both installations and continue after final construction and occupancy. No significant impacts to biological resources (vegetation, wildlife and threatened and endangered species) are expected from the implementation of the preferred alternative. Alternative siting variations would provide similar impacts and benefits as compared to the preferred alternative. The no action alternative provides the baseline conditions for comparison to the preferred alternative. Additional concerns or impacts may be identified as a result of comments received on this DEIS.

FAQs on the Draft EIS for Fort Sam Houston, TX (cont.)

► ***What specific management measures were identified in the DEIS?***

Most minor impacts could be reduced through proper engineering design, adherence to protective regulations and implementation of operations and management measures. Best Management Practices would reduce or eliminate the potential short-term effects to the environment due to deconstruction and construction activities. Cumulative impacts associated with the preferred alternative would be minimal in all resource categories. Strict adherence to the Historic Properties Component of the Fort Sam Houston Integrated Cultural Resources Management Plan would minimize or negate significant cumulative impacts to historic property. The potential for flooding impacts due to increased stormwater runoff at Fort Sam Houston would be reduced or negated by proper engineering design of stormwater conveyance structures and the addition of retention ponds, as required. Mitigation measures would not be required as long as proper engineering design, adherence to protective regulations, and incorporation of Best Management Practices are used to reduce short-term environmental impacts.

► ***Has the public been involved in the EIS process?***

Yes. The public was notified of the intent to develop an EIS through a Notice of Intent published in the *Federal Register*. Scoping letters requesting input to the process were sent to state and federal agencies. A public scoping meeting was held on Tuesday, 2 May 2006, at the St. Patrick's Community Center from 2 p.m. to 4 p.m. and again from 7 p.m. to 9 p.m. Public notification was published in the 26 April 2006 edition of the *San Antonio Express News* and the 30 April 2006 edition of *La Prensa*. Specific agencies were mailed invitations to attend the 2 p.m. to 4 p.m. scoping meeting. The public notices not only invited interested parties to attend, but also requested the submission of comments or questions concerning the proposed action or scope of issues. Potential issues identified during the public scoping meeting included traffic, air quality, socioeconomics, water quality (storm water management) impacts, and effects from adaptive reuse of historic buildings (cultural resources) at Fort Sam Houston. These issues are included and addressed in the DEIS along with direct and indirect effects on other resources.

► ***Does the public have the opportunity to comment on the DEIS?***

The Army invites the general public, local governments, other Federal agencies, and state agencies to submit written comments or suggestions concerning the analyses and alternatives addressed in the DEIS. Comments on the DEIS must be received within 45 days from the date the Notice of Availability (NOA) is published in the Federal Register. The general public, local governments, other Federal agencies, and state agencies are also invited to participate in a public meeting where oral and written comments and suggestions on the DEIS will be received.

The Army welcomes your input on the issues and concerns that should be addressed in the Fort Sam Houston BRAC EIS. If you would like to submit a written comment, please complete a Comment Card and give it to one of the representatives at the scoping meeting. Written comments or inquiries on the DEIS may be submitted to:

Mr. Phillip Reidinger
Public Affairs Office, Building 124
1212 Stanley Road, Fort Sam Houston, Texas 78234
E-mail Phillip.Reidinger@samhouston.army.mil
Telephone (210) 221-1151
during normal business hours Monday through Friday.

Public Meeting on the Draft Environmental Impact Statement (DEIS) for the Realignment of Fort Sam Houston, TX

October 24, 2006
7:00 pm to 9:00 pm
St. Patrick's Church
1801 IH-35 North
San Antonio, TX

The public comment period is a part of the environmental impact statement (EIS) preparation process through which a federal agency describes a planned approach to a proposed action and possible alternatives, and seeks input from other agencies, organizations, and the public. We hope that you will share with us your thoughts on the issues presented in the EIS for the realignment of Fort Sam Houston, Texas. This public meeting includes information stations available to help attendees identify potential issues and concerns to be addressed in the EIS. The stations provide information on topics such as population, economics, and the proposed action; traffic and air quality; noise; natural resources; historic and archeological resources; and the National Environmental Policy Act of 1969 (NEPA), EIS, and public involvement processes. Representatives are available for questions.

FREQUENTLY ASKED QUESTIONS (FAQs)....

FAQs on Environmental Policy and the EIS

► *What is the National Environmental Policy Act (NEPA)?*

NEPA requires the analysis of potential environmental effects associated with major federal actions. NEPA ensures that social and environmental factors are considered along with the technical and economic components of a decision and requires that potential environmental impacts, and any adverse effects that cannot be avoided, be identified and alternatives to the proposed action be considered. NEPA also requires consultation with all relevant federal agencies to determine these impacts. NEPA is a "full disclosure" law with provisions for public access to, and full participation in, the federal decision-making process. The act's intent is to protect, restore, and enhance the environment through well-informed federal decisions. Two NEPA documents will be created in the course of this action: An EIS that analyzes any potential significant environmental and socioeconomic impacts, and a Record of Decision (ROD) that documents the final decision on the proposed action and specifies mitigation measures (methods to lessen negative impacts) and monitoring programs to be undertaken.

► *What is an Environmental Impact Statement (EIS)?*

An EIS is a summary of a detailed study that analyzes the environmental impacts of a proposed action and its alternatives. It also includes an extensive public involvement process. The potential for significant environmental effects or high public interest associated with a proposed action is usually the basis for preparing an EIS.

An EIS analyzes the potential effects of a proposed action and alternatives on the human, socioeconomic, and natural environments. It describes the baseline (affected environment) against which effects are evaluated and then identifies potential consequences and appropriate mitigation measures.

► *Why does Fort Sam Houston need an EIS for the BRAC Action?*

While the decision to realign Fort Sam Houston is not subject to NEPA, NEPA is required to analyze the potential environmental effects of how the realignment of Fort Sam Houston will be accomplished. Title 32 of the *Code of Federal Regulations* Part 651, Environmental Analysis of Army Actions, also requires a NEPA analysis.

► *What will be evaluated in the EIS?*

The EIS will evaluate the potential impacts of realigning Fort Sam Houston on land use, aesthetics, air quality, noise, biological resources, water resources, cultural resources, traffic and transportation, socioeconomics and quality of life, environmental justice, utility system infrastructure and capacity, and hazardous and toxic materials and wastes. The EIS will consider a range of alternatives to accommodate the realignment of Fort Sam Houston. The EIS will also evaluate locations for training activities at Camp Bullis, Texas.

Projected EIS Timeline

Draft EIS Available for Review	October 2006
Draft EIS Public Meeting	October 2006
Draft EIS Comments	Due 45 days from publication of the Notice of Availability in the Federal Register
Final EIS Available for Review	March 2007
Record of Decision	April 2007

FAQs on the Realignment of Fort Sam Houston, TX

► *What were the BRAC Commission's recommendation pertaining to Fort Sam Houston?*

- Close Fort McPherson, GA and relocate the Army Contracting Agency Southern Region Headquarters to Fort Sam Houston.
- Close Air Force Research Lab, Mesa City, AZ and relocate Air Force and Navy directed energy research labs to Fort Sam Houston.
- Realign the Zachary Taylor Building, a leased installation in Arlington, VA, by relocating the Army Installation Management Agency headquarters to Fort Sam Houston.
- Realign Rock Island Arsenal, Illinois, as follows: relocate the Army Installation Management Agency Northwest Region headquarters to Fort Sam Houston, and consolidate it with the Army Installation Management Agency Southwest Region headquarters to form the Army Installation Management Agency Western Region; and relocate the Army Network Enterprise Technology Command Northwest Region headquarters to Fort Sam Houston, and consolidate it with the Army Network Enterprise Technology Command Southwest Region headquarters to form the Army Network Enterprise Technology Command Western Region.
- Realign Seven Corners Corporate Center, a leased installation in Falls Church, VA, and 4700 King Street, a leased installation in Alexandria, VA, by relocating the Army Community and Family Support Center to Fort Sam Houston.
- Realign Rosslyn Metro Center, a leased installation in Arlington, VA, by relocating the Army Family Liaison Office to Fort Sam Houston.
- Realign Skyline Six, a leased installation in Falls Church, VA, by relocating the Army Contracting Agency headquarters to Fort Sam Houston.
- Realign the Hoffman 1 Building, a leased installation in Alexandria, VA, by relocating the Army Contracting Agency E-Commerce Region headquarters to Fort Sam Houston.
- Realign Fort Buchanan, Puerto Rico, by relocating the Army Contracting Agency Southern Hemisphere Region headquarters to Fort Sam Houston.
- Realign Aberdeen Proving Ground, MD, by relocating the Army Environmental Center to Fort Sam Houston.
- Realign Walter Reed Army Medical Center, Washington, DC, as follows: relocate enlisted histology technician training to Fort Sam Houston; relocate the Combat Casualty Care Research sub-function (with the exception of those organizational elements performing neuroprotection research) of the Walter Reed Army Institute of Research (Forest Glen Annex) and the Combat Casualty Care Research sub-function of the Naval Medical Research Center (Forest Glen Annex) to the Army Institute of Surgical Research, Fort Sam Houston.
- Close Brooks City Base, San Antonio, TX and relocate the Army Medical Research Detachment to the Army Institute of Surgical Research, Fort Sam Houston.
- Realign Naval Air Station Great Lakes, IL, Sheppard Air Force Base, TX, Naval Medical Center Portsmouth, Naval Medical Center San Diego, CA, by relocating basic and specialty enlisted medical training to Fort Sam Houston.
- Realign Building 42, 8901 Wisconsin Ave, Bethesda, MD, by relocating the Combat Casualty Care Research sub-function of the Naval Medical Research Center to the Army Institute of Surgical Research, Fort Sam Houston.
- Realign Naval Station Great Lakes, IL, by relocating the Army Dental Research Detachment, the Air Force Dental Investigative Service, and the Naval Institute for Dental and Biomedical Research to the Army Institute of Surgical Research, Fort Sam Houston.
- Realign Fort Sam Houston, and Randolph AFB, by relocating the installation management functions to Lackland AFB, TX.

FAQs on the Draft EIS for Fort Sam Houston, TX

► *What is the basis for the Army's action?*

The Defense Base Closure and Realignment Act of 1990 (Public Law 101-510, as amended) provided for a 2005 Defense Base Closure and Realignment Commission to recommend military installations for realignment and closure. The 2005 Commission submitted a report of its recommendations to the President on September 8, 2005. The President approved and forwarded the report to Congress on September 16, 2005. In the absence of a joint resolution or other action disapproving the recommendations, the recommendations of the Commission have become law and must be implemented consistent with the requirements of the Defense Base Closure and Realignment Act of 1990. The 2005 Commission's recommendation was that Fort Sam Houston be realigned.

► *What is the purpose of the Draft Environmental Impact Statement (DEIS)?*

The purpose of the DEIS is to provide a full and fair assessment of environmental impacts of a proposed action and to inform decision makers and the public of reasonable alternatives. The DEIS ensures that government agencies, non-governmental organizations, and members of the public have an opportunity to provide input on federal actions which may have the potential for significant impact to the environment. It is required under the provisions of the National Environmental Policy Act of 1969 (NEPA).

► *What proposed action and alternatives are assessed in the DEIS?*

The DEIS evaluates the potential environmental and socioeconomic effects associated with 2005 BRAC Commission's realignment recommendations and Army Modular Force (AMF) activities at Fort Sam Houston, Texas and related field training activities at Camp Bullis, Texas. Alternatives for the Army's proposed realignment action include varying siting options where new construction and/or renovation activities could be located on Fort Sam Houston. The no action alternative provides the baseline conditions for comparison to the varying siting alternatives. The BRAC law relieves the Department of Defense from the NEPA requirement to consider the need for closing, realigning, or transferring functions and from looking at alternative installations to close or realign.

► *What aspects of the decision making process apply to this DEIS?*

Public Law 101-510 exempts the decision-making process of the Commission from the provisions of the National Environmental Policy Act of 1969 (NEPA). The law also relieves the Department of Defense from the NEPA requirement to consider the need for closing, realigning, or transferring functions and from looking at alternative installations to close or realign. Nonetheless, the Department of the Army must still prepare environmental impact analyses during the process of property disposal and during the process of relocating functions from a military installation being closed or realigned to another military installation after the receiving installation has been selected but before the functions are relocated. These analyses will include consideration of the direct and indirect environmental and socioeconomic effects of these actions and the cumulative impacts of other reasonably foreseeable actions affecting the installations.

Guidelines for Public Comment Time

1. This is a Public Meeting to present the Fort Sam Houston/Camp Bullis Draft Environmental Impact Study (DEIS). Please understand, we will not take questions or comments during the presentation portion of the meeting.

2. The public will have an opportunity **after** the presentation to make comments and ask questions.

3. **No questions will be answered during the Public Comment Time.**

4. If you wish to ask a question or make a comment, please fill out a comment card. Cards are available at the sign-in table near the entrance.

5. We ask that you limit comments and questions to issues within the scope of this meeting.

6. Please limit comments to four (4) minutes. You will be given a signal when you have spoken for 3 ½ minutes. Please wrap up your comments at that point. No one person may not use another person's comment time to make a point, every person has only four minutes and no more.

7. **If you have a longer written statement, please feel free to summarize those comments orally and submit the written document in its entirety.**

8. If you prefer to have your comment or question read rather than speak please say so when your name is called.

9. All comments and questions will be noted in the Responsive Summary and will be available for review when the Final EIS is published. The Final EIS can be viewed at www.samhouston.army.mil or www.hqda.army.mil/acsim/brac/braco.htm. Printed copies are available for review at the Fort Sam Houston Public Affairs Office, Building 124, 1212 Stanley Road, Fort Sam Houston, or at the Government Section of the San Antonio Central Library, 600 Soledad, San Antonio.

Comment Card

Fort Sam Houston welcomes your input!

If you would like to provide a comment on the Post's
Base Realignment and Closure (BRAC) actions please use this card.

Your name and address is not required. However, If you would like to be added to the mailing list please PRINT the following information.

MRS.
MS.
MR. ______________________________

(First Name) (Last Name)

____

Address City State Zip Code

Comment: ______________________________

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______________________________ **Over**

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Comment: ______________________________

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Comments continued

Privacy Advisory: As the United States Army undertakes the preparation of an environmental impact statement (EIS) on the realignment of Fort Sam Houston, Texas, we invite you to participate. Your information in identifying important issues that need to be studied will assist the U.S. Army in formulating alternatives and carrying out our responsibilities under the National Environmental Policy Act. Comments, names, and addresses are generally made available for public review although personal home addresses and phone numbers will not be published in the final EIS. **Individuals wishing to have their name, address and phone number withheld from public disclosure to the extent allowed by law, should check this box** ☐

Comments continued

Privacy Advisory: As the United States Army undertakes the preparation of an environmental impact statement (EIS) on the realignment of Fort Sam Houston, Texas, we invite you to participate. Your information in identifying important issues that need to be studied will assist the U.S. Army in formulating alternatives and carrying out our responsibilities under the National Environmental Policy Act. Comments, names, and addresses are generally made available for public review although personal home addresses and phone numbers will not be published in the final EIS. **Individuals wishing to have their name, address and phone number withheld from public disclosure to the extent allowed by law, should check this box** ☐

Base Realignment and Closure Actions
Fort Sam Houston, Texas
Summary of Potential Impacts, BMPs and Mitigation Measures

Resource Area	No Action Alternative	Preferred Alternative	Best Management Practices	Mitigation Measures
Land Use	No change to existing conditions.	• No effect on airspace, management or use on FSH or Camp Bullis. • Improved quality of facilities on FSH. • Loss of potentially eligible historic facilities on FSH. • Alteration of historic facilities on FSH. • Siting of non-medical research facility in conflict with FSH land use plan and potential impact on nearby recreational vehicle park. • Siting of vehicle maintenance facilities within view of residential neighborhoods outside FSH. • Temporary siting of relocatable modular facilities during the renovation and construction period is not compatible with nearby historic properties. Build-out schedule may require longer than a five-year use.	• Strictly follow procedures in the Installation Design Guide (IDG), Landscape Design Guide and the Historic Property Component (HPC) of the FSH Integrated Cultural Resources Management Plan (ICRMP) for alterations and replacement of historic facilities. • Consider incompatible neighboring uses when designing the non-medical research facility and the vehicle maintenance facilities and potential addition of screening with berms, landscaping or other means. • Provide screening for the relocatable modular facilities where sited near the Quadrangle. Relocate to an area on FSH that would not significantly impact the historic facilities and districts for more than five years.	• Not applicable
Aesthetics and Visual Resources	No change to existing conditions. Older facilities remain and continue to age.	• Potential positive or negative impact on aesthetics with new facilities and deconstruction of aged facilities. • Potential significant impact on historic viewscapes.	• Strictly follow procedures in the IDG, Landscape Design Guide and the HPC of the FSH ICRMP for alterations and replacement of historic facilities.	• Not applicable
Air Quality	No change to existing conditions.	• Potential short-term increase in criteria pollutants during construction and deconstruction activities. • Increased mobile and stationary emission sources. • No significant impacts to local or regional air quality.	• Dust suppression Best Management Practices during construction and deconstruction. • Selection of energy-efficient systems in new construction. • Selection and use of equipment per Texas Commission on Environmental Quality (TCEQ) air quality measures.	• Not applicable
Noise	No change to existing noise environment.	• No significant increase in noise resulting from increase in weapons training and use of ground burst simulators during training exercises at Camp Bullis. • Slight increase in noise from vehicle traffic and construction equipment. • Medical Evacuation helicopter flights in the BAMC area will increase from an average of 1 per day to 2 per day. Nevertheless, no significant noise impact.	• No noise reduction measures required.	• Not applicable
Geology and Soils	No change to existing conditions.	• No significant effects to geologic resources or karst features would occur. • Improved control of erosion after facility construction and paving. • Increased potential for erosion during construction at FSH and Camp Bullis sites.	• Erosion control and silt control required during construction.	• Not applicable
Water Resources	No change to existing environment. Water consumption would remain the same. The existing Stormwater Pollution Prevention Plan (SWPPP); Spill Prevention, Control and Countermeasures (SPCC) Plan; and Pollution Prevention (P2) Plan would remain in force.	• Potential effects of increased stormwater runoff due to increased impervious surfaces on FSH and Camp Bullis. • Increased pumping from the Edwards Aquifer at FSH. • Increased pumping from the Trinity Aquifer at Camp Bullis. • No impact on wetlands.	• Engineered design of stormwater management structures, including retention ponds if needed, is required to prevent flooding on portions of FSH and prevent significant impacts on downstream off-installation properties. • Increased pumping at FSH would be offset partially by decreased pumping at Lackland AFB due to the transfer of medical activities from WHMC to BAMC; will remain below DoD allocations. • Implementation of water conservation measures during design of facilities is required. • Utilizing reuse water for landscaping and other approved uses should be considered. • The existing SWPPP, SPCC Plan and P2 Plan would be updated to include new construction at FSH and Camp Bullis,.	• Not applicable
Biological Resources	No changes to existing biological resources.	• No significant effects on biological resources at FSH or Camp Bullis. • Noise during construction not expected to impact endangered species at Camp Bullis. • Karst protected species not found in construction areas at Camp Bullis.	• Adhere to procedures in KMP.	• Not applicable
Cultural Resources	No change to existing conditions. No deconstruction or alteration of potentially eligible historic facilities.	• Deconstruction or alteration of several facilities on FSH potentially eligible for listing on the National Register of Historic Places. • Potential significant impact on viewscapes of historic districts. • No impact to identified archaeological resources.	• Strictly follow procedures in the IDG, Landscape Design Guide and the HPC of the FSH ICRMP for alterations and replacement of historic facilities.	• Not applicable
Socioeconomics	No change to baseline socioeconomic conditions.	• No significant effects on demographics, employment or income potential anticipated. • Substantial increase in construction-related spending would create substantial beneficial economic effects throughout the San Antonio Metropolitan Statistical Area. • No environmental justice concerns.	• None identified.	• Not applicable
Transportation	No change in current traffic conditions.	• Increase in vehicular traffic in southwestern and eastern areas of FSH. • Increased waiting time at access control points (ACPs) in southwestern and eastern areas of FSH. • Decreased Level of Service on several intersections and road segments on FSH.	• Continued permanent improvements inside and outside FSH ACPs. • Selected roadway widening and intersection traffic control to reduce congestion of FSH.	• Not applicable
Utilities	No change in current consumption or wastewater and solid waste generation.	• Increase in water and energy consumption. • Increase in wastewater generation and solid waste tonnage. • Utility systems and regional landfills are adequate to meet increased demands.	• Integrate water and energy conservation into the design of facilities. • Continued use of reuse water for irrigation requirements at new facilities or xeriscape.	• Not applicable
Hazardous Materials and Waste Management	No change to existing conditions.	• Increased storage and use of hazardous materials for vehicle maintenance and medical services. • Increased quantities of hazardous wastes would be generated, primarily petroleum products and construction debris. • Increased quantities of bio-medical wastes would be generated at the expanded patient care facilities.	• Included recycling incentives in deconstruction contracts. • Comply with existing procedures for tracking, handling, storage and use of hazardous and toxic materials. • Implement P2 product substitutions and waste minimization. • Comply with existing procedures for contract disposal of hazardous and bio-medical wastes. • Survey for lead-based paint and asbestos-containing material before demolition. • Perform unexploded ordnance clearance before construction.	• Not applicable

Traffic

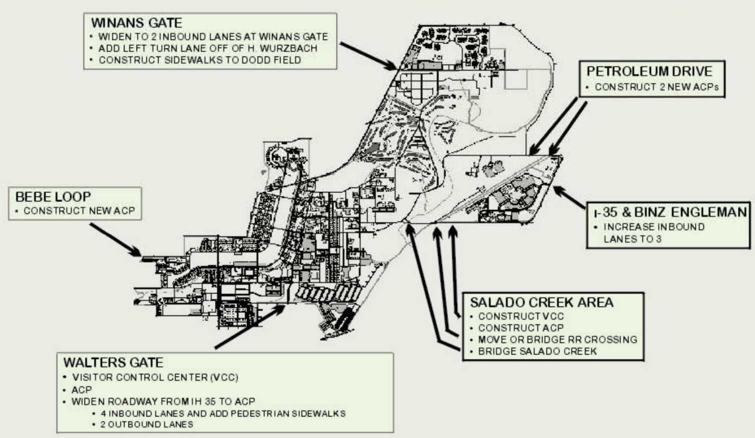
What the Environmental Impact Statement found

- ✓ Traffic will increase, but remain in acceptable ranges as the Post upgrades the gates and intersections according to current traffic plans.
- ✓ The most significant ongoing improvement plans for the gates are:
  - Walters Road Gate project, adds capacity and improves the visitor processing area.
  - Recently opened primary gate at the Harry Wurzbach–East (Scott) gate.
- ✓ About 70% of the 5,000 new trainees will reside in on-post dorms, creating minimal additional traffic.

Traffic count

Field Counts from Tuesday 11 - 13 September 2006					
		Peak Hour			Distribution
ACP	ADT	AM	PM	MD	%
Walters Primary	6,111	736	315	523	20.0%
Binz-Engleman Primary	4,588	388	276	306	15.0%
BAMC Beach Primary	2,433	504	171	180	7.0%
BAMC I35	6,128	923	320	499	20.0%
Jadwin	428	64	31	33	1.0%
Wilson	782	171	24	49	3.0%
Nursery	1,525	321	60	75	5.0%
Winans	1,698	188	79	101	6.0%
Harry Wurzbach East (Scott)	4,465	663	171	464	15.0%
Harry Wurzbach West	1,379	291	54	161	5.0%
Camp Bullis	900	144	27	45	3.0%
Total	30,437	4,393	1,528	2,436	100.0%

ADT = Average Daily Traffic



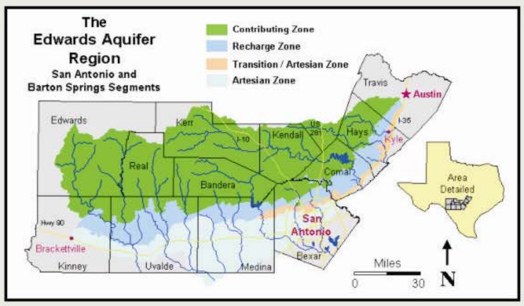
✓ Projected increases in gate usage

Walters	2.4 %
Binz-Engleman	2.0 %
BAMC Beach	2.0 %
BAMC I35	2.0%
Jadwin	3.2 %
Wilson	3.2 %
Nursery	2.0%
Winans	2.0 %
Harry Wurzbach East (Scott)	2.1 %
Harry Wurzbach West	3.2 %
5A Quad	3.2 %
New Braunfels	2.7 %

Water & Biological Resources

MINIMUM IMPACTS

✓ Increased water use & pumping from the Edwards Aquifer



In 2005, Ft. Sam Houston was 51% under and DoD was 32% under strict pumping caps.

Since 1998 Ft. Sam Houston water consumption deceased almost 50%.

Net pumping increases from the Edwards Aquifer are partially offset by deceases at Lackland AFB.

✓ Increase in stormwater runoff

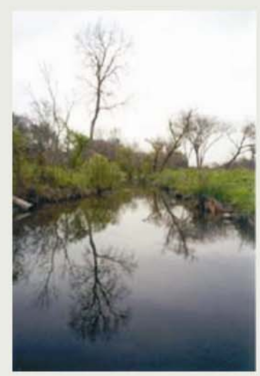
New buildings and roads may increase runoff and erosion.

During construction erosion will be controlled.

Grading, detention ponds, and landscaping will reduce and control erosion after construction is completed.

✓ Salado Creek water quality

No significant impact on the water quality of the creek.



✓ Water Conservation

The Post uses an average of 650,000 gallons of recycled water per day.

Recycled water used in chillers, fire training, and irrigation of athletic fields and the golf course.

Water line breaks were repaired and replaced; leaking swimming pools were demolished.

New landscaping uses native and drought resistant vegetation.

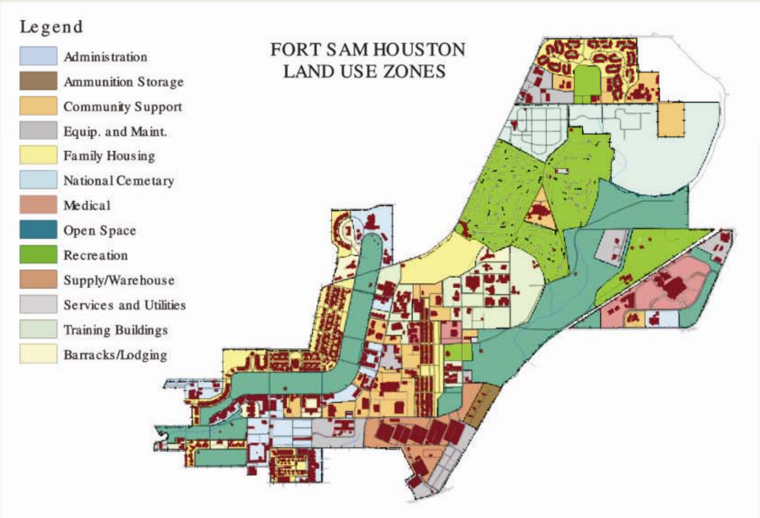
✓ Biological

Status of threatened or endangered species at Camp Bullis.

Photos Courtesy of Jean Kreica

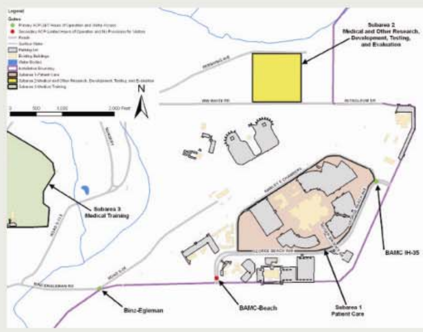
Land Use, Aesthetics, Cultural and Visual Resources

Proposed land use is compatible



- ✓ Preferred alternative is compatible with surrounding off-installation land uses.
- ✓ Ft. Sam Houston can accommodate the increase in mission with existing buildings, lands, and new construction.
- ✓ Preferred alternative complies with the Historical Properties component of the Integrated Cultural Resources Management Plan.

New patient care facilities are primarily focused in the BAMC Campus area on the eastern portion of the installation.



Adaptive reuse of historic buildings will be incorporated into the development of BRAC projects.

New facilities will be designed to protect the views of historic properties.

The new industrial facilities will be considered for landscape buffering to protect views.

Geology, Noise, and Air Quality

What we found

Geology

- ✓ The preferred alternative would have no significant impact on the area's geology.
- ✓ It is estimated that impervious surfaces will increase by only 11%, nearly 70% will remain pervious.

- ✓ Erosion control, grading and reseeding will limit long-term impact.

Noise

- ✓ There would be a slight increase in overall noise levels from construction activity and the slight increase in vehicle traffic.

- ✓ Only one additional MedEvac flight a day expected.

Air Quality

- ✓ Even with an overall increase in activity, no significant impacts to local or regional air quality is expected.

Vehicle Emission Comparison
2003 actual vs 2010 projected

Vehicle Emissions Summary								
Pollutant (tons/yr)								
	VOC	CO	NO_x	PM	PM_{10}	$PM_{2.5}$	SO_x	Pb
2003*	85.99	1,218.30	126.78	897.49	175.55	47.80	13.72	0.21
2010**	128.97	1,827.61	190.20	1,346.46	263.38	71.71	20.59	0.33
Change 2003/2010	42.98	609.3	63.4	449.0	87.8	23.9	6.9	0.12

Socioeconomics

What we learned

Local Housing Demand

San Antonio housing market continues to grow.

San Antonio recorded 38,581 single family residential lot applications in 2005.

San Antonio housing market can accommodate the expected demand for 3,122 units.

Commuting

Recent Headline

"S.A. drivers shave six seconds from daily commutes"

San Antonio Express-News 09/13/2006

Commuting times will not noticeably change.

EIFS values the anticipated construction investment to induce:

$8.7 billion in sales

$1.8 billion in personal income

44,608 jobs

New construction is valued at an estimated $1.8 billion between 2007 and 2015.

BRAC actions would create 5,179 military positions which should generate 12,915 new jobs in the San Antonio.

Community will see an increase in personal earnings of $415.5 million per year.

Medical Services

Little impact on community hospital and patient services.

Majority of the incoming population will use military medical services.

K-12 Schools

The majority of the projected 1,000+ new students will live off-post and attend area schools.

Living off-post, parents pay local school taxes and the schools receive a Federal Impact Funds for each school age military dependant.

Children living on Ft. Sam Houston attend schools on Post.

Cumulative Effects

The Environmental Impact Study shows these moves benefit the San Antonio region.

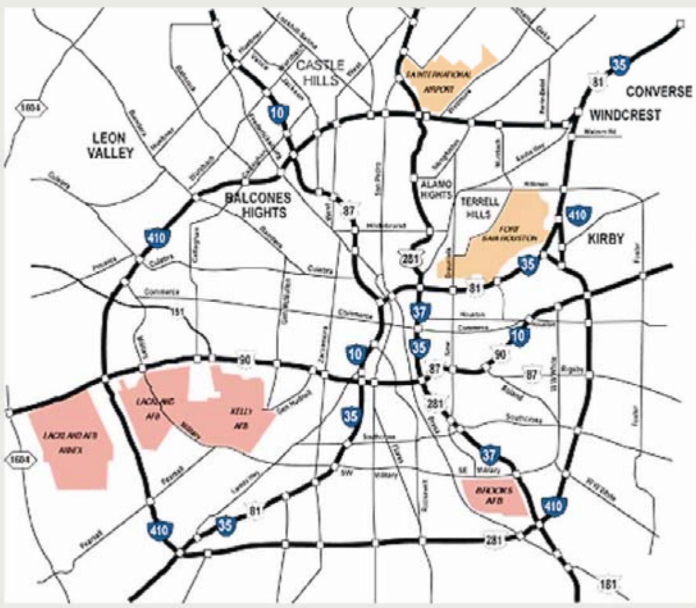
DOD population in San Antonio will increase an estimated 9%.

DOD's increase will increase San Antonio's population .06 % (est.).

DOD installations cover only .04% of Bexar county. That number is not changing.

No significant effect on air quality.

No significant impact on endangered species.



Minimal upgrades to utility infrastructure.

Minimum effect on traffic.

Little impact on natural and cultural resources.

Minimum added noise.

Boost for the area's economy.

Water usage will remain below current DoD cap.

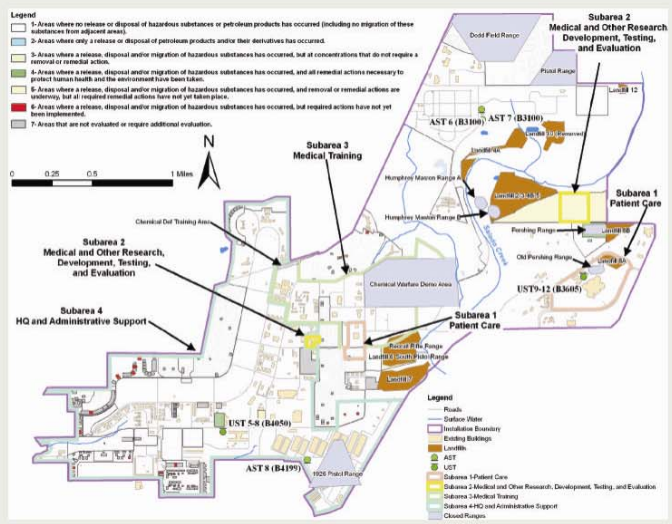
New Construction Dollars

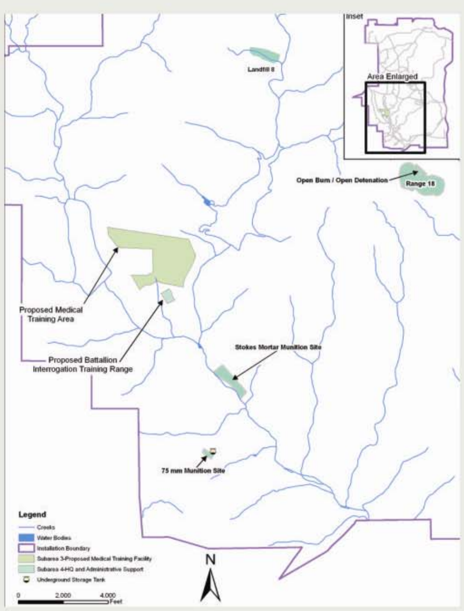
Fort Sam Houston	$1,800,000,000
Lackland AFB	$ 558,000,000
Randolph AFB	$ 53,400,000

Hazardous Materials, and Toxic Substances and Utilities

What we know

- Increased storage and use of hazardous materials and fuels for vehicle maintenance and medical services are expected, but no new chemical usage expected.
- Increased quantities of hazardous wastes would be generated, primarily petroleum products and construction debris, but quantities would still be within the capacity of existing storage and disposal facilities.
- Increased quantities of biomedical wastes, including low-level radioactive medical wastes, would be generated at the expanded patient care facilities from increased patient loads.
- Demolition/deconstruction wastes from asbestos-containing materials (ACM), lead-based paints (LBP) and PCB ballasts in buildings are expected.
- No change in pesticide usage expected.
- No concerns for naturally occurring radon at construction sites.





- Potential for unexploded ordnance (UXO) is considered low. UXO surveys prior to construction would be completed.

Utilities

- Ft. Sam Houston's current infrastructure will support increased utility usage and communications.

- Camp Bullis will need to add electrical infrastructure.

PUBLIC MEETING TRANSCRIPT

DEPARTMENT OF THE ARMY

PUBLIC MEETING ON THE

DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)

FOR THE REALIGNMENT OF FORT SAM HOUSTON, TX

OCTOBER 24, 2006

BE IT REMEMBERED that on the 24th day of October, 2006, commencing at 7:30 p.m., the following proceedings were had at St. Patrick's Church Community Center, 1801 I-35 N., San Antonio, Bexar County, Texas, to wit:

MR. REIDINGER: Good evening,

ladies and gentlemen. Thank you for coming tonight. The public meeting on the Draft Environmental Impact Statement for Fort Sam Houston and Camp Bullis is now in session. I am Phil Reidinger, the Public Affairs Officer for Fort Sam Houston. And I will be the Moderator for this evening's meeting.

This meeting is being held in accordance with the provisions from the National Environmental Policy Act, also referred to as NEPA. NEPA requires federal agencies to analyze the potential environmental impacts of proposed actions and alternatives and consider the impacts before making a decision. It also requires public input. This meeting is one method of presenting information about the potential environmental impacts of a pending federal decision and provides a forum for receiving comments from individuals.

Before we begin, I would like to introduce Colonel Wendy L. Martinson, Garrison Commander for Fort Sam Houston, and Lieutenant Colonel Barbara Holcomb, Chief of the Base

Transformation Office, who will describe the proposed actions, the focus of the environmental analysis, where we are in the analysis process, and summarize the contents of the DEIS.

Following Lieutenant Colonel Holcomb's presentation, you will have the opportunity to present your comments and make statements for the meeting record. Public input into the decision-making process at Fort Sam Houston and Camp Bullis helps ensure that local area needs, concerns, and recommendations relative to the proposed actions and any environmental effects are considered before an action is taken. Also with us is Patricia Phelps, the Court Reporter, who will record the transcript of this presentation and later any oral comments you provide, if you choose to make them.

Here is this evening's agenda. Lieutenant Colonel Holcomb's presentation on the Draft EIS will take approximately 25 minutes. This will be followed by a 15-minute break. Following the break, you may provide comments in one of two ways: There are blank

comment sheets available on which comments can be handwritten. Verbal comments will be recorded by the Court Reporter.

All comments, whether provided in writing or during our designated comment period at the meeting, will become part of the record.

If you desire to make a formal oral comment, you will need to fill out a registration card during the break. One should have been provided to you when you signed in. If you have not filled one out and wish to do so, they will be available during the break.

Please limit your spoken comments to four minutes. This is necessary to ensure that everyone who would like to speak will have the opportunity to do so. If your comments cannot be summarized in four minutes, you may provide them in writing, either as handwritten comments on the forms provided or by sending them via mail or e-mail after the meeting. For the sake of allowing us -- as many people as possible to contribute to this evening's meeting, no one will be permitted to give their four minutes to another person so

that they may speak longer than four minutes. You are also welcome to mail or e-mail your comments to the Army after the meeting to Phillip.Reidinger@Samhouston.army.mil. The address is at the bottom of the written comment form. Only those comments received by November 19th, 2006, will be accepted.

Let us begin with opening remarks by Colonel Martinson, who will then introduce Lieutenant Colonel Barbara Holcomb, who is in charge of the command Base Transformation Office.

Colonel Martinson.

COL. MARTINSON: Thank you, Phil.

Good evening, everyone, and welcome. Thank you for joining us tonight for a very important step in the NEPA process, the public meeting for the Draft Environmental Impact Statement. As a result of BRAC actions, Fort Sam Houston will increase not only in personnel numbers and expanded missions but also in new construction and renovation and adaptive reuse of existing buildings. The next five years will be very exciting for us as new

missions -- Army, Air Force, and Navy begin and traditional missions expand.

The NEPA process we are engaged in is a planning tool for us, and we need your input. I ask each of you to provide us with comments tonight and through the rest of the comment period so that we can have community input in the final product, the record of decision.

I hope that you leave here tonight with a better understanding of the proposed action and the focus of the environmental analysis. This action will invest billions in the local economy, create thousands of clean jobs and do so with no significant impact on the environment.

Lieutenant Colonel Holcomb will now give you an overview of the Draft EIS outlining the proposed actions for Fort Sam Houston and Camp Bullis.

Lieutenant Colonel Holcomb.

LT. COL. HOLCOMB: Good evening. On September 8, 2005, the Defense Base Realignment and Closure Commission, BRAC Commission, recommended that certain

realignment actions occur at Fort Sam Houston, FSH, and Camp Bullis. These recommendations were approved by the President on September 23, 2005, and forwarded to Congress. Congress did not alter any of the BRAC Commission's recommendations, and on November 9th, 2005, the recommendations became law. We must now implement the BRAC Commission recommendations. A complete listing of the BRAC Commission recommendations concerning FSH were provided in the handout you should have been given at the beginning of the meeting.

This slide shows the migration to Fort Sam from various locations within the U.S. There are also some local BRAC moves noted in the box in the lower right-hand corner of the slide. The first bullet shows the largest local move that involves reducing the Wilford Hall Medical Center on Lackland Air Force Base to a clinical facility and expanding BAMC to accommodate more patient and emergency activities.

As a side note, I would like to mention that the second bullet or Armed Forces Reserve Center at Camp Bullis was addressed

separately in an October 10th, 2006, environmental assessment, but its potential environmental impacts have been included in the Draft Environmental Impact Statement, as well, to assess potential cumulative effects.

Additionally, other transformation actions at Fort Sam Houston have already begun for several Army Modular Force, or AMF, units. These AMF units include the Fifth Army and Sixth Army and the 470th Military Intelligence Brigade as shown in the box in the lower left-hand corner of the slide. These units have already moved to Fort Sam Houston and occupied existing facilities; however, it is necessary to permanently integrate the growth of these units into the existing and projected future facilities and infrastructure along with the large volume of incoming BRAC personnel who will be relocating -- relocating to Fort Sam Houston. Therefore, the environmental effects of these AMF actions must be included in this Draft Environmental Impact Statement. While these transformations are not BRAC-related, they require additional consideration in conjunction

with the BRAC initiatives.

This chart depicts the changes in the personnel strength numbers for Fort Sam Houston and Camp Bullis. Please note that the first row existing population represents the existing strength figures for Fort Sam Houston. The rows below show numbers of incoming military, civilian, and student personnel and depict whether they represent BRAC or Army Modular Forces moves. The total growth from the Army Mod --- Modular Forces transformations, BRAC recommendations, and other activities as shown is 11,184 -- 36,312 to 25,128 -- as of summer 2006, which is the total number used for the analysis. In addition, 5,804 family members not included in this number are also expected and were considered as part of this analysis. These numbers may change prior to implementation; however, we don't expect them to change measurably.

Implementation of the proposed

action will also require renovation of existing facilities and construction of new facilities to accommodate the increase in personnel

assigned to Fort Sam Houston. As of summer 2006, new construction and renovation is estimated to total approximately 7 million square feet. The estimated cost of this work is 1.8 billion dollars.

As Phil stated previously, this Draft Environmental Impact Statement has been developed in accordance with the National Environment Policy Act, or NEPA, and implementing regulations issued by the President's Council on Environmental Quality and the Army. Its purpose is to inform decision-makers and the public of the likely environmental consequences of the proposed action and alternatives.

This draft document identifies, documents, and evaluates environmental effects of actions, such as construction, to accommodate the realignments at Fort Sam Houston and the ongoing impacts of the increased population and related activities.

The second bullet on this slide shows five important steps in the Environmental Impact Statement process. We completed step one in May of this year and held a public scoping meeting. Since then an interdisciplinary team of environmental scientists, biologists, planners, economists, engineers, archaeologists, historians, and technicians analyzed the potential impacts of implementing the realignments. These are found in the Draft Environmental Impact Statement which was published and distributed the first week in October. The document can also be found on the Fort Sam Houston website at www.samhouston.army.mil. We are at the public meeting tonight to look at what they found and receive comments and feedback.

The comments received tonight and others during the 45-day comment period will be addressed in the final EIS. After it is published, there will be a 30-day period for last-minute comments that should be considered before any final decisions are made on how Fort Sam Houston will accommodate the BRAC, Army Modular Forces, and other required local moves.

NEPA requires federal agencies to explore alternatives where possible with the objective of eliminating or lessening environmental impacts. It also requires the analysis of the no action alternative, which essentially provides a baseline of potential impacts of the status quo versus any changes. However, this alternative cannot be selected because BRAC prohibits selecting it.

Two alternatives were included in the DEIS for analysis. These include the no action alternative and the preferred alternative that would accommodate the BRAC, AMF, and other moves. A few minor siting variations under the preferred alternative were also analyzed. Other alternatives were eliminated because BRAC prohibits off-base sitings and on-base undeveloped land is limited.

We will now look at the potential impacts of the preferred alternative and the siting variations. The Army's realignment preferred alternative would account for the buildup of facilities and personnel within four mission-related subareas at Fort Sam Houston and the training area at Camp Bullis. These are shown as follows: One, patient care; two, medical and other research,

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development, testing, and evaluation; or, three, medical training including two training sites -- approximately 130 acres total -- in the southwest portion of Camp Bullis; and, four, HQ and administration.

The areas on Fort Sam Houston that would be impacted by these changes are collectively shown on this map. Now we'll look at each of -- of these subareas independently to get a better picture of what the real actions will be to accommodate the realigned missions.

Looking at the first two subareas, patient care and research, development, testing, and evaluation. Under the 2005 BRAC, Wilford Hall Medical Center located on Lackland Air Force Base and Brook Army Medical Center, BAMC, will be consolidated into one integrated medical operation known as the San Antonio Military Medical Center, SAMMC. All of the in-patient beds, trauma services, and surgeries will be consolidated at Fort Sam Houston.

The expected influx of population exceeds the existing capacity of

BAMC and the out-patient clinics at Fort Sam Houston. Without expansion, the patient workload that exceeds the capacity of available facilities would have to be diverted to the local civilian health network. All necessary improvements to in-patient facilities would be accommodated by renovating existing space in BAMC, as well as new construction. New construction includes administration additions, an emergency room bed tower addition, an ambulance garage, and two parking garages for approximately 5,000 vehicles.

Out-patient healthcare facilities will also need to accommodate the increased service population. This would be accomplished through a new primary care clinic to provide primary care services, expansion of the McWethy Clinic, which provides optometry, pharmacy, physical therapy, medical records, x-ray, primary care, Army substance abuse programs, and behavioral health services, and expansion and alteration of the Budge dental clinic. An additional pharmacy would also be needed in response to the increased student population.

Medical and other research, development, testing, and evaluation facilities will also need to be constructed as a component of BRAC. A new joint center of excellence for battlefield health and trauma will be established which will require additional medical research laboratories.

Medical and nonmedical research activities of the Navy and Air Force research facility would be on Pershing Field, north of the BAMC campus. This would also include a 440-meter laser range along the north side of Pershing Field.

The third subarea of medical training is shown on this slide. At present, Fort Sam Houston is the largest military medical training facility in the world. BRAC recommendations call for the consolidation of the Army, Navy, and Air Force enlisted medical training into a Medical Education Training Center campus, METC, at Fort Sam Houston. When BRAC is completed in September 2011, the METC will experience an average daily student load of approximately 9,000 students as compared to 4,965 students today and 3,600 faculty and

administrative personnel as compared to 1,900 today. Additional facilities will need to be constructed in order to accommodate this increase.

In addition to medical training activities at Fort Sam Houston an additional training facility will be needed at Camp Bullis to support certain field portions of medical training that are relocating from Sheppard Air Force Base. The medical training facility at Camp Bullis would consist of a 130-acre site in the southwest portion of the installation. The proposed site would be used for construction of new field training classrooms, administrative offices, warehouse space, a medical repair shop, training aids center, live tissue lab, a mock airfield-parking apron with static aircraft training, and space for tent pads. In addition to the field training from Sheppard AFB, a battalion interrogation range will be constructed for the 470th Military Intelligence Brigade.

Finally, the fourth subarea, headquarters and administration, is shown on this slide. FSH is acquiring new HQ and

administrative support functions for various field operating agencies, in addition to other existing AMF command and administrative missions. These new and expanding missions require changes in existing facility use, new construction, renovation, upgrade of facilities, and use of portable relocatables.

Once the preferred action was well enough defined, the environmental impact analysis was completed. Effects on the environmental resources, installation facilities and programs at FSH and Camp Bullis were evaluated in each subarea for implementation of the preferred action. This evaluation included effects on the areas of analysis shown.

The FSH preferred alternative is comprised of a mixture of new facilities construction and existing facilities renovation, alteration, and demolition, deconstruction in three of the four subareas. During the BRAC planning process FSH followed the master plan and the Installation Design Guide to help determine the suitable locations for the mission elements. Following a thorough

investigation of existing real estate assets, reuse of available facilities was the primary focus with new construction considered only if facility space was unavailable. The resulting preferred alternative closely follows the approved FSH land use plan. Furthermore, surrounding land use was taken into consideration, and it was determined that the preferred alternative would not create land use incompatibilities with the surrounding off-installation land uses.

Any unplanned or unconstrained design could significantly influence aesthetics and visual resources on the installation and to neighboring communities. Nevertheless, as stated previously, FSH has followed its approved land use plan, developed subarea and specific site plans to effectively deal with historic preservation and implemented an overarching policy for architectural compatibility in the Installation Design Guide, or the IDG. A primary goal of the IDG is to provide guidance for improving the quality of the visual environment by defining the placement and design of the elements of new

facilities such as the buildings' architectural styles, features, colors, and textures, landscaping, roads, walkways, and signage.

The plan to provide administrative space for the HQ and other administrative functions is primarily through renovation of existing space in the southwestern portion of the installation that abuts several historic areas. Adherence to the FSH historic preservation component and attention to the Installation Design Guide are critical in this area to avoid significant impacts to the historic quality of the installation. When properly done, facilities improvement in this subarea could positively impact the Government Hill historic neighborhood outside the installation boundary.

The preferred alternative consists of several projects that would be undertaken at FSH and Camp Bullis to accommodate the expanded installation mission.

At this point no significant archaeological resources have been identified in the proposed construction areas that would be impacted significantly by the preferred alternative.

There is always potential for ground-disturbing activities to encounter unrecorded cultural sites. In the event of an inadvertent discovery of Native American remains, funerary objects, sacred objects, or objects of cultural patrimony, procedures outlined in the standard operating procedures with federally recognized Native American Tribes and the historic properties component of the integrated cultural resources management plan would be followed.

Projects completed in the areas shown in the central and western portion of the installation require historic review and approval. The preferred alternative at FSH includes several projects that would involve alteration or demolition, deconstruction of existing structures or new construction. Any project action that might affect facilities and structures that either are listed on or are eligible to be listed on the national register of historic places would follow the historic preservation component, which establishes a series of procedures that must be followed on projects that involve eligible or listed

properties and projects that take place within the installation.

This slide shows that the estimated air emissions from implementing the preferred alternative will only be a small fraction of the total air emissions in the San Antonio area. Air emissions are expected to increase due to the influx of personnel and the added facilities at FSH and Camp Bullis. However, there would be no long-term measurable effects to the local air quality identified in the Draft Environmental Impact Statement. Localized short-term impacts to air quality might be present during construction and demolition activities.

There will likely be a short-term increase in overall noise levels from the construction activities and the slight increase in vehicle traffic. The primary source of noise associated with construction activities under the preferred alternative would be the use of heavy trucks, bulldozers, backhoes, generators, and ground compactors. In addition, medical evacuation flights to FSH will increase from an average of one per day to two per day. However, there will be no significant effects due to noise.

The preferred alternative would have no significant impacts on the geology of FSH or Camp Bullis. No borrow pits or quarries are in operation at FSH; however, several at Camp Bullis are used to obtain sand and gravel for construction and routine maintenance. Nonetheless, the quantity of materials mined from these areas does not significantly deplete the geologic resources and the preferred alternative would not appreciably change current quantities.

Implementing the preferred alternative would not result in significant impacts on biological resources within or adjacent to FSH. Under the preferred alternative only one facility location is within an undeveloped, urbanized portion of the installation. The Navy and Air Force research facility is planned for construction north of W.W. White Road on Pershing Field. This location is not within unique or special habitats, such as wetlands or other aquatic features, and previously has been disturbed

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through past actions. All other construction activities would occur within developed, urbanized portions of the installation, therefore, there would be no substantial effects on biological resources on the installation posed by the preferred alternative.

Likewise, implementing the preferred alternative would not result in significant effects on biological resources at Camp Bullis. The preferred alternative location is next to the cantonment area of Camp Bullis, which is developed and contains associated infrastructure for facilities. Only a small percentage -- less than one percent of the land area -- of grass land, oak savanna acreage on the installation would be disturbed.

Impacts to two types of water resources were analyzed in the Draft Environmental Impact Statement, surface water and ground water. The surface water region of influence for FSH includes Salado Creek, the San Antonio River via the Alamo ditch, and a portion of the City of San Antonio storm drainage system. The surface water region of

influence for Camp Bullis water resources includes Salado Creek.

Storm water runoff was the area having the greatest potential impact to surface water features on both installations. Runoff on FSH is carried into the Salado Creek drainage system and the San Antonio River via the Alamo ditch. Impervious surfaces, such as pavement and facilities, accumulate dust, debris, and soil from atmospheric fallout, automobile traffic, and other land-disturbing activities. Flushing of these impervious surfaces by rain events generates more runoff, which might contaminate stream waters and increase flow volumes that can degrade stream channels and banks. The preferred alternative would not add potential new sources of pollutants to Salado Creek. Best Management Practices, or BMPs, such as construction of new and upgrade of existing water detention ponds would reduce both the contaminating and erosion effects from the increase in impervious surfaces. Therefore, no significant impact to surface water quality or quantity, stream channels or bank is expected by implementing

the preferred alternative at either installation. The runoff time delay of the retention ponds is expected to minimize impacts to Salado Creek of flooding due to the increase in impervious surfaces.

In addition, there will be no significant impacts to the quality or quantity of water entering the Edwards Aquifer Recharge Zone at Camp Bullis.

FSH is located above the Edwards Aquifer, from which it obtains its drinking water from five wells. Camp Bullis is located above the Trinity Aquifer, from which it obtains its water from wells installed in the upper level.

FSH currently draws less than one percent of the total withdrawal from the Edwards Aquifer. Since 1998, we have reduced our groundwater pumping by over 40 percent through conservation, use of recycled water, and replacement of over 90 percent of the potable water pipes and, thereby, have created spare capacity to grow now without causing significant environmental effects.

Implementing the preferred

alternative would create measurable economic benefits within the San Antonio Metropolitan Statistical Area. Under the preferred alternative approximately 5,179 employment positions would be created or relocated into the San Antonio -- San Antonio Metropolitan Statistical Area from outside the region. This employment would potentially generate an estimated payroll of approximately 175.9 million dollars per year based on anticipated average annual salaries by government pay grade.

In addition, there would be a substantial increase in construction spending. As part of the preferred alternative, approximately 7 million square feet of renovated, remodeled and new facility space would be required on FSH and 260,000 square feet at Camp Bullis. The value of the new construction would be approximately 1.8 billion dollars between 2007 and 2015. The construction activity is anticipated to induce an additional 8.7 billion dollars in sales, 1.8 billion dollars in total personal income, and 44,608 employment positions in the San Antonio

Metropolitan Statistical Area.

With the implementation of the preferred alternative, installation staffing and facilities would increase. This would result in increased vehicular traffic and increased lines at the access control points resulting in overall lower levels of service, defined in terms of start, stop traffic and waiting time for intersections and roadway segments throughout the installation. However, the traffic movement would remain at conventionally accepted levels, provided that FSH continues to implement its strategic traffic planning and improvements program that includes modifications and upgrades at the access control points. Specific measures, including signalizing the Hardee and Scott Roads intersection and adding turning lanes to the Schofield and Patch Roads intersection, should be considered. Roadway improvements and intersection modifications should be coordinated closely with the proposed work of the preferred alternative and with the off-installation programmed improvements by local and state agencies.

Camp Bullis also would experience minor traffic growth due to its use as an additional area for training facilities. The projected growth will be minor since the additional trips are generally limited to student buses or other high-occupancy vehicles originating from FSH.

Potable water usage would increase with the personnel increase associated with the preferred alternative. Impact to the existing water systems at FSH and Camp Bullis would be negligible because current production capabilities at each installation are sufficient to produce potable water supplies. Wastewater generation would increase at both FSH and Camp Bullis and are considered negligible.

Current infrastructure is adequate to support increased growth and usage of electricity and natural gas resulting from the preferred alternative at FSH.

Camp Bullis' electrical distribution system would have to be expanded to provide adequate electrical service to the location of the preferred alternative; however,

the current CPS power supply infrastructure is adequate to support increased growth and electrical demand on Camp Bullis.

Current infrastructure is adequate to support the collection and disposal of increased generation of solid waste on both FSH and Camp Bullis. Current off-site landfill facilities have adequate capacities to properly dispose of increased solid wastes generated as the result of the preferred alternative implementation at FSH and Camp Bullis.

Control, management, and disposal of hazardous materials were evaluated in the Draft Environmental Impact Statement. This slide and the next show areas covered.

Current hazardous materials use would continue at FSH and Camp Bullis. Similar types but slightly increased quantities of these materials are expected. They would continue to be managed in accordance with applicable Army regulations.

Under the preferred alternative minor impacts to storage tank management could result from the potential demolition, deconstruction activities. Tanks associated

with buildings that are proposed for demolition will be removed from the site in accordance with applicable Army and state regulations. Construction of new facilities could increase fuel storage capacity requirements at FSH or Camp Bullis primarily for facilities that require fuel for standby power generators, auxiliary power units, or propane tanks. All new tank installations and operations would be managed in accordance with Army and state regulations. Therefore, no significant impacts to storage practices at FSH or Camp Bullis are expected under the preferred alternative.

Under the preferred alternative none of the Installation Restoration Program, or IRP, sites, Military Munitions Response Program, or MMRP, compliance-related cleanup or other areas with known environmental concerns would be disturbed significantly or otherwise impacted by the proposed activities at either FSH or Camp Bullis.

Short-term increase in the

disposal of construction debris would be needed during the construction, demolition deconstruction or renovation periods at each

installation. Federal and state environmental regulations require characterization of demolition debris to determine proper disposal, asbestos and lead characterization of building materials.

The cumulative effects of implementing the preferred alternative are minor. There will be no significant impact to any natural, cultural, social, or economic resource. The increase in personnel represents a fraction of one percent increase in the population of San Antonio, a mere 0.6 percent increase. With continuing conservation initiatives, water usage will remain well below the DOD allocation. There is sufficient land on Fort Sam Houston and Camp Bullis to implement the preferred alternative. Similarly, there will be no significant impact to air quality, utilities, traffic, noise, or endangered species. At the same time, the preferred alternative will generate a number of benefits to the City of San Antonio and its residents. There will be a significant boost to the area's economy. The estimated construction dollars added to the local economy is estimated to be 298 million dollars per year from 2006 through 2011. Many of these construction dollars will fund long overdue renovation and restoration of historic structures on Fort Sam Houston. Implementing the preferred alternative will invest billions in the local economy, create thousands of clean high-tech jobs, and do so with no significant impact on the San Antonio environment.

Thank you.

MR. REIDINGER: This concludes our presentation. We will now take a 10-minute break. Following the break, we will take public comments.

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THE STATE OF TEXAS)
COUNTY OF BEXAR)

I, PATRICIA PHELPS-OCHOA, Certified Shorthand Reporter in and for the State of Texas, do hereby certify that the above and foregoing was reported by me and transcribed, to the best of my ability.

____
PATRICIA PHELPS-OCHOA, Texas CSR 5159
Expiration Date: 12/31/06
Esquire Deposition Services
Firm Registration No. 77
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San Antonio, TX 78230

PUBLIC COMMENTS EXCERPT FROM THE

DEPARTMENT OF THE ARMY

PUBLIC MEETING ON THE

DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)

FOR THE REALIGNMENT OF FORT SAM HOUSTON, TX

OCTOBER 24, 2006

BE IT REMEMBERED that on the 24th day of October, 2006, commencing at 7:30 p.m., the following proceedings were had at St. Patrick's Church Community Center, 1801 I-35 N., San Antonio, Bexar County, Texas, to wit:

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(A brief recess was taken.)

MR. REIDINGER: Ladies and gentlemen, if you would take your seats.

Okay. Thank you, sir.

Arthur Browne, please approach the microphone.

MR. BROWNE: My name is Arthur Browne. I'm with the City of San Antonio. I work for Fort Sam Houston. My concern is that if we see an increase in traffic at Fort Sam Houston on both I-35 and Broadway, which were impacted significantly with the close of the base several years ago, that that increase in traffic congestion is going to contribute significantly to both EOCs and nodes which are -- those are the precursors the City of San Antonio has already been violating for the past three years, the 85 approximately ozone level. And so that could be said that the City of San Antonio will be put in noncompliance with the ozone level because of Sam Houston increase in congestion due to the closure of the base. The increase in traffic on the base is going to significantly impact this. The problem for the citizens of San Antonio is that

if we were put into non-attainment and the EPA and 416 M sections, that San Antonio state inspection sticker prices will go from approximately $12.50 to approximately $40.00.

That's on every car in the city of San Antonio who gets a state inspection. So there's a significant impact there, and I do not see this addressed in the environmental impact statement.

Thank you.

MR. REIDINGER: That being the only public comment, the public meeting is closed.

Thank you for being with us tonight.

(End of proceedings.)

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THE STATE OF TEXAS)
COUNTY OF BEXAR)

I, PATRICIA PHELPS-OCHOA, Certified Shorthand Reporter in and for the State of Texas, do hereby certify that the above and foregoing was reported by me and transcribed, to the best of my ability.

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San Antonio, TX 78230

COMMENT AND RESPONSE SUMMARY

INTRODUCTION

The Army has complied with the National Environmental Policy Act (NEPA) mandate of public participation in the environmental impact analysis process. This appendix includes comments received verbally at the public meeting and in writing during the comment period for this EIS.

The intent of NEPA is to ensure that environmental considerations are incorporated into federal agency decision making. To this end, regulations implementing NEPA require the analysis of environmental changes that would result from implementing a Proposed Action or alternative.

ORGANIZATION

Written and verbal comments on the Draft EIS for proposed BRAC and Army Modular Force actions at Fort Sam Houston and Camp Bullis were received from local and state government agencies and San Antonio area organizations and citizens. The comments have been grouped according to the part of the EIS to which they pertain. The comments addressed the Description of Proposed Action and Alternatives (DOPAA), Land Use, Air Quality, Water Resources, Cultural Resources, Socioeconomics, Transportation, Hazardous Materials and Toxic Substances, and Cumulative Effects. The majority of comments on the EIS related to Cultural Resources and Transportation. The U.S. Department of the Interior responded that they do not have any official comment (see Document 8 attached). The Alamo Area Council of Governments (AACOG) approved of the Army proceeding with the proposed action described in the Draft EIS (see Document 9 attached). The U.S. Environmental Protection Agency Region 6 rated the DEIS as "LOW," meaning they have a lack of objection to the proposed action (see Document 10 attached).

Within each of the following sections, each comment and response is numbered sequentially when there is more than one comment and response. For example, under Air Quality, individual comment-responses are labeled AQ1, AQ2, etc. At the end of each comment-response, a reference is provided to specific comment documents received. The individual comment documents are indicated in parentheses; e.g., Document __, page __. Readers who wish to read the original comments may turn to the photocopies of the documents included in this appendix.

DOPAA

Was Playland Park, land that is vacant and contiguous to FSH and may still be on the market, evaluated as potential space for land acquisition? If land is needed, this could provide additional space through the condemnation process as was used for land at Camp Bullis.

Response: The Defense Base Realignment and Closure Act does not provide for land acquisition, so the acquisition of Playland Park is not a viable alternative. (Document 1, page 1)

LAND USE

The EIS only considered potential impacts within the boundaries of the installation and did not take into account potential off-site impacts on the residential, commercial, industrial and recreational land uses adjacent to both Fort Sam Houston and Camp Bullis.

Response: Section 4.2.1 of the EIS identifies the Government Hills Neighborhood Plan and provides a general description of land uses in the off-post surrounding community. Section 4.2.2 states that there would be no land use incompatibilities in the surrounding community as a result of the BRAC and AMF actions. (Document 2, page 1)

AIR QUALITY

AQ1: The closure of Fort Sam Houston to civilian traffic has increased traffic congestion on both Broadway and I35. This has resulted in increased emissions of volatile organic compounds and nitrogen oxides which are both ozone precursors.

The closure of Fort Sam Houston to civilian traffic and an increase of "Gate traffic waiting" has been the main factor in San Antonio being declared in non attainment for ozone for the past several years. Non-attainment will result in increased state inspection fees for every vehicle in Bexar County. Reopening FSH to civilian traffic was recommended as a mitigation strategy for the increased air emissions.

AQ1 Response: The closure of FSH to civilian through traffic occurred before the BRAC Commission announcement and is not related to the BRAC actions. The air quality analyses in Section 4.4 of the EIS show that the overall expected increase in FSH air emissions is considered negligible in comparison to San Antonio air emissions. An air mitigation strategy for the BRAC actions at FSH is not necessary. Anti-Terrorism Force Protection requirements would also preclude reopening the base to civilian traffic. The environmental effects of closing the installation to through traffic were documented in a *Final Programmatic Environmental Assessment Access Control Measures at FSH and Camp Bullis*, May 2004.

Also, it is not correct that San Antonio has been "declared in non attainment for ozone for the past several years." San Antonio has been deemed "deferred" or "unclassifiable" under a December 2002 Early Action Compact that is in place until as late as the end of 2007 (and perhaps longer). See USEPA notice in the Federal Register, August 22, 2005, Volume 70, Number 161, pages 48877 - 48880. It is also not accurate that activity at Fort Sam Houston has been the "main factor" in any ozone attainment problems for San Antonio. As the cumulative effects section of the EIS demonstrates, Fort Sam Houston's ozone emissions are less than one percent of total ozone emissions sources in the San Antonio area. (Document 3, pages 1 and 2)

AQ2: Why are sulfur oxides and lead emissions projected to increase by 2010 from the 2003 baseline data when leaded gas has not been sold in San Antonio in 20 years?

AQ2 Response: Emissions for vehicles on Fort Sam Houston and Camp Bullis were calculated using the USEPA emission factors for gasoline and diesel engines as contained in AP-42, Volume II, Appendix H. The emission factors for pollutants are in grams of pollutant per mile traveled, based on vehicle classification.

SO_x emission factors are derived based on the assumption that all sulfur in the fuel is exhausted as either sulfate or gaseous sulfur dioxide (SO_2). SO_x emissions are assumed to equal SO_2 emissions. Sulfur emission factors are calculated using the SO_2 emission factor equation found in the appendix to USEPA's *PART5 User's Guide*.

Lead emission factors are derived from the maximum allowable residual lead content in unleaded gasoline (0.05 grams per gallon), assuming that all available lead in the fuel is burned in the combustion process. Of the lead that is burned, some is entrained in the catalytic converter, with the remainder being exhausted to the atmosphere.

Since January 1, 1996, the Clean Air Act banned the sale of leaded fuel for use in on-road vehicles. However, fuel containing lead may continue to be sold for off-road uses, including aircraft, racing cars, farm equipment, and marine engines, until 2008 (see http://en.wikipedia.org/wiki/Gasoline). (Document 3, page 2)

AQ3: AACOG Air Quality Emission Standards should be incorporated into the air quality analyses.

AQ3 Response: FSH and Camp Bullis are aware and very appreciative of AACOG's involvement with air quality issues. The Army will comply with all applicable legally binding air quality standards and will consider other relevant standards. (Document 2, page 3)

AQ4: EPA finalized changes to the National Ambient Air Quality Standards (NAAQS) for particulate matter (PM) on October 17, 2006. The primary 24-hour standard PM2.5, and the annual and secondary 24-hour PM10 standards were changed (see 71 FR 61144). Table 4-1 on page 4-21 of the DEIS should be corrected to reflect these changes.

AQ4 Response: Comment noted. The PM2.5 24-hour primary standard was changed from 65 $\mu g/m^3$ to 35 $\mu g/m^3$. USEPA is retaining the 24-hour PM10 primary standard, revoking the annual PM10 primary standard. Table 4-1 will be revised to reflect these changes.

AQ5: Wilson County is listed on page 4-22 as part of the San Antonio Early Action Compact (EAC) area. Wilson County officials were initially involved in planning and discussions regarding the EAC but opted out of the process prior to finalizing the document.

AQ5 Response: Concur. Wilson County is not included in the EAC area maps Web page (www.epa.gov/air/eac/areamaps.html) and will be removed from the list of San Antonio EAC counties on page 4-22. In Figure 4-5, Wilson County will not be shown as an EAC county.

AQ6: Section 4.4.2 on page 4-26 incorrectly identifies Bexar County as being in attainment of all NAAQS. Based on ozone monitoring data, EPA has designated Bexar, Comal and Guadalupe Counties as nonattainment for ozone. Because of the Bexar County's participation in the San Antonio EAC, EPA has deferred the date of this nonattainment designation, so the DEIS is correct that transportation and general conformity does not apply in these counties.

AQ6 Response: Page 4-22 of the DEIS stated that local air quality monitoring data exceeded the 8-hour ozone NAAQS and that on June 15, 2004, USEPA designated Bexar, Comal and Guadalupe Counties as nonattainment. The statement on lines 9 and 10 of page 4-26 is not correct. It will be revised to indicate that monitoring results would also need to show compliance with the ozone NAAQS for Bexar County to be reclassified as attainment. The attainment status statement in the last paragraph of this section on page 4-27 will also be removed.

AQ7: The DEIS used emission factors from EPA's AP-42 publication to generate emission estimated for on-road mobile sources. The current EPA-approved mobile source emission factor model is MOBILE6.2. It is suggested that any subsequent mobile source analysis be done using this model, as it will contain the latest emission factor available.

AQ7 Response: Mobile source emissions presented in AP-42 are based on MOBIL% and partially on MOBILE6. Future mobile source analyses for this EIS, if needed, will be conducted in accordance with MOBILE6.2.

WATER RESOURCES

WR1: There are drainage and watershed management issues and concerns for upstream and downstream portions of both Camp Bullis and Fort Sam Houston (FSH).

WR1 Response: Comment noted. Section 4.7.1 of the EIS noted the exceedance of TCEQ water quality criteria in reaches of Salado Creek at FSH, erosive damage to the bridge pylons beneath the IH-35 bridge and the presence of eight inactive landfills along the creek as well as the flooding potential on portions of the creek at FSH and Camp Bullis. Section 4.7.2 stated that BMPs such as construction of new stormwater detention ponds or upgrading of existing detention ponds would be sized and designed to reduce the effects of runoff from increases in impervious surfaces at FSH to Salado Creek water quality. (Document 2, page 2)

WR2: The City of San Antonio Unified Development Code (UDC) requirements pertaining to drainage and other improvements along Salado Creek should be adopted.

WR2 Response: Army policy for managing floodplains in accordance with Executive Order 11988 will be followed. EO 11988 requires Federal agencies to design or modify their action in order to minimize potential harm to the floodplains and for Federal structures and facilities to conform to standards and criteria consistent with the intent of those promulgated under the National Flood Insurance Program. UDC standards for floodplain development may be considered in the design of our construction projects. (Document 2, page 3)

WR3: The City of San Antonio (COSA) should develop "inter-local" agreements with Fort Sam Houston to improve drainage as well as address water quality concerns for Salado Creek. COSA would need to have access to both Camp Bullis and FSH to identify storm water conveyance and water quality issues.

WR3 Response: The Army will continue to work with the community in addressing Salado Creek and drainage issues. (Document 2, page 2)

CULTURAL RESOURCES

Numerous cultural-resource-related comments regarding a variety of topics were received and included: 1) not providing data on "missed" archaeological sites, 2) the need for mitigation, 3) determination of the significance of impacts, 4) applicability of the Historic Properties Component (HPC) to non-Army actions, 5) definitions for Visual Zones, 6) lack of analyses for facility siting alternatives for planned facilities within historic areas, 7) the availability of HPC Standard Operating Procedures (SOPs), 8) concerns regarding demolition of the "Long Barracks" building, 9) opportunities for rehabilitation of historic buildings and 10) concerns for provision of adequate cultural resources staff.

CR1: Based on the location of the bridge that would be constructed over Salado Creek there appears to be two recorded archeological sites that were not discussed in Section 4.9 Cultural Resources. Concerns were expressed about the construction of the bridge over the creek because there was no discussion of alternatives, impacts or mitigation of known archaeological sites at or near the proposed bridge location.

CR1 Response: The nearest known archaeological sites (BXO778 and BXO780) to the proposed bridge location are more than 600 feet away. The results from Phase II archaeological investigations conducted at these two sites were documented in a December 2002 report titled *National Register Testing of Two Prehistoric Sites at Fort Sam Houston, Bexar County, Texas*. Both sites were recommended as ineligible. (Document 2, page 3, and Document 4, page 1)

CR2: With the demolition, alterations and new construction occurring within historic districts at FSH, mitigation needs to be done, however, mitigation measures are currently listed as "not applicable."

CR2 Response: The Army believes that it is too early to determine whether mitigation needs to be conducted for the proposed demolition of Buildings 2007, 2008 and 2010 in the National Historic Landmark (NHL) District. Planned undertaking within the NHL District will be reviewed using the IDG historic review requirements and the SOPs in the

HPC. The determination of harm to the NHL and required mitigations will be determined per the HPC SOPs. (Document 4, page 1)

CR3: The EIS states that significant impacts may be mitigated by following pertinent Standard Operating Procedures in the Historic Properties Component (HPC) of the Integrated Cultural Resources Management Plan. Strict adherence to the HPC provides appropriate procedures for consideration of historic resources and consultation with the Texas Historical Commission (THC) and interested parties, but does not preclude a significant negative impact on historic resources. On page 4-92, line 16 "may" should be changed to "will be."

CR3 Response: The Army agrees that this wording is appropriate for the Final EIS. This wording change has been made in the Final EIS. (Document 4, page 1, and Document 5, page 2)

CR4: The THC is uncertain how the HPC procedures will function for the consolidation of installation management for Randolph AFB and FSH under Lackland AFB (joint-basing). This may invalidate the existing Army Alternative Procedures set forth in the HPC, which apply only to Army operations and FSH.

CR4 Response: The disposition of the FSH HCP after transfer of base support functions to the Air Force is unknown at this time. FSH personnel will strive to persuade the Air Force to maintain the Army Alternative Procedures system. However, standard Section 106 consultation procedures will be followed if the HPC becomes void. Either way, the historic or potentially eligible historic properties at FSH will be afforded all the protection provided by the National Historic Preservation Act and other applicable cultural resources laws and regulations. (Document 4, page 1)

CR5: "Visual Zones" should be defined. The purpose of the visual zones is not clear. The criteria for their establishment should be specified.

CR5 Response: Army property under FSH control has been divided into seven Visual Zones (VZs). The VZs were developed during a Visual Enhancement Study and are based largely on historical development of common design elements and/or current uses at FSH. VZ1 encompasses the entire National Historic Landmark District. VZ2 includes all those areas in the New Post building programs as well as those immediately adjacent. VZ3 includes the Harris Heights and Watkins Terrace neighborhoods and the west portion of the METC campus. VZ4 includes training brigade troop housing and support areas from several different uncoordinated building programs. VZ5 includes the supply warehouse area south of Wilson Street, and open space areas south of Binz-Engleman Avenue and between BAMC and W.W. White Road. VZ6 encompasses the BAMC subarea. VZ7 includes the National Cemetery, the golf course, and open space and recreation areas along Salado Creek and north of W.W. White Road. (Document 4, page 1)

CR6: Facilities 2010, 2007, 2008, and 4190 are not located on any maps so it can not be determined if these facilities are in the National Historic Landmark (NHL) District.

CR6 Response: The locations of Buildings 2007, 2008, 2010 and 4190 will be added to Figure 4-23. Each building will also be labeled in this figure. Visual Zone 1 in this figure corresponds to the NHL District. The figure key will be revised to indicate this. These buildings, except for 4190, are within VZ1. (Document 4, pages 1 and 2)

CR7: All of the buildings listed on page 4-99 lines 21 through 26, except for 610, are identified as eligible for designation to the National Register of Historic Places and do not meet the criteria for Deconstruction per SOP 2, therefore SOP 7 should be followed. This paragraph should be rewritten to note the distinction between the properties.

CR7 Response: The demolition of Building 610 was part of a renovation project to reuse the 600 area. Due to the high renovation and demolition costs associated with this project and the expected shortfalls in military construction funding for BRAC projects, this project has been cancelled. HPC SOPs would be followed for the project and findings as discussed in the response to CR2. (Document 4, page 1)

CR8: Building 610 is not on the HPC list, but building 610B is listed, please check that a “typo” has not occurred.

CR8 Response: The demolition of Buildings 610, A610 and B610 was part of the cancelled renovation project for the 600 area. All of these buildings are listed in Appendix A of the HPC (FSH Inventory of Historic Properties). (Document 4, pages 1 and 2)

CR9: The estimated cost of alternative to deconstruction of historic properties was not provided.

CR9 Response: The estimated costs of alternatives would be considered in the follow-up evaluation for undertakings in the NHL District as described in the response to CR2. (Document 4, page 2)

CR10: A more thorough review and adverse effects determination per HPC SOP 6 needs to be documented for the demolition of historic buildings and new construction within historic districts. The document does not adequately discuss the potential impacts of the proposed construction of two new buildings within the Quadrangle.

CR10 Response: A determination of adverse effects from demolition of existing buildings and construction of new buildings within FSH historic districts would be completed separately from this EIS if demolition could not be avoided, as described in the response to CR2. (Document 2, page 3, and Document 4, page 2)

CR11: Other siting alternatives for Enlisted Unaccompanied Personnel Housing (UPH, Project # 64191), the 5th Army Headquarters and Administration Support Area (Project #17142) and the Shoppette with Car Wash (Project # 64215) should be examined to see if new construction can occur outside the Quadrangle and New Post Historic Districts due to the instrusion of these projects on these districts. NEPA documentation should include a discussion of alternatives above and beyond the “build and no build” alternatives since these projects are in the National Historic Landmark (NHL) District.

CR11 Response: Project 17142 (HQ and Administrative facility for the Fifth Army) has been redesignated as a potential future project beyond 2012. This project is now beyond the reasonably foreseeable range of the environmental analysis and has been removed from the EIS. The proposed Enlisted UPH facility location was listed as being in the Quadrangle in Table 4-28. The proposed location is actually in the Artillery/Cavalry Post Historic District. This table entry will be corrected. New Post was designated a Historical Conservation District (IDG page I-10) and is not part of the NHL District.

One alternative site was considered for the Shoppette on the east side of Nursery Road adjacent to the existing Wash Rack (Facility 3106) and across the street from the FSH National Cemetery, which is also part of the NHL District. This alternative site was eliminated from consideration early in the BRAC planning process because its location is too isolated from most of the working population at FSH. (Document 4, page 2)

The full extent of impacts on historic resources from projects cannot be fully determined without additional project-specific documentation, which is not available at this early planning stage. A determination of adverse effects from alteration of existing buildings or construction of new buildings within an NHL District or a Historical Conservation District would be completed separately from this EIS as described in the response to CR2. Siting options for new facilities would be part of this review process. (Document 2, page 3, and Document 4, page 2)

CR12: Demolition/deconstruction does have a significant impact upon the structure and a historic district, regardless what mitigation efforts are done. The document discounts the importance of demolishing eligible and contributing buildings within the National Register Historic Districts. The paragraph on page 4-99 lines 27 through 30 should be rewritten to acknowledge the impact and loss upon these nationally significant districts, and state that appropriate SOPs will be followed.

CR12 Response: The last sentence will be revised to state that the significance of impacts from demolition and/or deconstruction projects within the NHL District will be assessed in following the IDG historic review requirements and the SOPs in the HPC. (Document 2, page 3, and Document 4, page 2)

CR13: The full extent of impacts on historic resources from the proposed demolition of historic structures inside and outside the NHL District cannot be determined without additional project specific documentation, which is not available at this early planning stage. The impacts also cannot be fully determined without additional consultation and scoping meetings with the Texas Historical Commission.

CR13 Response: Comment noted. See the CR12 response. (Document 5, pages 1 and 2)

CR14: It was suggested that when SOPs are referenced in the body text, a copy should be included as an appendix or made available on a Web site provided so the general public or reviewer could easily access that information.

CR14 Response: The HPC was sent to the City of San Antonio and the Texas Historical Commission, but will be available at www.samhouston.army.mil. (Document 4, page 2)

CR15: In the cumulative effects section, page 4-204 line 26, the statement that "Potential minor impacts to cultural and visual resources…would occur" should be changed to "Significant impacts to cultural and visual resources would occur and be mitigated by following the SOPs as formally agreed upon in the Army Alternative Procedures."

CR15 Response: Project-specific cultural resource impacts will be determined by following the IDG historic review procedures and the HPC SOPs. Section 4.3.2 of the EIS acknowledged that unplanned or unconstrained design and construction activities at FSH could pose significantly adverse affects to aesthetic and visual resources of the installation and surrounding neighborhoods. The HPC further commits the Army to resolving adverse impacts to these resources, minimize harm to the NHL District and allow public input through the SOPs.

The Army believes it is premature to judge that significant effects will occur to these resources before allowing time to review specific project details that will be developed for BRAC projects within the historic areas. (Document 4, page 2)

CR16: Sections 4.16 and 4.17 need to be rewritten to accurately reflect the significant negative impact and mitigation efforts to be taken on historic buildings.

CR16 Response: The Army will follow the HPC procedures in determining the magnitude of cumulative effects to historic resources to FSH. The follow-up historic review and NEPA processes described in CR2 will be used to determine whether such activities will occur and whether they would be considered an unavoidable significant loss. (Document 4, page 3)

CR17: "Serious" concerns were expressed about any action regarding Building 610 which is one of the most architecturally significant buildings in the Army inventory, the City of San Antonio and the State of Texas. By restoring and adaptively reusing the Long Barracks complex as "overflow" administrative space, the need for temporary portable units and the associated expense would be eliminated. A deconstruction/demolition alternative was not an option cited in the February 2004 report prepared by the Protective Design Center of the US Army Corps of Engineers (COE) for perimeter set-backs and Force Protection Standards. The COE discussed building reinforcement and vacancy as alternatives. The following alternatives for Building 610 should be considered:

A. After restoration of the exterior of Building 610, leave the building vacant.
B. Same as alternative "A", but provide building reinforcement as noted in the 2004 COE report.
C. Construct a reinforced concrete "blast wall" along the inside of the perimeter fence, with a 30 degree top cantilever, as a means of protecting 610.

CR17 Response: The renovation project, which included the demolition of Building 610, has been cancelled. The use of Building 610 was no longer under consideration for accommodation of the BRAC and Army Modular Force actions at FSH. Even if the Long Barracks area were adaptively reused, the restoration process could not be completed in time to avoid the need to use temporary portable units for Amy Modular Force actions described in the EIS. However, if the project were re-evaluated and it were determined that the restoration costs for this building are feasible, then the HPC SOPs would be followed for the restoration effort. (Document 1, pages 1 and 2)

CR18: The increase in mission and the corresponding need for additional facilities creates tremendous opportunity to rehabilitate and reoccupy many of the significant historic landmarks languishing vacant at FSH. Rehabilitation according to the Secretary of the Interior's Standards would impact historic and cultural resources positively, but insensitive rehabilitations and new construction risk negative impacts.

CR18 Response: Section 4.9.2 of the EIS shows that historic Buildings 2000, 2001 and 2270 are proposed for alteration, renovation and reuse (see Table 4-26), and that historic Building 1281 is proposed for demolition (see Table 4-27). The renovation of these three facilities should have a positive impact on cultural resources. As explained in the response to CR2, additional IDG historic review and NEPA procedures will be completed for these facilities once additional specific project design information is generated.

FSH included a "Vacant or Excess Facilities Reduction Strategy" in the *Real Property Master Plan Digest* that identified 30 vacant buildings within the 600 Area (Long Barracks) and four other historic vacant buildings in the Old Hospital Area. The reuse of additional vacant historic buildings to accommodate the BRAC and AMF actions was not possible due to excessive renovation/alteration costs and other considerations. (Document 5, page 1)

CR19: A full complement of qualified cultural resource personnel is required by the HPC. Beyond FSH's current effort to fill a vacant historical architect position, additional staff may be necessary to manage the tremendous increase in workload and impacts that are likely to result from BRAC-related construction.

CR19 Response: Comment noted. (Document 5, page 2)

SOCIOECONOMICS

The COSA Economic Development Department plans to conduct an assessment of the BRAC directives to fully determine the extent of the economic impact of BRAC on the community.

Response: Comment noted. (Document 2, page 1)

TRANSPORTATION

T1: Traffic mitigation alternatives need to be provided and analyzed to reduce negative traffic impacts. Alternatives for management of traffic could include additional entrances or exit gates, staggered work hours and/or reversible lanes. Entrances not reliant on IH-35 should be considered.

Response: Comment noted. The Army cannot consider the possibility of allowing additional entrances or gates due to FSH Department of the Army (DA) requirements for installation access control programs from 10 October 2003 and Army Regulation (AR) 525-13, which requires all U.S. Army installations to maintain defenses in accordance with the current force protection requirements. (Document 2, page 3)

T2: Concerns were also expressed about potential traffic impacts to areas surrounding Fort Sam Houston (FSH), and specifically along Harry Wurzbach Road which borders FSH on the west side of the Post. A growing number of vehicles going in and out of the FSH gate (Access Control Point or ACP) at Harry Wurzbach in the vicinity of Scott Road are cutting through the Bel Meade neighborhood creating lines of speeding traffic that try to avoid the traffic signal at the intersection of Wurzbach and Burr Roads.

The concern of members of the Bel Meade neighborhood is that as the number of personnel expands, more traffic will cut through their neighborhood and reduce their quality of life. Virtually all of the cut through traffic, both that occurs now and that which will increase in the future, is attributable to FSH and should be considered as an environmental impact associated with the planned expansion at FSH. The Bel Meade neighborhood was designed as a limited access neighborhood and was not designed to handle this type of congestion. Solutions and preventions need to be developed so that the existing cut through traffic is eliminated and that future cut through traffic is prevented.

T2 Response: Comment noted. The traffic using this road in this area is attributable to several sources, including traffic accessing Fort Sam Houston, the residential towers immediately off-installation and Harry Wurzbach traffic not accessing the installation. The new ACP at Harry Wurzbach was designed prior to the BRAC announcement to comply with DA requirements for installation access control programs from 10 October 2003 and to comply with AR 525-13, which requires all U.S. Army installations to maintain defenses in accordance with the current force protection requirements. The environmental effects for changes to the ACP for FSH and Camp Bullis were analyzed in a separate Environmental Assessment on *Access Control Measures at Fort Sam Houston and Camp Bullis, Texas*, from May 2004. This new gate was not programmed and constructed as part of the BRAC and AMF actions for FSH.

A significant portion of the on-base growth in this area of the base due to BRAC activity is expected to be students who will live on base and not access the base through the HW East ACP and subsequently are not expected to use Burr Road as a cut-through. While there could be some marginal increase at this ACP, the overall effects to the surrounding neighborhoods and traffic infrastructure are expected to be minimal.

Since Burr Road is a public thoroughfare, there are no feasible measures that can be implemented to prohibit or limit its use to the general public. If speeding vehicles are a concern, it is an enforcement issue. Along with speed reduction measures that can be placed, there are also traffic calming measures that can be considered, including on-street parking, speed humps, sidewalk bulb-outs, aggressive signing and pavement marking strategies. These measures could not be implemented by the Army; however, since it does not own or control these streets. Any such measures would require the approval of the City of San Antonio.

The City of San Antonio (COSA) is about to begin a study of off-post traffic issues, which may include this neighborhood. Note discussion of this in the T5 response following later in this document. FSH is certainly willing to work with COSA to improve traffic flows adjacent to the post. (Documents 6 and 7)

T3. The San Antonio Police Department (SAPD) concluded that there will not be any impact to their delivery of services in this area from the traffic data presented in the EIS. The SAPD welcomes the traffic simulation modeling projects for traffic around FSH currently being conducted by the San Antonio-Bexar County Metropolitan Planning Organization (MPO) and advocates the use of the modeling results and MPO recommendations for future neighborhood and traffic planning between FSH and COSA.

T3 Response: Comment noted. (Document 2, page 1)

T4: A timeline for FSH's internal traffic study is requested. The study results are needed to determine the impact to the local street network surround the post.

T4 Response: The FSH infrastructure study that is scheduled to begin in February 2007 will conduct further analysis of existing traffic conditions. Further information on this study is available from the Fort Sam Houston Public Affairs Office. A traffic analysis of the Medical Education Training Campus (METC) was completed for the METC Area Development Plan. This analysis was incorporated into Section 4.11.1 of the EIS (Table 4-45). The EIS also presented an analysis of existing traffic conditions in the Headquarters/Administration Area of FSH (Table 4-46) and the Brook Army Medical Center area (Table 4-47). Project traffic volume increases were modeled for the EIS (Appendix G) and were summarized in Section 4.11.2.

COSA and TXDOT have also begun a study to analyze off-post traffic issues adjacent to FSH. The results of this study will also aid in determining the effects of BRAC actions on the local street network, but will not be available for the EIS. The Council on Environmental Quality (CEQ) regulations on NEPA specify that where data are unavailable, the fact should be noted and analyzed in the EIS (see 40 CFR 1502.22). We therefore acknowledge that these specific data will not be available for the EIS. The Army believes that the probability of significant traffic consequences related to the BRAC actions being found in the FSH infrastructure and COSA/TXDOT studies are low.

T5: The scope of review for potential traffic congestion is not adequately addressed in the EIS. The area of potential traffic effects extends beyond FSH.

T5 Response: The Army considers the traffic analyses in the EIS to be adequate for three reasons: 1) A significant portion of the BRAC-driven growth at FSH will be due to the increase of student training loads at METC, which are not expected to generate a large increase in off-installation peak hour traffic, 2) the ACP improvements that were started prior to the BRAC announcement and are ongoing are expected to alleviate off-base traffic backups during peak hour travel and 3) a significant portion of potential traffic increases around FSH may be driven by overall growth in the San Antonio metro area.

The COSA/TXDOT off-post traffic study results will not be available for this EIS. The Army will of course cooperate with COSA and TXDOT in addressing mutual traffic issues in the future and acknowledges that these data will not be available for the EIS. However, as described in the EIS, we have general information and prior studies on off-post traffic flows that we believe adequately address the issue. Also, analysis of the three factors above leads us to believe that the probability of significant traffic consequences related to our BRAC action being found in the COSA study is low.

HAZARDOUS MATERIALS AND TOXIC SUBSTANCES

There needs to be adequate contingency planning for removal/remediation of any hazardous materials that may be concealed on-base. Proper plans for biohazard and biomedical waste removal are also needed.

Response: Comment noted. Section 4.13.2 of the EIS states that all current management plans, including the Spill Prevention and Countermeasures Control Plan (SPCC), Storm Water Pollution Prevention Plan (SWPPP) and the Installation Spill Contingency Plan (ISCP), would be updated to include proper protection and response procedures for the new facilities, storage location and personnel. The Army has long established existing programs, such as the Installation Restoration Program and Military Munitions Response Program, that should be adequate to provide removal/remediation of hazardous materials and hazardous wastes from the environment after the completion of emergency response under the SPCC, SWPPP and/or ISCP. (Document 2, page 2)

CUMULATIVE EFFECTS

CE1: The Texas Department of Transportation (TxDOT) will be widening IH-35 adjacent to FSH thereby affecting traffic congestions. This should be considered in the traffic analyses.

CE1 Response: It is the Army's understanding that the improvements and modifications to IH-35 adjacent to FSH will result in a cumulative improvement in traffic conditions. (Document 2, page 3)

CE2: The transportation section does not adequately address the cumulative effects of peak hour traffic to surrounding neighborhoods and traffic flow patterns.

CE2 Response: The Army will check the MPO to see if they have any preliminary data from the simulation model that could be reviewed to assess cumulative effects on off-post neighborhood traffic. FSH will keep abreast of future MPO traffic studies and simulations as they relate to FSH traffic and will consider them as specific siting and design decisions are made. (Document 2, page 2)

LIST OF DOCUMENTS

Document 1 – The Society for the Preservation of Historic Fort Sam Houston, Inc. Letter from Joan Gaither, President. October 24, 2006.

Document 2 – The City of San Antonio (COSA), Economic Development Department. Letter from Jelynne L. Burley, Deputy City Manager. November 17, 2006. Combined comments from the COSA Environmental Services, Police, Economic Development, Development Services, Planning & Community Development and Public Works Departments, and the San Antonio Metropolitan Health District.

Document 3 – Arthur Browne, San Antonio, Texas. Speaker/Comment Card and Verbal Comment. October 24, 2006.

Document 4 – City of San Antonio, Planning Department. Letter from Cherise J. Bell, Senior Planner. October 24, 2006.

Document 5 – Texas Historical Commission, Austin, Texas. Letter from F. Lawrence Oaks, Executive Director. November 17, 2006.

Document 6 – Howard W. Peak, San Antonio, Texas. Electronic Mail. November 7, 2006.

Document 7 – Judy Gray, President, Bel Meade Homes Association, Inc., San Antonio, Texas. Electronic Mail. November 13, 2006.

Document 8 – U.S Department of the Interior, Office of Environmental Policy and Compliance, Albuquerque, New Mexico. Letter from Stephen R. Spencer, Regional Environmental Officer. November 16, 2006.

Document 9 – Alamo Area Council of Governments. Letter from Al J. Notzon, III, Executive Director. October 25, 2006.

Document 10 – U.S. Environmental Protection Agency, Region 6. Letter from Rhonda M. Smith, Chief of Office of Planning and Coordination, November 17, 2006.

COMMENT LETTERS

DOCUMENT 1

THE SOCIETY FOR THE PRESERVATION OF HISTORIC FORT SAM HOUSTON, INC.
LETTER FROM JOAN GAITHER, PRESIDENT.
OCTOBER 24, 2006

The Society For The Preservation Of
Historic Fort Sam Houston, Inc.
A Nonprofit 501(c)(3) Corporation

OCT 24 2006

Mr. Phil Reidinger
Public Affairs Office, Building 124
1212 Stanley Road
Fort Sam Houston, TX 78234

Dear Mr. Reidinger:

Enclosed are our Society comments with regard to the 29 September, 2006 Draft Environmental Impact Statement for Base Realignment and Closure Action at Fort Sam Houston.

Very truly yours,

Joan Gaither

Joan Gaither, President

P.O. Box 340308 • Fort Sam Houston, Texas 78234-0308

The Society For The Preservation Of
Historic Fort Sam Houston, Inc.
A Nonprofit 501(c)(3) Corporation

OCT 24 2006

COMMENTARY ON DRAFT EIS STATEMENT ON BRAC ACTIONS FOR FSH

1. Page ES-1, line 23 & 24; Page 2-1, 2.1.2., line 24 & 25

Both of these citations noted that "there is no room for land expansion". Did the consultant evaluate the availability of the vacant Playland Park, land that is contiguous to FSH and may still be on the market? If land is needed, this could provide additional space, using the condemnation process as was used for land at Camp Bullis.

2. Page 2-12, line 7&8; Page 3-3, Table 3-1; Page 3-10, line 17& 18

These three citations all mention the possible need to use temporary portable modular facilities if administrative space is not available when new units arrive at FSH. Up to 25+ units were mentioned. See comment 3 following.

3.Page 4-99, line 21-22

This citation notes (among others) that demolition/deconstruction of Buildings 610, 610A and 611 are contemplated. The Society has serious reservations about any action regarding 610. This is the south end unit of this Alfred Giles designed "Long Barracks" structure, one of the most architecturally significant buildings in the Army inventory and, in fact in the City of San Antonio and State of Texas. On 19 May, 2006, the Society wrote a letter to the Garrison Commander proposing to restore and adaptively reuse the Long Barracks complex as administrative space. To date, the Society has not had the courtesy of a response to this proposal. By restoring and adaptively reusing the Long Barracks complex as "overflow" administrative space, the need for temporary portable units and the associated expense would be obviated. The Society is still prepared to undertake that project and provide further details.

If the concern with Building 610 is that of Force Protection Standards, the Society is non-plussed with understanding why a deconstruction/demolition alternative is recommended when that was not an option cited in the February 2004 report prepared by the Protective Design Center of the US Army COE. That report, in

P.O. Box 340308 • Fort Sam Houston, Texas 78234-0308

Table 3 and Appendix B had no mention of demolition/deconstruction as an option to solve perimeter set-backs and Force Protection Standards. Rather, they discussed building reinforcement and vacancy as alternatives. Therefore, the Society offers the following alternatives with regard to Building 610:

A. After restoration of the exterior of Building 610, leave the building vacant.

B. Same as alternative "A", but provide building reinforcement as noted in Table 3 of the February, 2004 report

C. In lieu of A and B above, since the roadway on Carson Street is at least 5 feet below the level of Building 610 foundation, consider a reinforced concrete "blast wall" along the inside of the perimeter fence (see Appendix D) ,with a 30 degree top cantilever, as a means of protecting 610.

All of these alternatives would have to be evaluated against the cost estimates as noted in the February, 2004 report

OCT 2 4 2006

DOCUMENT 2

THE CITY OF SAN ANTONIO (COSA), ECONOMIC DEVELOPMENT DEPARTMENT
LETTER FROM JELYNNE L. BURLEY, DEPUTY CITY MANAGER
NOVEMBER 17, 2006
COMBINED COMMENTS FROM THE COSA ENVIRONMENTAL SERVICES, POLICE, ECONOMIC DEVELOPMENT, DEVELOPMENT SERVICES, PLANNING & COMMUNITY DEVELOPMENT AND PUBLIC WORKS DEPARTMENTS, AND THE SAN ANTONIO METROPOLITAN HEALTH DISTRICT

CITY OF SAN ANTONIO

November 17, 2006

ECONOMIC DEVELOPMENT DEPARTMENT
P.O. BOX 839966
SAN ANTONIO, TEXAS 78283-3966
TEL: 210/ 207-8080
FAX: 210/ 207-8151

Colonel Wendy L. Martinson, USA
Commander, US Army Garrison
Fort Sam Houston
1206 Stanley Road
Suite #A
Fort Sam Houston, TX 78234-5001

Dear Colonel Martinson,

On behalf of the members of the City of San Antonio, we would like to congratulate Fort Sam Houston on its upcoming expansion as a result of the Base Realignment and Closure (BRAC) 2005 directives. We would also like to thank you and your staff for the community outreach you have provided on the results of the Draft Environmental Impact Statement (EIS).

During the meeting of the BRAC Core Group on October 31, 2006, Lieutenant Colonel Barbara Holcomb provided an excellent detailed summary of the draft EIS findings to staff from departments within the City of San Antonio. The group was impressed by the thoroughness of the report and its findings and conclusions.

Attached are comments from our City departments addressing the draft findings and conclusions of the Fort Sam Houston Draft EIS. The City of San Antonio believes successfully meeting the goals of BRAC and accommodating the expansion of missions and personnel at Fort Sam Houston will require our continued partnership and collaboration. We value the long-standing relationship between the military and the community, and stand ready to support Fort Sam Houston to ensure the BRAC directives are successfully implemented.

Sincerely,

Jelynne L. Burley
Deputy City Manager

cc: Mayor Phil Hardberger
Councilman Richard Perez, District 4
Councilman Sheila D. McNeil, District 2
Councilman Kevin A. Wolff, District 9
Councilman Roland Gutierrez, District 3
City Manager Sheryl L. Sculley

City of San Antonio Comments to the Draft Fort Sam Houston Environmental Impact Statement for 2005 BRAC Actions

- **Environmental Services Department**—The Environmental Services Department has no concerns or comments on the findings of the draft Environmental Impact Statement (EIS). The Department is supportive of the proposed actions and welcomes the new personnel and the ancillary activities it brings to San Antonio.

- **Police Department**—The San Antonio Police Department's Research and Planning Section reviewed the EIS report that was presented on October 31, 2006. The Department's main concern stemmed from potential traffic issues arising as a result of the increased population and construction taking place at Fort Sam Houston starting in 2007. Since approximately 70% of the 5,000 new trainees will reside in on-post dormitories, the EIS contends there will only be a minimum effect on traffic patterns in and around the entrance gates at Ft. Sam Houston. The resulting increase in traffic is projected to range from 2.4% – 3.2% at the various gates. Based on this information, the Police Department concludes there will not be any impact to their delivery of services in this area.

  The Police Department welcomes the micro-simulation modeling project for traffic around Fort Sam Houston currently being conducted by the San Antonio-Bexar County Metropolitan Planning Organization. The department looks forward to the results of the study and believes these results and recommendations should be incorporated into future neighborhood and traffic planning between Fort Sam Houston and the City of San Antonio.

- **Economic Development Department**—The upcoming expansion at Fort Sam Houston will have a tremendous economic impact on the community. New missions, personnel and construction, according to the EIS, will provide a $10 billion economic impact. This will add to the current substantial impact the military has each year on the community. San Antonio was fortunate to be a net job gainer as a result of BRAC 2005 and the Economic Development Department plans to conduct an assessment of the BRAC directives to fully determine the extent of the economic impact of BRAC on the community.

- **Development Services**—Development Services does not have any specific comments on the Draft Fort Sam Houston EIS. However, there are some concerns regarding the studied land use impacts in the EIS. The EIS only considered potential impacts within the boundaries of the installations and did not take into account potential off-site impacts on the residential, commercial, industrial and recreational land uses adjacent to both Fort Sam Houston and Camp Bullis.

- **San Antonio Metropolitan Health District**—The Metropolitan Health District has comments and/or concerns on the following issues regarding BRAC related growth at Fort Sam Houston:
    - Historical land use—Need for adequate contingency planning for removal/remediation of any hazardous materials that may be concealed on base;
    - Need to have in place proper plans for biohazard and biomedical waste removal;
    - Use and disposal of radiological devices;
    - Careful monitoring of traffic movement through surrounding residential areas as a result of the thousands of additional personnel and vehicles coming onto the base;
    - General impact on surrounding communities over time;
    - Watershed management and drainage (Salado Creek).

- **Planning & Community Development Department**—The Planning & Community Development Department has reviewed the Fort Sam Houston Draft EIS for BRAC Actions and has the following concerns:

    - **Traffic Congestion**—With approximately 10,000 new personnel expected to work at Fort Sam Houston, we feel the scope of review for potential traffic congestion is not adequately addressed in the DEIS. The document states only the roadway network "within the boundaries" of Fort Sam Houston will be examined. However, the Area of Potential Effects extends beyond Fort Sam Houston limits. Although there is a brief discussion about "off-installation," the transportation section does not adequately address the cumulative effects of peak hour traffic to surrounding neighborhoods and traffic flow patterns. We understand the need for security, but feel alternatives need to be provided and thoroughly analyzed to reduce the negative traffic impact. Alternatives can include additional entrances or exit gates, staggered work hours and/or reversible lanes. TxDOT will soon be widening IH-35 adjacent to Fort Sam Houston thereby causing further traffic congestion. Entrances not reliant on IH-35 should be considered.

    - **Cultural Resources**—Please see the shared comments with the Public Works Department below.

- **Public Works Department**—The Public Works Department has reviewed the Fort Sam Houston Draft EIS and has three main points for comment.

    - **Drainage**—Currently, there are drainage issues and concerns upstream and downstream of both Camp Bullis and Fort Sam Houston. It is recommended that the City of San Antonio develop inter-local agreements with Fort Sam Houston to improve drainage as well as address water quality concerns. To assist with facilitation of these recommendations, Public Works Storm Water Operation Group would need to have access to both Camp Bullis and Fort Sam Houston to identify storm water conveyance and water quality items. Another recommendation is to incorporate Unified Development Code (UDC) requirements as they pertain to drainage and other improvements specifically along Salado Creek.

- **Traffic**—The Public Works Department believes the scope of review for potential traffic congestion is not adequately addressed in the draft EIS. While the report states only the roadway network "within the boundaries" will be discussed, it is important to look at the area of potential effects beyond Fort Sam Houston limits. The Public Works Department does not dispute that security is important; however alternatives need to be provided and thoroughly analyzed to reduce the negative impact on traffic. Possible alternatives can include additional entrances or exit gates, staggered work hours and/or reversible lanes. TxDOT will be widening IH-35 adjacent to Fort Sam Houston thereby affecting traffic congestions. This should be considered in traffic analysis. The San Antonio-Bexar County Metropolitan Planning Organization is currently drafting a Fort Sam Houston traffic model that will serve as a useful tool when making transportation decisions. This data is not currently available at this time. However, based on the air emissions analysis contained within your report, it appears that traffic related impacts to air quality will be minimal. We believe it is important to incorporate Alamo Area Council of Government's (AACOG) Air Quality Emissions standards. The Public Works Department requests a timeline for Ft. Sam Houston's Internal Traffic Study. The Department needs the study summary to determine the impact to the local street network surrounding the post.

- **Cultural Resources**—The archeology section of the Public Works Department has a concern over the construction of the bridge over Salado Creek. No discussion is made as to alternatives, impacts or mitigation of the recorded sites. For standing structures, the document discounts the importance of demolishing eligible and contributing buildings within the listed National Register Historic Districts. As opposed to what is mentioned in the draft report, demolition/deconstruction does have a significant impact and the EIS needs to acknowledge this impact and state the appropriate Standard Operating Procedures that will be followed. In addition, the document does not adequately discuss the potential impacts of the proposed construction of two new buildings within the Quadrangle Historic District, nor is there discussion of alternatives other than build or no build.

DOCUMENT 3

ARTHUR BROWNE, SAN ANTONIO, TEXAS
SPEAKER/COMMENT CARD AND VERBAL COMMENT
OCTOBER 24, 2006

Speaker/Comment Card

Fort Sam Houston welcomes your input!

If you would like to speak during the public comment time or provide a written comment on the Post's Base Realignment and Closure (BRAC) actions please use this card.

Please PRINT your name below. Your address is not required. However, if you would like to be added to the mailing list please PRINT your address.

MRS.
MS.
~~MR.~~ Arthur Browne
(First Name) (Last Name)

Address City State Zip Code

☐ I would like to speak during the Public Comment Time. (Comments limited to 4 min.)

Comment: The closure of Fort Sam Houston to civilian traffic has increased traffic congestion on Both Broadway and I 35. This has resulted in a contribution of Both **Over**

Geography Noise and Air Quality Poster SOx and lead increased 2003 To 2010

leaded gas has not been sold in SA For 20 years How did you get an increase

Comments continued

Privacy Advisory: As the United States Army undertakes the preparation of an environmental impact statement (EIS) on the realignment of Fort Sam Houston, Texas, we invite you to participate. Your information in identifying important issues that need to be studied will assist the U.S. Army in formulating alternatives and carrying out our responsibilities under the National Environmental Protection Act. Comments, names, and addresses are generally made available for public review although personal home addresses and phone numbers will not be published in the final EIS. **Individuals wishing to have their name, address and phone number withheld from public disclosure to the extent allowed by law, should check this box** ☐

VOC and NOx which are both Ozone Precursors Since San Antonio ~~has~~ For several years violated The 85 PPB Ozone standard by 2-3 PPB. It could be said That The Closure of Fort Sam Houston to civilian traffic and an increase of "Gate traffic waiting" has been the main Factor in San Antonio being declared in Non Attainment which will result in increased State Inspection Fees For every vehicle in Bexar Co. A Mitigation Strategy would be to reopen FSH to Civilian traffic

DOCUMENT 4

CITY OF SAN ANTONIO, PLANNING DEPARTMENT
LETTER FROM CHERISE J. BELL, SENIOR PLANNER
OCTOBER 24, 2006

CITY OF SAN ANTONIO

October 24, 2006

Jackie Schlatter
Environmental Specialist
Attn: IMSW-SMH-PWE
2202 15th Street, B4196
Fort Sam Houston, TX 78234-5036

Dear Ms. Schlatter:

This letter provides comments on the DEIS for the proposed BRAC for Fort Sam Houston, and Camp Bullis, Texas.

Table ES-1, "Summary of the Preferred Alternative" states "A bridge would be constructed over Salado Creek..." based on the location there appears to be two recorded archeological sites at this location. I was unable to find any discussion of these sites, their impacts or mitigation in Section 4.9 Cultural Resources.

Table ES-2, Cultural Resources: "Mitigation Measures if Needed" currently reads "Not Applicable". However, page 4-99 states that SOP 7 would be followed. With the demolition, alterations and new construction occurring within historic districts, mitigation needs to be done, please correct the table to appropriately address mitigation.

Page 4-92 line 16. "Significant impacts may be mitigated by following pertinent SOPs in the HPC." We recommend changing "may" to "will be". Significant impacts will occur as historic buildings are slated to be demolished, and this in turn will activate the need for mitigation.

Map 4-95. "Visual Zones" should be defined. It is unclear the purpose of the visual zones and their criteria for establishment.

Table 4-97. The following facilities are not located on any maps: 2010, 2007, 2008 and 4190. Per the HPC, each building is either listed, contributing or eligible for the National Register of Historic Places.

Page 4-99 lines 21 through 26. All of the buildings listed, except for 610, are identified as eligible for designation and do not meet the criteria for Deconstruction per SOP 2, therefore SOP 7 should be followed. This paragraph should be rewritten to note the distinction between the properties. In addition, building 610 is not on the HPC list, but

PLANNING DEPARTMENT • P.O. BOX 839966 • SAN ANTONIO, TEXAS 78283-3966
TEL: (210) 207-7873 TTY: (210) 207-7911 FAX: (210) 207-7897

building 610B is listed, please check that a "typo" has not occurred. Neither the maps nor the HPC denote if these buildings are located in an NHL. Per SOP 6 "If the CRM determines that an activity will have an adverse effect (SOP 4) on historic properties, this determination will be documented in the NEPA document, along with a review of project alternatives. When the historic property is a building, and the project involves deconstruction, the evaluation of alternatives will consider the estimated cost of alternative (see 6.6.2)." This information was not provided in the NEPA document. Only two alternatives are provided and there is no discussion of estimated cost of alternatives. A more thorough review needs to be documented in the NEPA document regarding the demolition of historic buildings and new construction within historic districts.

Table 4-28. We are concerned about projects 64191 and 17142 and the intrusion into the Quadrangle Historic District and about project 64215 and the impact to the New Post Historic District. Table ES-9 only address the "No action" and "Preferred Alternative", more alternatives should be examined to see if new construction can occur outside the historic district. According to SOP 6: "In accordance with SOP 13: National Historic Landmarks, National Historic Landmark properties require that, to the maximum extent possible, Fort Sam Houston undertake planning and actions as may be necessary to minimize harm to such landmark. When NHLs may be adversely affected, Fort Sam Houston will follow SOP 13 and minimize the effects to the maximum extent possible." SOP 13: "Because of the higher level of significance of NHLs, agencies are required by Section 110(f) of NHPA to "...the maximum extent possible, undertake such planning and actions as may be necessary to minimize harm to such landmark..." .
Both the Quadrangle and the Post are NHL districts. NEPA documentation should include a discussion of alternatives above and beyond, "build and no build".

Page 4-99 lines 27 through 30. Change "Those activities **would not have significant impacts** on historic districts, facilities and structures if the appropriate SOPs in the HPC are followed." Demolition/deconstruction **does have a significant impact** upon the structure and a historic district, regardless what mitigation efforts are done. This paragraph should be rewritten to acknowledge the impact and loss. An example sentence could be: "It is regrettable that some demolition of historic structures must occur, however appropriate mitigation measures will be initiated. Introduction of new facilities will follow the Secretary of Interior Standards and take full measures to reduce any negative impact upon the historic district." A change of tone and intention acknowledges the impact the proposed BRAC will have upon these nationally significant districts.

Suggestion: when SOPs are referenced in the body text, a copy should be put as an appendix or a website provided so the general public or reviewer could easily access that information.

Page 4-204 line 26. "Potential minor impacts to cultural and visual resources ... would occur". Demolition of a historic resource is an impact, this sentence should be changed to "Significant impacts to cultural and visual resources would occur and be mitigated by following the SOPs as formally agreed upon in the Army Alternative Procedures."

Page 4-219, lines 21 through 27. Again demolition of historic buildings is significant and possibly avoidable and mitigation needs to be done. Sections 4.16 and 4.17 need to be rewritten to accurately reflect the negative impact and mitigation efforts to be taken on historic buildings.

7.0 Distribution List
Please update the mailing address for the Historic and Design Review Commission to **1901** S Alamo, San Antonio, TX **78204.**
Please note that the contact person for the San Antonio Conservation Society changes on a yearly basis, so make any notices to "President".

Thank you for the opportunity to review the DEIS. If you have any questions regarding these comments please contact me at 210-207-3327 or cherise.bell@sanantonio.gov.

Sincerely,

Cherise J. Bell

Cherise J. Bell
Senior Planner
Planning Department
City of San Antonio

DOCUMENT 5

TEXAS HISTORICAL COMMISSION, AUSTIN, TEXAS
LETTER FROM F. LAWERENCE OAKS, EXECUTIVE DIRECTOR
NOVEMBER 17, 2006

TEXAS HISTORICAL COMMISSION

The State Agency for Historic Preservation

RICK PERRY, GOVERNOR

JOHN L. NAU, III, CHAIRMAN

F. LAWERENCE OAKS, EXECUTIVE DIRECTOR

November 17, 2006

Mr. Phillip Reidinger
Public Affairs Office, Building 124
1212 Stanley Road
Fort Sam Houston, TX 78234

Re: Project comment under the National Environmental Policy Act of 1969 (NEPA); Draft Environmental Impact Statement (DEIS) for BRAC Realignment; Fort Sam Houston, Bexar County, Texas (U.S. Army, National Historic Landmark)

Dear Mr. Reidinger:

Thank you for your correspondence regarding the above referenced documents. This letter serves as comment from the State Historic Preservation Officer, the Executive Director of the Texas Historical Commission.

The Texas Historical Commission looks forward to serving as a consulting party to the development of the Final EIS and implementation for realignment activities at Fort Sam Houston. Large portions of the installation are designated as a National Historic Landmark (NHL) and other areas are eligible for the *National Register of Historic Places*. The realignment of Fort Sam Houston has the potential to significantly impact historic and cultural resources, both positively through rehabilitations and negatively through demolition. To guide ongoing realignment planning toward positive impacts, we offer the following comments.

(1) PROPOSED REUSE AND REHABILITATION OF HISTORIC BUILDINGS: As indicated in our November 16 semi-annual Army Alternate Procedures monitoring meeting, the increase in mission and the corresponding need for additional facilities creates tremendous opportunity to rehabilitate and reoccupy many of the significant historic landmarks languishing vacant at Fort Sam Houston. Rehabilitation according to Secretary of the Interior's Standards would impact on historic and cultural resources positively, but insensitive rehabilitations and new construction risk negative impacts.

(2) PROPOSED DEMOLITION OF HISTORIC BUILDINGS: While our November 16 meeting focused on the potential positive impacts of the realignment, we cannot ignore the fact that the DEIS proposes demolition of historic structures both inside and outside the NHL district. We understand that

project-specific documentation is not available at this early planning stage, but we will not be able to determine the full extent of the impact on historic resources without additional project specific NEPA documentation, consultation and scoping meetings.

(3) CONSULTATION PROCEDURES: Strict adherence to the Historic Properties Component (HPC) of the Integrated Cultural Resources Management Plan (ICRMP) provides appropriate procedures for consideration of historic resources and consultation with our office and interested parties but does not preclude a significant negative impact on historic resources.

(4) PROPOSED JOINT-BASING: We are uncertain how the HPC procedures will function under the proposed realignment. The realignment calls for the consolidation of installation management for Randolph AFB and Fort Sam Houston under the auspices of Lackland AFB. This may invalidate the existing Alternate Procedures set forth in the HPC, which apply only to Army operations and specifically Fort Sam Houston. These are the same procedures that the DEIS is relying on to minimize the impacts of the realignment. We understand that all parties, including the Advisory Council on Historic Preservation, are working to resolve this issue but there may be no solution until after the final EIS and Record of Decision.

(5) ADEQUATE CULTURAL RESOURCES STAFFING: As a final note, we'd like to stress the importance of the installation maintaining a full complement of qualified cultural resource personnel as required by the HPC. While Fort Sam Houston's current efforts to fill the vacant historical architect position are a positive, additional staff may be necessary to manage the tremendous increase in workload and impacts that are likely to result from BRAC related construction.

Thank you for your participation in this federal review process. We look forward to further intensive but productive consultation to minimize any negative impacts of the realignment. **If you have any questions concerning our review or if we can be of further assistance, please contact me at 512/463-6100.**

Sincerely,

F. Lawerence Oaks
Executive Director
Texas Historical Commission

DOCUMENT 6

HOWARD W. PEAK, SAN ANTONIO, TEXAS
ELECTRONIC MAIL
NOVEMBER 7, 2006

-----Original Message-----
From: Reidinger, Phillip A Mr GARRISON-FSHTX
Sent: Tuesday, November 07, 2006 1:29 PM
To: Schlatter, Jackie R Ms GARRISON-FSHTX; Cannizzo, James V Mr GARRISON-FSHTX; Holcomb, Barbara R LTC GARRISON-FSHTX
Subject: FW: Environmental Impact Statement Comments

The following comments are related to the verbatim DEIS presentation LTC Holcomb presented to the Military Transformation Task Force and review of the BRAC DEIS web site. These comments should be addressed in the EIS. Howard Peak is former city councilman and mayor. He is chair of the MTTF facilities infrastructure and land use subcommittee of the MTTF. Phil

-----Original Message-----
From: PEAK, HOWARD W (SBCSI) [mailto:hp4974@att.com]
Sent: Tuesday, November 07, 2006 9:01 AM
To: Phillip.Reidinger@samhouston.army.mil
Subject: Environmental Impact Statement Comments

To Whom It May Concern: Although I was not able to attend the public meeting for the Environmental Impact Statement, I want to express concerns about potential traffic impacts to areas surrounding Fort Sam Houston (FSH), and specifically along Harry Wurzbach Road which borders FSH in part on the west side of the Post. I live in a neighborhood known as Bel Meade which actually abuts FSH in part, and is also bordered by Harry Wurzbach across from FSH. We're a neighborhood first developed in the mid 1940's, and one which has long been, and continues to be, a place of residence for many active and retired military personnel, especially from the U.S. Army. On the opposite side of the neighborhood from Harry Wurzbach is Burr Road, which extends between Harry Wurzbach and Broadway. Harry Wurzbach is a major thoroughfare with access points into FSH at several locations, and Burr Road provides access to and from Harry Wurzbach and FSH. Unfortunately, a growing number of vehicles going in and out of the FSH gate at Harry Wurzbach in the vicinity of Scott Road are cutting through Bel Meade, either coming from or to Burr Road (in order to save about a half mile and avoid a traffic signal).

My concern, and that of many of my neighbors in Bel Meade, is that as the number of personnel expand at FSH, more traffic will cut through Bel Meade, thereby increasing traffic problems and reducing our quality of life. Virtually all of the cut through traffic, both that occurs now and that which will increase in the future, is attributable to FSH as, except for the Towers residential complex on Harry Wurzbach, there are no destinations other than FSH.

My request is that, though the traffic problems that I have described, present and future, are off FSH, they are generated from traffic to and from FSH and, therefore, should be considered as an environmental impact associated with the planned expansion at FSH. I am requesting that solutions and preventions be developed so that the existing cut through traffic is eliminated and that future cut through traffic is prevented. My purpose is not to create problems for the mission expansions and additions, I support them wholeheartedly, but that they not create problems for those of us who have been good neighbors to FSH for many decades. Thank you for your consideration, and I look forward to working with you to accomplish our objectives.

Howard W. Peak
238 Medford
San Antonio, TX 78209
210-826-5481

DOCUMENT 7

JUDY GRAY, PRESIDENT, BEL MEADE HOMES ASSOCIATION, INC.
SAN ANTONIO, TEXAS
ELECTRONIC MAIL
NOVEMBER 13, 2006

Jenkins, Josh

From: Schlatter, Jackie R Ms GARRISON-FSHTX [Jackie.Schlatter@samhouston.army.mil]
Sent: Monday, November 13, 2006 1:37 PM
To: Bales, Nancy; Baumgartel, Gary; Tripe, Jeffry A SWF; Jenkins, Josh
Subject: FW: Fort Sam Houston Environmental Impact Study
Importance: High

Another comment...

From: Reidinger, Phillip A Mr GARRISON-FSHTX
Sent: Monday, November 13, 2006 12:23 PM
To: Schlatter, Jackie R Ms GARRISON-FSHTX
Cc: Cannizzo, James V Mr GARRISON-FSHTX; Andrews, Darrel W Sr LTC GARRISON-FSHTX
Subject: FW: Fort Sam Houston Environmental Impact Study
Importance: High

public comment RE draft EIS -

From: Gray, Judy [mailto:Judy.Gray@alamotitle.com]
Sent: Monday, November 13, 2006 12:19 PM
To: Phillip.Reidinger@samhouston.army.mil
Subject: Fort Sam Houston Environmental Impact Study
Importance: High

Mr. Reidinger,

As the President of the Bel Meade Homes Association, Inc., I would like to take this opportunity to express my agreement and support of Howard Peak's memorandum to you dated November 7, 2006.

I realize that the federal Environmental Impact Study being conducted for Fort Sam Houston will not include an analysis of any impact on adjoining areas, but because Bel Meade is so directly impacted by any changes made to the Post, it is important that you understand our great concerns.

Due to the growth at Fort Sam Houston and the closing of gates for security purposes, Bel Meade, which is a limited public-access subdivision, battles the impact of lines of speeding traffic cutting through the subdivision solely for the purpose of creating a speedy route and avoiding the traffic light at the intersection of Harry Wurzbach and Burr Road. Our neighborhood, established in 1946, was not designed to handle this type of congestion and it is greatly affecting the lives of its residents.

Please include our comments in your ideas for any proposed funding and/or alterations at the Post, if not officially, then unofficially.

Thank you for your attention.

Judith A. Gray
Attorney at Law
President
Bel Meade Homes Association, Inc.
311 W. Hathaway
San Antonio, Texas 78209

DOCUMENT 8

U.S DEPARTMENT OF THE INTERIOR
OFFICE OF ENVIRONMENTAL POLICY AND COMPLIANCE
ALBUQUERQUE, NEW MEXICO
LETTER FROM STEPHEN R. SPENCER, REGIONAL ENVIRONMENTAL OFFICER
NOVEMBER 16, 2006

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
P.O. Box 26567 (MC-9)
Albuquerque, New Mexico 87125-6567

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:

November 16, 2006

File 9043.1
ER 06/954

Phillip Reidinger
Fort Sam Houston
Public Affairs Office, Bldg 124
1212 Stanley Road
Fort Sam Houston, TX 78234

Dear Mr. Reidinger:

The U.S. Department of the Interior has reviewed the Draft Environmental Impact Statement for Base Realignment and Closure (BRAC) Actions, Fort Sam Houston, Texas. In this regard, we have NO COMMENT.

Thank you for the opportunity to review this document.

Sincerely,

Stephen R. Spencer
Regional Environmental Officer

DOCUMENT 9

ALAMO AREA COUNCIL OF GOVERNMENTS
LETTER FROM AL J. NOTZON, III, EXECUTIVE DIRECTOR
OCTOBER 25, 2006

AACOG
Alamo Area Council
Of Governments

October 25, 2006

Phil Reidinger, Public Affairs Office
Army Medical Department Center and School
1212 Stanley Road, Bldg. 124
Fort Sam Houston , TX 78234-5004

RE: TRACS #TX-R-20061006-0002-50
Base Realignment and Closure (BRAC) Actions
Draft Environmental Impact Statement
United States Department of the Army, Fort Sam Houston

Dear Mr. Reidinger,

This letter is to advise you that the Board of Directors of the Alamo Area Council of Governments met on Wednesday, October 25, 2006 and recommended a consensus to proceed review for the above-mentioned DEIS.

The review and comment process of this application was executed by the Economic Development and Environmental Review Committee as required by state executive order EO31272 during their scheduled meeting on October 17, 2006. Their comments were submitted to the AACOG Board of Directors for final approval and afterwards the approved comments were entered into the Office of the Governor's TRACS database.

If you have any questions, please call me or Joe Ramos, Government Services Manager. We can be reached at (210) 362-5200.

Regionally yours,

Al J. Notzon, III
Executive Director

Cc: Wendy L. Martinson
Colonel, US Army
Headquarters, United States Army Garrison, Fort Sam Houston

AN/bv

8700 Tesoro, Suite 700 • San Antonio, Texas • 78217 • (210) 362-5200 • Fax: (210) 225-5937 • Web site: www.aacog.com • E-mail: mail@aacog.com

DOCUMENT 10

U.S. ENVIRONMENTAL PROTECTION AGENCY
LETTER FROM RHONDA M. SMITH, CHIEF
NOVEMBER 17, 2006

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TX 75202-2733

NOV 1 7 2006

Mr. Phil Reidinger
Fort Sam Houston
Public Affairs Office
Building 124
1212 Stanley Road
Fort Sam Houston, TX 78234

Dear Mr. Reidinger:

In accordance with our responsibilities under Section 309 of the Clean Air Act, the National Environmental Policy Act (NEPA), and the Council on Environmental Quality (CEQ) Regulations for Implementing NEPA, the U.S. Environmental Protection Agency (EPA) Region 6 office in Dallas, Texas, has completed its review of the Draft Environmental Impact Statement (DEIS) for the proposed base realignment and closure (BRAC) actions at Fort Sam Houston, Texas. The DEIS evaluates the potential environmental impacts associated with realignment actions directed by the BRAC Commission and Army Modular Force (AMF) transformation activities at Fort Sam Houston, Texas and Camp Bullis, Texas.

EPA rates the DEIS as "**LO,**" i.e., EPA has "**Lack of Objections** " to the proposed action as described in the DEIS. EPA has some comments to offer on air quality and asks that these comments be addressed and responded to in the Final EIS (FEIS). Our enclosed detail comments are offered to complement and to more fully insure compliance with the requirements of NEPA and the Council on Environmental Quality (CEQ) regulations.

Our classification will be published in the Federal Register according to our responsibility under Section 309 of the Clean Air Act to inform the public of our views on proposed Federal actions. If you have any questions, please contact Michael Jansky of my staff at 214-665-7451 or by e-mail at jansky.michael@epa.gov.

EPA appreciates the opportunity to review the DEIS. Please send our office two copies of the FEIS when it is sent to the Office of Federal Activities, EPA (Mail Code 2252A), Ariel Rios Building, 1200 Pennsylvania Ave, N.W., Washington, D.C. 20460.

Sincerely yours,

for Rhonda M. Smith, Chief
Office of Planning and
Coordination (6EN-XP)

Enclosure

DETAILED COMMENTS
ON THE
DRAFT ENVIRONMENTAL IMPACT STATEMENT
FOR THE
BASE REALIGNMENT AND CLOSURE ACTIONS AT
FORT SAM HOUSTON, SAN ANTONIO, TEXAS

COMMENTS

This DEIS describes in detail the potential impact to the San Antonio air shed that may result from the Base Realignment and Closure (BRAC) actions planned for Fort Sam Houston. This military installation is located in San Antonio, Texas, which is currently operating under an EPA-approved Early Action Compact (EAC) for 8-hour ozone. The document is thorough in its approach and description to possible air quality impacts and offers the public an excellent overview of air quality issues facing San Antonio. EPA does, however; have several comments to offer for clarity and corrections:

1. On October 17, 2006, EPA finalized changes to the National Ambient Air Quality Standards (NAAQS) for particulate matter (PM). The primary 24-hour standard for PM2.5 was lowered to $35\mu g/m^3$ and the annual PM10 standard was revoked. The secondary 24-hour PM10 standard was changed to $150\mu g/m^3$. See 71 FR 61144 for further details. Please correct Table 4-1 on page 4-21 of the DEIS.
2. Page 4-22 of the document lists Wilson County as a part of the San Antonio Early Action Compact area. Please remove Wilson County from this list; county officials were initially involved in planning and discussions regarding the EAC but opted out of the process prior to finalizing the document.
3. Section 4.4.2 on page 4-26 incorrectly identifies Bexar County as being in attainment of all NAAQS. In fact, the ozone monitor in Bexar County indicates nonattainment of the 8-hour ozone standard and EPA has designated Bexar, Comal and Guadalupe counties as nonattainment for ozone. However, because of their participation in the San Antonio EAC, EPA has deferred the effective date of this nonattainment designation, so the document is correct that transportation and general conformity does not apply in these counties.
4. Finally, EPA would like to offer a cautionary note regarding modeling of on-road mobile emissions. The document uses emission factors from EPA's AP-42 publication to generate emission estimates for on-road mobile sources. While this may meet the public disclosure requirements of the National Environmental Policy Act (NEPA), the current EPA-approved mobile source emission factor model is MOBILE6.2 and suggests any subsequent mobile source analysis be done using this model, as it will contain the latest emission factors available.

APPENDIX B

AIR QUALITY SUPPORTING DOCUMENTATION

Table 4.4-3a Fort Sam Houston Typical Vehicle Type and Distribution

Vehicle Category	Desription	Average Distribution[a]
LDGV	Light-duty gasoline fueled vehicles (gasoline passenger cars)	68.90%
LDGT1	Light-duty gasoline fueled trucks, Type 1 (Pick-Ups, Sport Utility Vehicles, and Vans with a GVW less than	11.40%
LDGT2	Light-duty gasoline fueled trucks, Type 2 (Pick-up, Sport Utility Vehicles, and Vans with a GVW between 6,001	8.50%
HDGV	Heavy-duty gasoline fueled vehicles exceeding 8,500 pounds	1.50%
LDDV	Light-duty diesel fueled vehicles (diesel passenger cars)	3.90%
LDDT	Light-duty diesel fueled trucks (Diesel Pick-ups, Sport Ulitity Vehicles, and Vans with a GVW less than 8,500	1.90%
HDDV	Heavy-duty diesel fueled vehicles (Includes Diesel Trucks and Buses with a GVW exceeding 8,500 pounds)	2.90%
MC	Motorcycles	1.00%

[a]Values are the average of the calender year 2000 and 2010 values listed in AP-42, Volume II, Appendix I. Assumed typical for FSH and Camp Bullis.

Table 4.4-3b Fort Sam Houston Total Vehicle Count by Vehicle Type

Vehicle Distribution	Weekday 2003[a]	Weekday 2010[b,c,d]	Annual 2003[e]	Annual 2010[b,c,e]
LDGV	11,241	16,862	2,810,250	4,215,500
LDGT1	1,860	2,790	465,000	697,500
LDGT2	1,387	2,081	346,750	520,250
HDGV	245	368	61,250	92,000
LDDV	637	956	159,250	239,000
LDDT	310	465	77,500	116,250
HDDV	474	711	118,500	177,750
MC	164	246	41,000	61,500
Total	16,314	24,479	4,079,500	6,119,750

[a] Vehicle count data obtained from Programmatic Acess Control EA for FSH and CB, May 2004. Assume an average vehicle model year of 2000.

[b] BRAC Actions are estimated to be complete by 2010

[c] Assumes a 50% increase in vehicle traffic due to BRAC Actions

[d] Assume and average vehicle model year of 2007

[e] Assumes 5 days per week, 50 weeks per year.

Table 4.4-3c EPA Mobile Vehicle Emission Factor[a]

	VOC (g/mi)	CO (g/mi)	NO_x (g/mi)	PM (g/mi)	PM_{10} (g/mi)	$PM_{2.5}$ (g/mi)	SO_x (g/mi)	Pb (g/mi)
LDGV	0.5	8.3	0.6	3.6	0.71	0.2	0.072	0.0015
LDGT1	0.5	8.9	0.7	5.53	1.08	0.29	0.096	0.002
LDGT2	0.5	9.4	0.8	13.43	2.58	0.66	0.098	0.0021
HDGV	1.2	14.6	3.1	28.62	5.51	1.42	0.154	0.0033
LDDV	0.4	1.3	1	3.69	0.8	0.28	0.116	Neg
LDDT	0.6	1.5	1.2	7.8	1.59	0.48	0.157	Neg
HDDV	2	10.4	6.5	40.03	7.73	2.01	0.512	Neg
MC	4.1	20.2	0.9	0.34	0.08	0.03	0.032	0.0012

[a] Air emission factors based on AP-42 Volume II, Appendix H for low altitudes for year 2003 emissions of model year 2000 vehicles

Table 4.4-3d On-Installation 23003 Annual Emissions by Vehicle Class[a]

	VOC (lb/yr)	CO (lb/yr)	NO_x (lb/yr)	PM (lb/yr)	PM_{10} (lb/yr)	$PM_{2.5}$ (lb/yr)	SO_x (lb/yr)	Pb (lb/yr)
LDGV	7,746	128,579	9,295	55,769	10,999	3,098	1,115	23
LDGT1	1,282	22,813	1,794	14,175	2,768	743	246	5
LDGT2	956	17,968	1,529	25,671	4,932	1,262	187	4
HDGV	405	4,930	1,047	9,663	1,860	479	52	1
LDDV	351	1,141	878	3,239	702	246	102	Neg
LDDT	256	641	513	3,332	679	205	67	Neg
HDDV	1,306	6,794	4,246	26,149	5,049	1,313	334	Neg
MC	927	4,565	203	77	18	7	7	0
Total (lb/yr)	13,229	187,431	19,505	138,076	27,008	7,353	2,111	34
Total (ton/yr)	6.61	93.72	9.75	69.04	13.50	3.68	1.06	0.02

[a]Assumes 2.5 miles traveled on-installation each week day, 50 weeks per year (Weekend days are not evaluated)

By/Date: JVF 12/20/06
Chkd By/Date: [illegible] 12/21/06

Table 4.4-3e Off-installation 2003 Annual Emissions by Vehicle Class[a]

	VOC (lb/yr)	CO (lb/yr)	NO_x (lb/yr)	PM (lb/yr)	PM_{10} (lb/yr)	$PM_{2.5}$ (lb/yr)	SO_x (lb/yr)	Pb (lb/yr)
LDGV	92,949	1,542,954	111,539	669,233	131,988	37,180	13,385	279
LDGT1	15,380	273,762	21,532	170,101	33,221	8,920	2,953	62
LDGT2	11,469	215,613	18,350	308,051	59,179	15,139	2,248	48
HDGV	4,862	59,155	12,560	115,959	22,325	5,753	624	1
LDDV	4,214	13,695	10,534	38,872	8,428	2,950	1,222	Neg
LDDT	3,076	7,690	6,152	39,988	8,151	2,461	805	Neg
HDDV	15,678	81,523	50,952	313,786	60,594	15,756	4,013	Neg
MC	11,120	54,785	2,441	922	217	81	87	3
Total (lb/yr)	158,747	2,249,176	234,060	1,656,912	324,101	88,240	25,337	393
Total (ton/yr)	79.37	1,124.59	117.03	828.46	162.05	44.12	12.67	0.20

[a]Assumes 30 miles traveled off-installation each week day, 50 weeks per year (Weekend days are not evaluated)

Table 4.4-3f On-installation 2010 Annual Emissions by Vehicle Class[a]

	VOC (lb/yr)	CO (lb/yr)	NO_x (lb/yr)	PM (lb/yr)	PM_{10} (lb/yr)	$PM_{2.5}$ (lb/yr)	SO_x (lb/yr)	Pb (lb/yr)
LDGV	11,619	192,875	13,943	83,657	16,499	4,648	1,673	35
LDGT1	1,922	34,220	2,691	21,263	4,153	1,115	369	8
LDGT2	1,434	26,958	2,294	38,516	7,399	1,893	281	6
HDGV	609	7,404	1,572	14,515	2,794	720	78	2
LDDV	527	1,713	1,317	4,862	1,054	369	153	Neg
LDDT	384	961	769	4,998	1,019	308	101	Neg
HDDV	1,960	10,190	6,369	39,223	7,574	1,969	502	Neg
MC	1,390	6,848	305	115	27	10	11	0
Total (lb/yr)	19,845	281,170	29,261	207,148	40,519	11,032	3,167	51
Total (ton/yr)	9.92	140.59	14.63	103.57	20.26	5.52	1.58	0.03

[a]Assumes 2.5 miles traveled on-installation each week day, 50 weeks per year (Weekend days are not evaluated)

Table 4.4-3g Off-installation 2010 Annual Emissions by Vehicle Class[a]

	VOC (lb/yr)	CO (lb/yr)	NO_x (lb/yr)	PM (lb/yr)	PM_{10} (lb/yr)	$PM_{2.5}$ (lb/yr)	SO_x (lb/yr)	Pb (lb/yr)
LDGV	139,428	2,314,499	167,313	1,003,879	197,987	55,771	20,078	418
LDGT1	23,070	410,643	32,298	255,152	49,831	13,380	4,429	92
LDGT2	17,207	323,497	27,532	462,187	88,790	22,714	3,373	72
HDGV	7,303	88,853	18,866	174,176	33,533	8,642	937	20
LDDV	6,324	20,553	15,810	58,338	12,648	4,427	1,834	Neg
LDDT	4,614	11,535	9,228	59,982	12,227	3,691	1,207	Neg
HDDV	23,516	122,285	76,428	470,679	90,891	23,634	6,020	Neg
MC	16,680	82,178	3,661	1,383	325	122	130	5
Total (lb/yr)	238,142	3,374,042	351,136	2,485,776	486,231	132,381	38,008	608
Total (ton/yr)	119.07	1,687.02	175.57	1,242.89	243.12	66.19	19.00	0.30

[a]Assumes 30 miles traveled off-installation each week day, 50 weeks per year (Weekend days are not evaluated)

Table 4.4-3h Vehicle Emissions Annual Summary

Emissions Totals	VOC	CO	NO_x	PM	PM_{10}	$PM_{2.5}$	SO_x	Pb
2003 (lb/yr)	171,976	2,436,607	253,565	1,794,988	351,110	95,593	27,448	427
2010 (lb/yr)	257,987	3,655,212	380,397	2,692,924	526,751	143,413	41,176	658
2003 (tons/yr)	85.99	1,218.30	126.78	897.49	175.55	47.80	13.72	0.21
2010 (tons/yr)	128.99	1,827.61	190.20	1,346.46	263.38	71.71	20.59	0.33

By/Date: JVF 12/20/06
Chkd By/Date: KRM 12/21/06

APPENDIX C

OPERATIONAL NOISE CONSULTATION

DEPARTMENT OF THE ARMY
US ARMY CENTER FOR HEALTH PROMOTION AND PREVENTIVE MEDICINE
5158 BLACKHAWK ROAD
ABERDEEN PROVING GROUND MD 21010-5403

MCHB-TS-EON

MEMORANDUM FOR

Environmental Planning Support Branch (SFIM-AEC-TSP/Ms. Alicia Booher), U.S. Army Environmental Center, 5179 Hoadley Road, Aberdeen Proving Ground, MD 21010-5401
Environmental Office (MCCS-BFE-C/Mr. David Walker), Directorate of Public Works, 2202 15th Street, Fort Sam Houston, TX 78234-5036

SUBJECT: Operational Noise Consultation 52-ON-04CA-06, Operational Noise Contours for Camp Bullis and Fort Sam Houston, TX, January 2006

1. REFERENCES. Enclosure 1 contains the references utilized in the consultation.

2. AUTHORITY. The Army Environmental Center, Aberdeen Proving Ground, MD funded this study.

3. PURPOSE. To provide Camp Bullis and Fort Sam Houston noise contours for the appropriate National Environmental Policy Act (NEPA) documentation for realignment under Base Realignment and Closure actions.

4. BACKGROUND.

a. Fort Sam Houston is located on the northeast side of San Antonio, Texas. The post is surrounded by San Antonio and the primary mission is medical training and support. The post is the home of the Brooks Army Medical Center.

b. Camp Bullis is a subpost of Fort Sam Houston. Camp Bullis is located in Bexar County in southeastern Texas and adjacent to and just north of the city of San Antonio. The military reservation stretches approximately 16 kilometers in a north-south direction with an average width of six kilometers.

5. NOISE ZONE DESCRIPTIONS. Enclosure 2 contains the Noise Zone Descriptions and Land Use Guidelines used in this consultation.

6. NOISE CONTOURING PROCEDURES.

a. LARGE CALIBER OPERATIONS.

(1) The noise simulation program used to assess large caliber weapons (20mm and greater) noise is BNOISE2 (U.S. Army 2000a). The BNOISE2 program requires operational data concerning type of weapons fired from each range or firing point including demolitions, the number and type of rounds fired from each weapon, the location of targets for each range or firing point, and the amount of propellant used to reach the target. Existing records on range utilization along with reasonable assumptions are used as BNOISE2 inputs. The BNOISE2 program accounted for the terrain at Camp Bullis when creating the noise contours.

(2) The inputs used to generate the large caliber noise contours for this report were created using the data summarized in Enclosure 3.

b. SMALL CALIBER OPERATIONS.

(1) The noise simulation program used to assess small caliber weapons (50 caliber and below) noise is SARNAM (U.S. Army 2000b). The SARNAM program requires operational data concerning type of weapons fired from each range, firing points, distance to targets, berms, and safety baffles.

(2) The inputs used to generate the small caliber noise contours for this report were created using the data summarized in Enclosure 3.

c. AIRCRAFT OPERATIONS.

(1) The noise simulation program used to assess aircraft noise is NoiseMap/Baseops (U.S. Air Force 2005a). The NoiseMap/Baseops program requires operational data concerning type of type of aircraft, altitude, flight tracks, and number of operations.

(2) The inputs used to generate the aircraft activity noise contours for this report were created using the data summarized in Enclosure 4.

d. FLIGHT CORRIDORS.

(1) The low number of aircraft operations utilizing the flight corridors/routes will not generate A-weighted day-night average level noise contours. Yet, there is the potential for aircraft to cause annoyance leading to noise complaint while entering/exiting the airspace.

(2) Scandinavian Studies (Rylander 1974 and Rylander 1988) have found that a good predictor of annoyance at airfields with 50 to 200 operations per day is the maximum level of the

three noisiest events. The maximum noise levels for the aircraft utilized in the Camp Bullis flight corridors are listed in Table 1. These maximum levels are compared with the levels listed in Table 2 to determine the percent of the population that would consider itself highly annoyed. While levels may be lower in the flight corridors with fewer than 50 operations per day, it is a tool in providing some indication of the percent of people who might be annoyed.

TABLE 1. MAXIMUM NOISE LEVELS OF AIRCRAFT OPERATING IN THE CAMP BULLIS FLIGHT CORRIDORS.

Slant Distance (Feet)	**Maximum Level, dBA**			
	AH-64	**UH-60**	**C130**	**C17**
200	94	91	108	100
500	86	83	98	92
1000	79	76	90	85

TABLE 2. PERCENTAGE OF POPULATION HIGHLY ANNOYED FROM AIRCRAFT NOISE.

Maximum, dBA	**Percentage Highly Annoyed**
70	5
75	13
80	20
85	28
90	35

(3) Flight corridors vary in width depending upon the type of aircraft and type of activity. Generally the aircraft fly the center line of the flight corridor but can vary anywhere within the corridor. Thus, to account for possible annoyance, the area of possible noise impact must be expanded based on the actual aircraft location within the corridor. For example, if a flight corridor is one mile in width for an AH-64 at 500' above ground level (AGL), to account for variation in aircraft location, the overall area of noise impact would be an additional one-third mile on each side of the corridor. This gives an adequate buffer to reduce possible annoyance. The buffer dimensions were determined based on results from the SelCalc Program (U.S. Air Force 2005b) and areas within the buffer may receive a max level dBA above 70, based on the altitude and slant distance of the aircraft. Enclosure 5 contains a graphic description of AGL, ground track, and slant distance.

7. NOISE CONTOUR MODELING RESULTS.

a. LARGE CALIBER WEAPONS NOISE CONTOURS.

(1) The existing large caliber weapons noise contours for Camp Bullis are shown in enclosure 6. The LUPZ (57 CDNL), Noise Zone II (62 CDNL), and Noise Zone II (70 CDNL) contours do not extend off-post.

(2) To predict the risk of complaints for large caliber weapon operation PK 15(met) contours were developed. The large caliber weapons PK15(met) noise contours for Camp Bullis are shown in enclosure 7. The PK15(met), 115 dB contour extends beyond the southwestern boundary less than 400 meters and beyond the eastern boundary less than 130 meters. The PK15(met) 130 dB noise contour does not extend off-post. The contours indicate a low probability of receiving noise complaints.

b. SMALL CALIBER WEAPONS NOISE CONTOURS. The small caliber weapons noise contours for existing operations at Camp Bullis are shown in enclosure 8. The Zone II [PK15(met) 87 dB] extends beyond the southern boundary less than 150 meters and beyond the eastern boundary less than 500 meters. The Zone III [PK15(met) 104 dB] contours do not extend beyond the installation boundary of Camp Bullis.

c. AVIATION NOISE CONTOURS.

(1) CAMP BULLIS COMBAT ASSUALT LANDING STRIP (CALS). The CALS is utilized approximately 12 days per year.

(a) The noise contours for the existing aviation operations utilizing the CALS are shown in enclosure 9. The LUPZ (60 ADNL) extends beyond the northeastern boundary less than 200 feet. The Noise Zone II (65 ADNL) and Noise Zone III (75 ADNL) contours do not extend beyond the boundary. However, there is the potential for aircraft to cause annoyance while entering/exiting the airspace.

(b) The noise contours for the future aviation operations utilizing the CALS are shown in enclosure 10. The LUPZ (60 ADNL) extends beyond the northern boundary over eight miles (crossing State Highway 46) and beyond the eastern boundary less than two miles. The Noise Zone II (65 ADNL) extends beyond the northern boundary approximately one and one-half miles and beyond the eastern boundary less than a mile. The Noise Zone III (75 ADNL) contours do not extend beyond the boundary.

(2) CAMP BULLIS FLIGHT CORRIDORS. The distances in Table 3 are added to the flight corridors width to account for annoyance created by activity taking place at the edge of the flight corridor. Enclosures 11 - 14 contain the annoyance flight corridor buffers for Camp Bullis.

TABLE 3. CAMP BULLIS SUPPLEMENTAL BUFFER FLIGHT CORRIDOR WIDTHS TO REDUCE ANNOYANCE POTENTIAL.

Aircraft Type	**Supplemental Buffer Width to Flight Corridor** NOE 200' AGL	Helipad 250 – 500' AGL	Drop Zone 1000' AGL
Rotary Wing:			
AH-64	1/3 Mile	----	----
UH-60	1/4 Mile	1/4 Mile	1/4 Mile
Fixed Wing Military Transport Aircraft (C130/C17)	----	----	2/3 Mile

(3) FORT SAM HOUSTON.

(a) BROOKS ARMY MEDICAL CENTER (BAMC) HELIPAD. The Life Flight operations utilizing the BAMC helipad have neither established routes into/out of the helipad or altitude restrictions, but the general directions of the Life Flight routes are to the northeast, southeast, and southwest. The land use in the buffer area is a mix of residential and commercial; however, the helicopters tend to over fly the commercial areas. To account for the variables occurring at the BAMC helipad; the assumption was made that within a one and half mile of the helipad the helicopters would be 500' AGL and below. Enclosure 15 contains the annoyance buffers for the BAMC helipad. The distances in Table 4 provide details of the buffer width by altitude and aircraft. It should be noted that because of the nature of these type operations very few, if any, complaints are generated.

(b) FORT SAM HOUSTON TRAINING FLIGHT CORRIDORS. The distances in Table 4 are added to the training flight corridors width to account for annoyance created by activity taking place at the edge of the corridor. Enclosure 16 contains the annoyance flight corridor buffers for the helicopter support of MOS 91W medical training at Fort Sam Houston.

TABLE 4. FORT SAM HOUSTON SUPPLEMENTAL BUFFER FLIGHT CORRIDOR WIDTHS TO REDUCE ANNOYANCE POTENTIAL

Aircraft Type	**Supplemental Buffer Width to Flight Corridor** < 500' AGL	1000' AGL
Rotary Wing:		
Bell 206	1/4 Mile	-----
Bell 412	1/3 Mile	1/3 Mile
UH-60	1/4 Mile	1/4 Mile

8. RECOMMENDATIONS.

a. Include the information from this consultation in the Camp Bullis and Fort Sam Houston appropriate NEPA documentation for realignment under Base Realignment and Closure actions.

b. Although no Federal Law prohibits the Department of Defense training and testing activities from making noise, the Services have always tried to be good neighbors. Due to the risk of noise complaints from off-post neighboring residents related to the proposed training noise, Camp Bullis should develop and implement an outreach program to inform the public of possible noise from training.

9. Please contact us if this report or any of our services did not meet your needs or expectations.

10. The point of contact is Ms. Kristy Broska or Dr. William Russell, Operational Noise Program, USACHPPM, at DSN 584-3829, commercial (410) 436-3829, or e-mail: kristy.broska@us.army.mil or william.russell4@us.army.mil.

FOR THE COMMANDER:

16 Encls
as

LAURIE A. CUMMINGS
COL, MS
Director, Environmental Health Engineering

CF:
COE (CESAM-PD-M) (w/encls)

REFERENCES

1. U.S. Air Force, 2005a, NOISEMAP/BASEOPS, Wright-Paterson Air Force Base, OH.

2. U.S. Air Force, 2005b, SELCAL Noise Model, Wright-Paterson Air Force Base, OH.

3. U.S. Army, 2000a, U.S. Army Construction Engineering Research Laboratories, BNOISE2 Computer Model.

4. U.S. Army, 2000b, U.S. Army Construction Engineering Research Laboratories, SARNAM Computer Model.

5. Rylander, et.al., 1974, "Re-Analysis of Aircraft Noise Annoyance Data Against the dBA Peak Concept", Journal of Sound and Vibration, Volume 36, pages 399 - 406.

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NOISE ZONES DESCRIPTIONS

1. Day Night Level Descriptions.

(a) The Noise Zone III consists of the area around the source of the noise in which the level is greater than 70 decibels (dB), C-weighted day-night sound level (CDNL) for large caliber weapons, greater than 104 PK 15(met) for small arms and greater than 75 dB, A-weighted day-night sound level (ADNL) for aircraft activity. The noise level within NZ III is considered so severe that noise-sensitive land uses will not be considered therein.

(b) The Noise Zone II consists of an area where the day-night sound level is between 62 and 70 dB CDNL for large caliber weapons, 87 and 104 PK 15(met) for small arms and 65 and 75 dB ADNL for aircraft activity. Exposure to noise within this area is considered significant, and use of land within NZ II should normally be limited to activities such as industrial, manufacturing, transportation, and resource production. However, if the community determines that land in NZ II areas must be used for residential purposes, then noise level reduction (NLR) features of 25 to 30 decibels should be incorporated into the design and construction of the buildings.

(c) The Noise Zone I include all areas around a noise source in which the day-night sound level is less than 62 dB CDNL for large caliber weapons, less than 87 PK 15(met) for small arms and 65 dB ADNL for aircraft activity. This area is usually acceptable for all types of land use activities.

(d) The Land Use Planning Zone (LUPZ) DNL noise contours, 57 dB CDNL and 60 dB ADNL, represent an annual average that separates the Noise Zone II from the Noise Zone I. Taking all operations that occur over the year and dividing by the number of training days generates the contours. But, the noise environment varies daily and seasonally because operations are not consistent through all 365 days of the year. In addition, the Federal Interagency Committee on Urban Noise document states “Localities, when evaluating the application of these guidelines to specific situations, may have different concerns or goals to consider.” For residential land uses, depending on attitudes and other factors, a 57 CDNL or 60 ADNL may be considered by the public as an impact on the community environment. In order to provide a planning tool that could be used to account for days of higher than average operations and possible annoyance, the LUPZ contour is being included on the noise contour maps.

(e) See Table 1 for land use ADNL and CDNL guidelines.

Table 1. Land Use Planning Guidelines**.**

Noise Zones	Large-Caliber Weapons (CDNL)	Aircraft Activity (ADNL)	Small Arms PK 15(met)
LUPZ	57 – 62	60-65	NA
I	< 62	<65	<87
II	62 - 70	65-75	87-104
III	> 70	>75	>104

Note:
LUPZ = Land Use Planning Zone
< = less than
> = greater than

2. PK15(met) Noise Contour Description.

(a) Community annoyance due to many types of transportation and industrial noise is typically and appropriately assessed based on average noise level over a protracted time period. The DNL is the primary descriptor used for this purpose in the United States. The DNL is the time weighted energy average sound level with a 10-decibel (dB) penalty added to the nighttime levels (2200 to 0700 hours). The use of average noise level over a protracted time period generally does not adequately assess community noise impact and complaint potential due to relatively infrequent blast noise events or weapon firing. For example, for a small arms range at which hundreds of rounds are fired each year, resultant peak levels (PK) can easily exceed 104 dB in regions that annual DNL values indicate to be adequately quiet for housing.

(b) To account for statistical variation in received weapons noise level due to weather, it is recommended that the PK15(met) noise level be calculated. The peak contours show the expected level that one would get on a sound level meter when a weapon was fired. Since weather conditions can cause noise levels to vary significantly from day to day (even from hour to hour) the programs calculate a range of peak levels. This range is based on weather conditions that favor or hinder sound propagation. By plotting the PK15(met) contour, events would be expected to fall within the contours 85% of the time. This gives the installation and the community a more realistic means to consider the areas impacted by training noise without putting stipulations on land that would only receive high sound levels under infrequent weather conditions that favor sound propagation. This metric represents the best available scientific quantification for assessing the complaint risk of large and small caliber weapons ranges. The complaint risk areas for PK15(met) noise contours are defined as follows:

(1) The high risk of complaint area consists of the area around the source of the noise in which PK15(met) noise contour is greater than 130 dB for large caliber weapons.

(2) The moderate risk of complaint area consists of an area where the PK15(met) noise contour is between 115 dB and 130 dB for large caliber weapons.

(3) The low risk of complaint area includes all areas around a noise source in which the PK15(met) noise contour is less than 115 dB for large caliber weapons.

(c) See Table 2 for complaint risk guidelines.

Table 2. Complaint Risk Guidelines.

Risk of Complaints	Large Caliber Weapons (20mm and greater)
	PK15(met) dB Noise Contour
Low	< 115
Moderate	115 - 130
High	> 130

CAMP BULLIS RANGE OPERATIONS

DEMOLITION AND LARGE CALIBER WEAPON EXPENDITURE.

WEAPON	NUMBER OF DAY ROUNDS (0700-2200)	NUMBER OF NIGHT ROUNDS (2200-0700)
35mm Sub-cal, Inert	4,545	0
40mm, HE	20	0
75mm, HE	175	0
LAW, HE	115	0
C4, 1.25 lb	188	0
Hand Grenade, HE	10,047	0
Mine, M18A1, Claymore	83	0

SMALL CALIBER WEAPON EXPENDATURE.

	PISTOL, .22 CAL	PISTOL, .40 CAL, LIVE	PISTOL, .45 CAL, LIVE	PISTOL, 9 MM, LIVE	RIFLE, .22 CAL, LIVE	RIFLE, 5.56 MM, LIVE	MACHINE GUN, 7.62 MM, LIVE	MACHINE GUN, 7.62 MM, BLANK*	SHOTGUN, 10 GAUGE BLANK	SHOTGUN, 12 GAUGE	SHOTGUN, .410 GAUGE
AUTOMATED FIELD FIRE						X					
AUTOMATED RECORD FIRE						X					
COMBAT PISTOL QUALIFICATION COURSE				X							
KNOWN DISTANGE RANGE B				X		X	X		X		
LAW ENFORCEMENT RANGE		X		X		X				X	
MULTI-PURPOSE MACHINE GUN RANGE						X	X		X	X	X
MODIFIED RECORD FIRE						X					
SMALL ARMS RANGE A			X	X		X	X			X	
SMALL ARMS RANGE B		X		X		X				X	
SPORTSMAN	X	X	X	X	X	X	X	X		X	
ZERO RANGE A				X		X	X				
ZERO RANGE B				X		X	X				
ZERO RANGE C						X	X				

*BLANK: any cartridge containing propellant but no bullet.
NOTE: The listing contains ammunition *utilized* during the period of interest.

CAMP BULLIS ASSAULT LANDING STRIP OPERATIONS

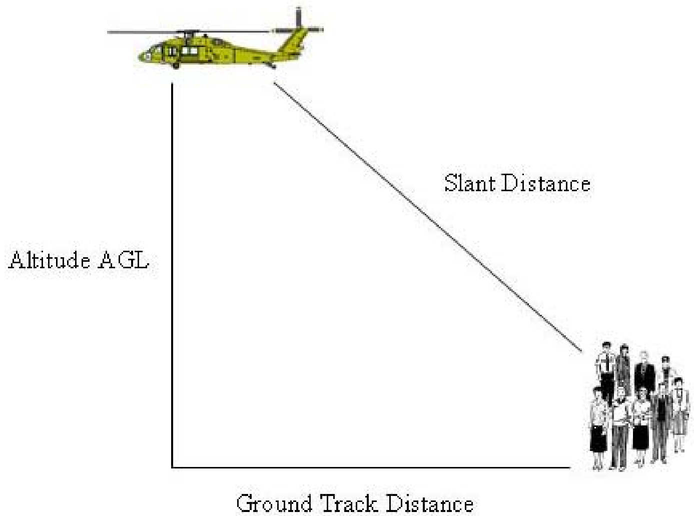
EXISTING DAILY OPERATIONS.

AIRCRAFT TYPE	DAYTIME (0700-2200)	NIGHTTIME (2200-0700)
AH-64	16	0
CH-47	4	0
OH-58	16	0
UH-60	16	0
C130	15	0

FUTURE DAILY OPERATIONS.

AIRCRAFT TYPE	DAYTIME (0700-2200)	NIGHTTIME (2200-0700)
AH-64	16	0
CH-47	4	0
OH-58	16	0
UH-60	16	0
C17	15	0

SUPPLEMENTAL BUFFER FLIGHT CORRIDOR



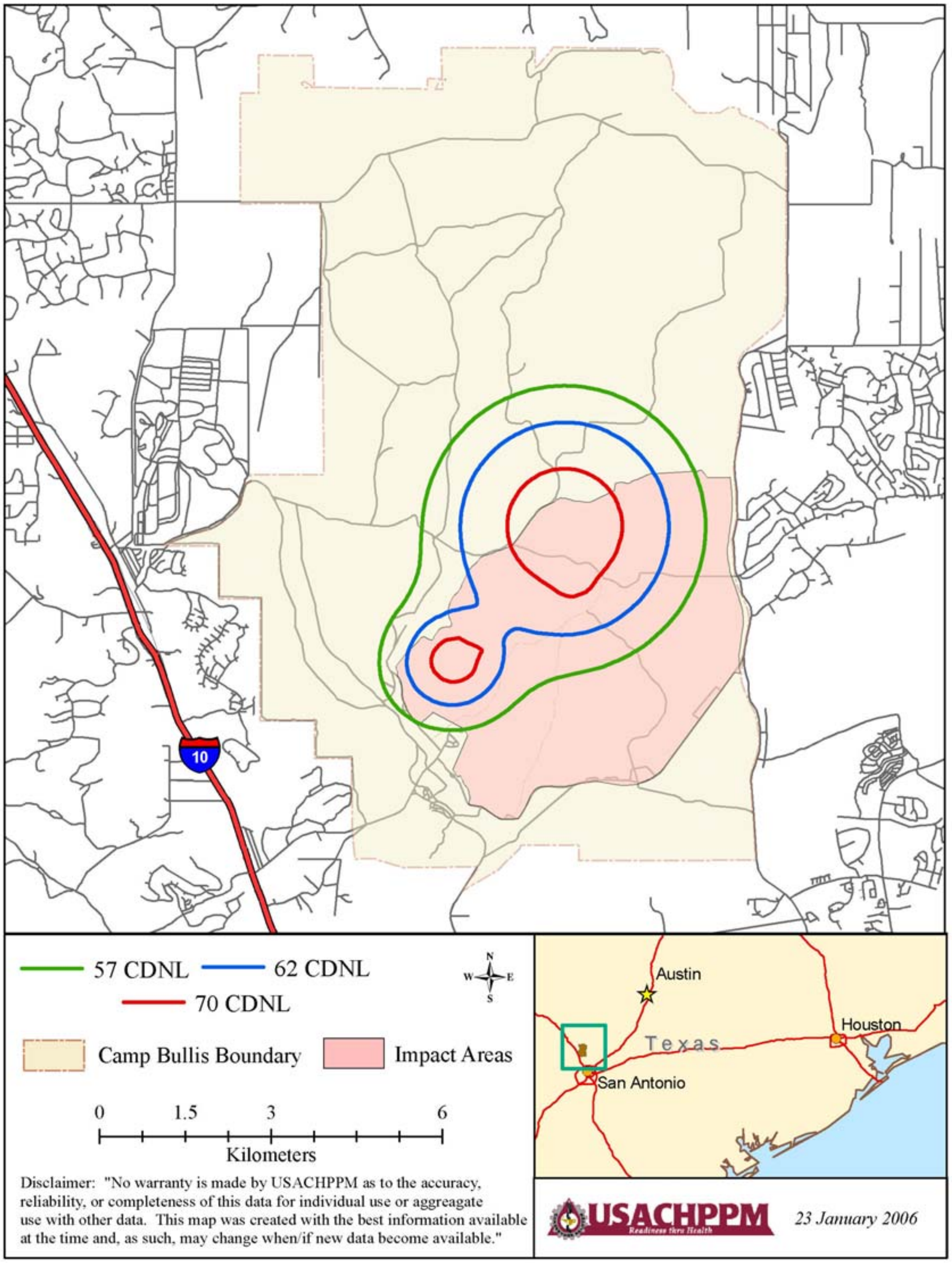
DEFENITIONS:

Altitude/AGL (Above Ground Level). Distance of the aircraft above the ground.

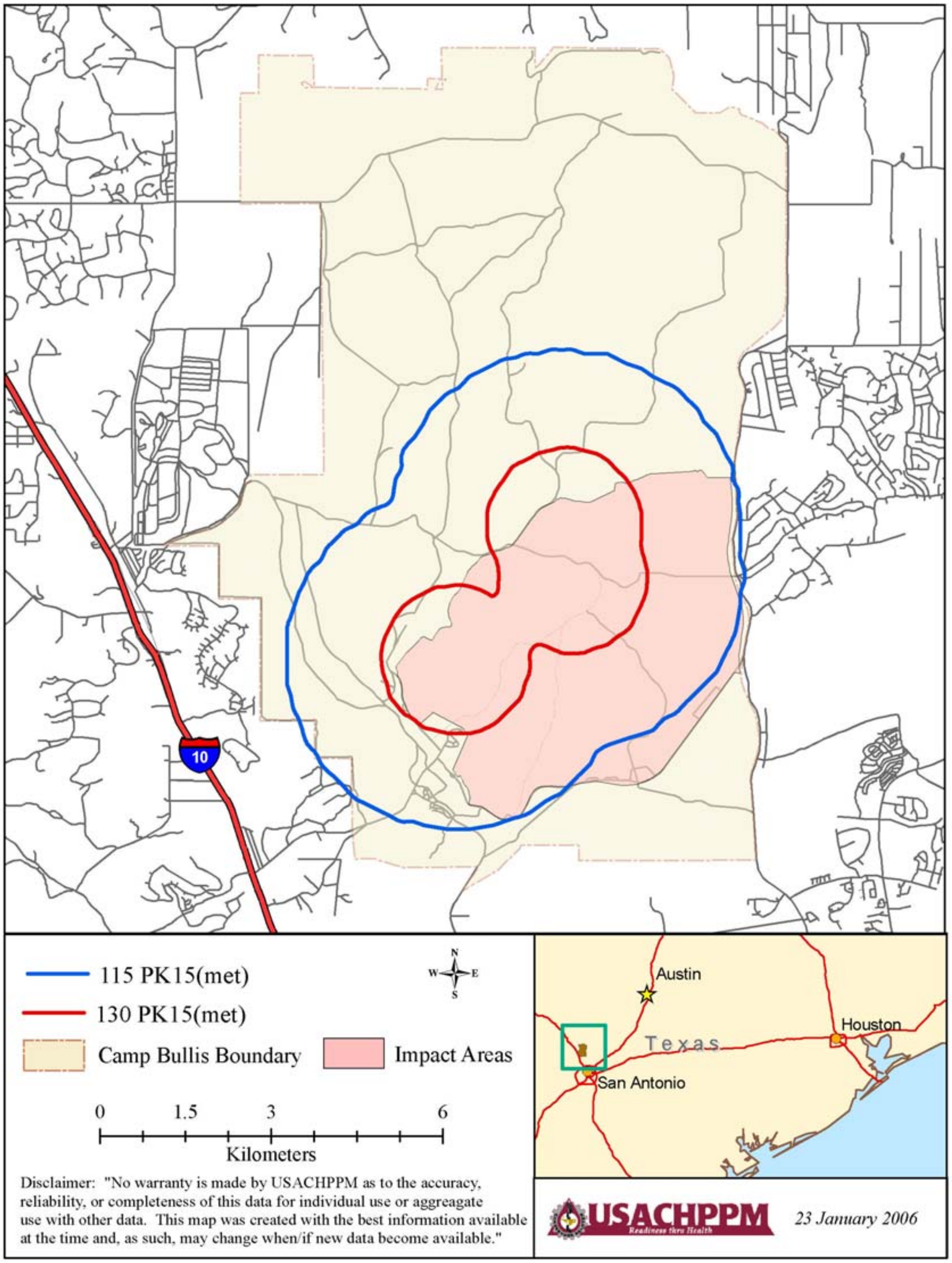
Ground Track Distance. The distance between receiver and the point on the Earth at which the aircraft is directly overhead.

Slant Distance. The line-of-sight distance between the receiver and the aircraft. The slant distance is the hypotenuse of the triangle represented by the altitude of the aircraft and the distance between the receiver and the aircraft's ground track distance.

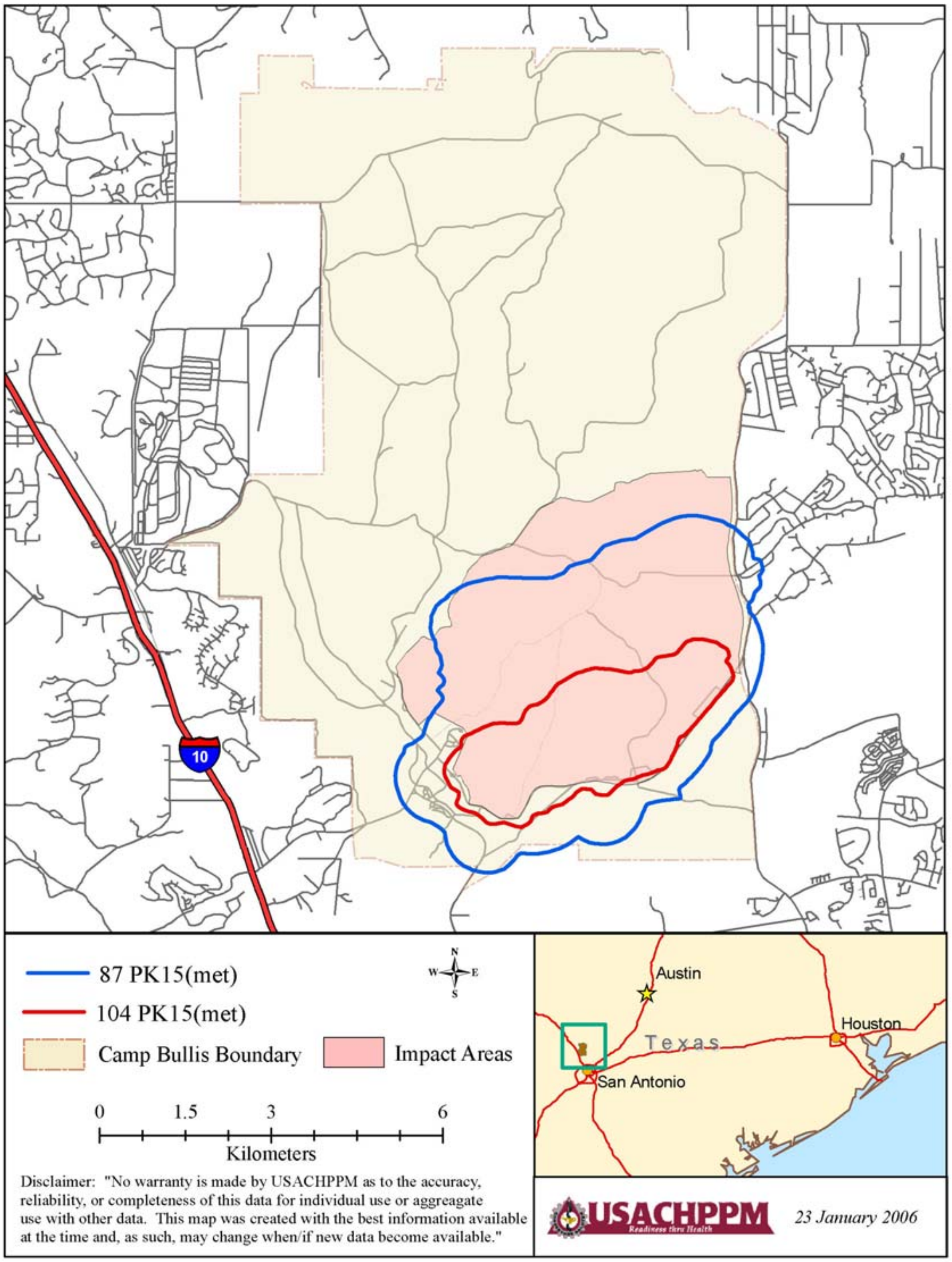
CAMP BULLIS
DEMOLITION AND LARGE CALIBER
OPERATIONAL NOISE CONTOURS



CAMP BULLIS
DEMOLITION AND LARGE CALIBER
OPERATIONAL PK15(met) NOISE CONTOURS

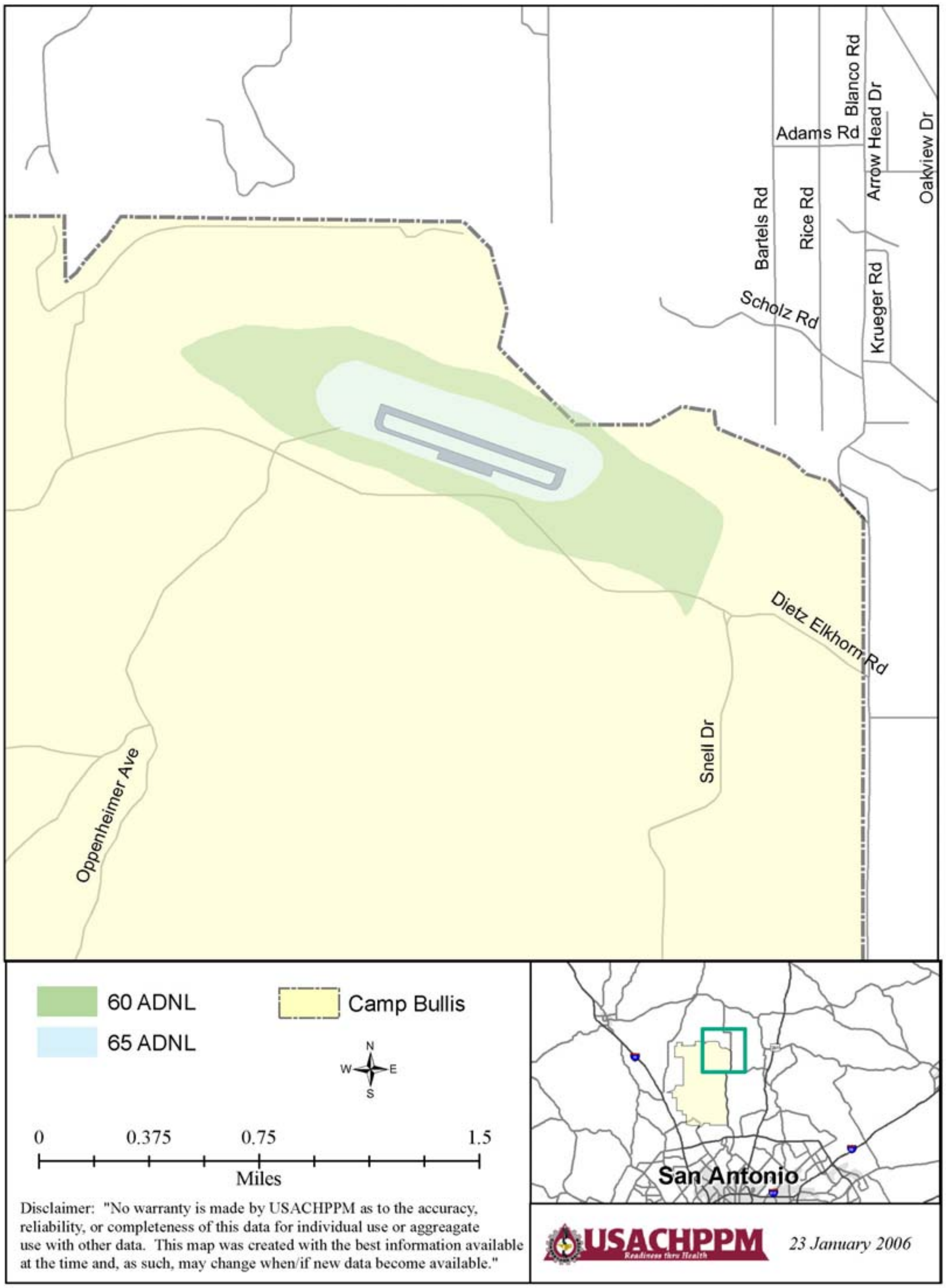


CAMP BULLIS
SMALL CALIBER
OPERATIONAL NOISE CONTOURS



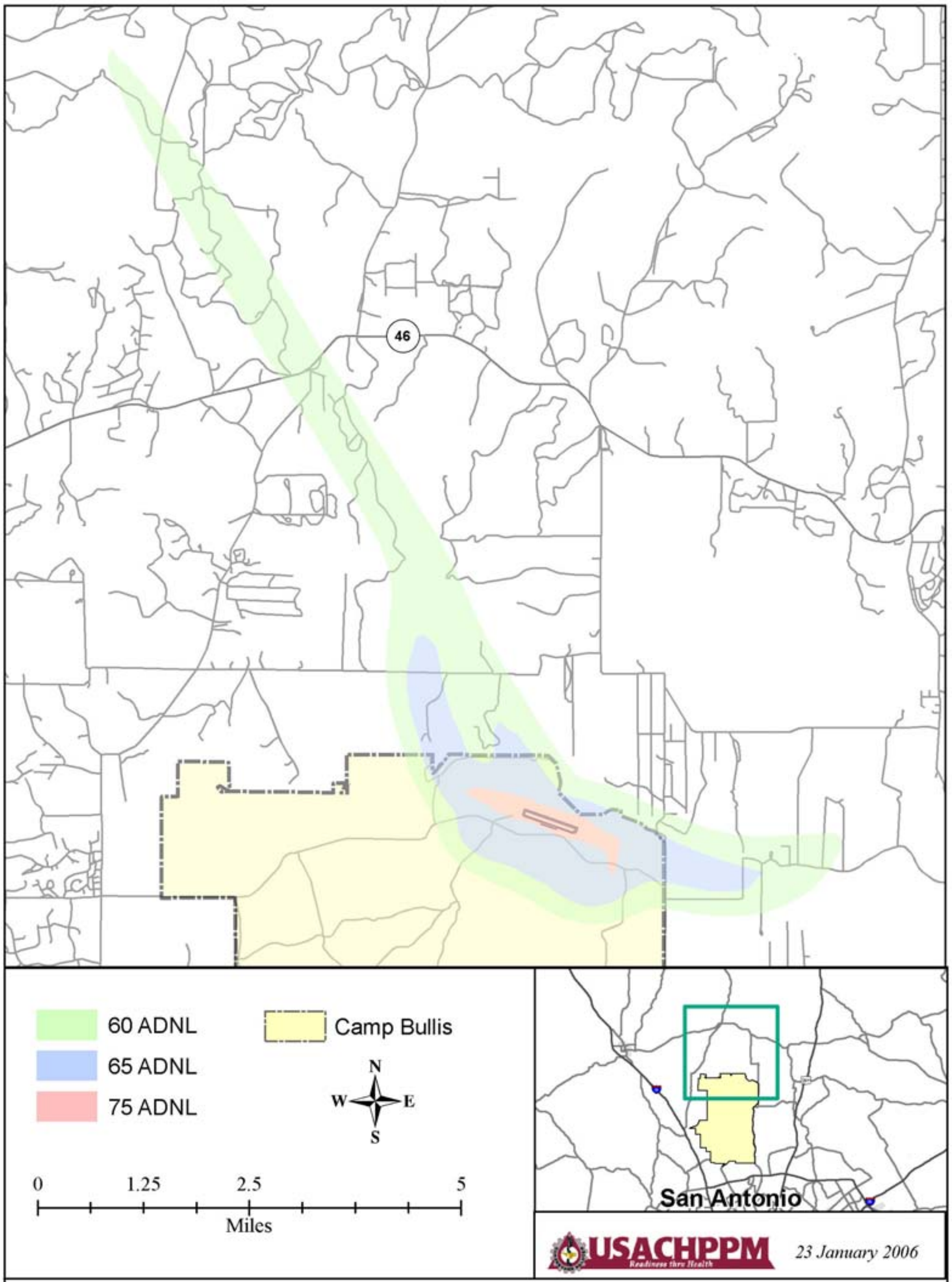
Enclosure 8

CAMP BULLIS
COMBAT ASSUALT LANDING STRIP
EXISTING OPERATIONAL NOISE CONTOURS



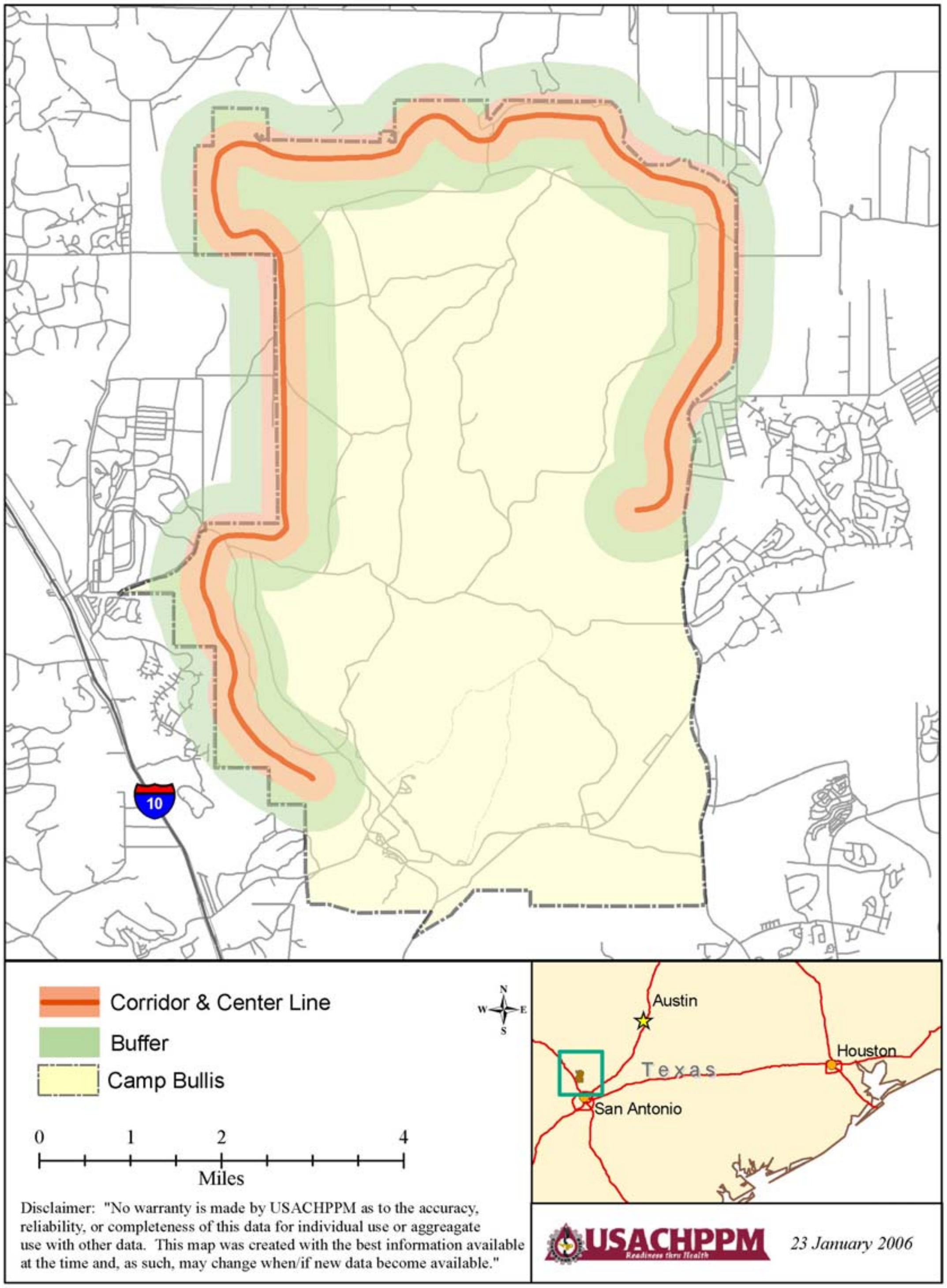
Enclosure 9

CAMP BULLIS
COMBAT ASSUALT LANDING STRIP
FUTURE OPERATIONAL NOISE CONTOURS

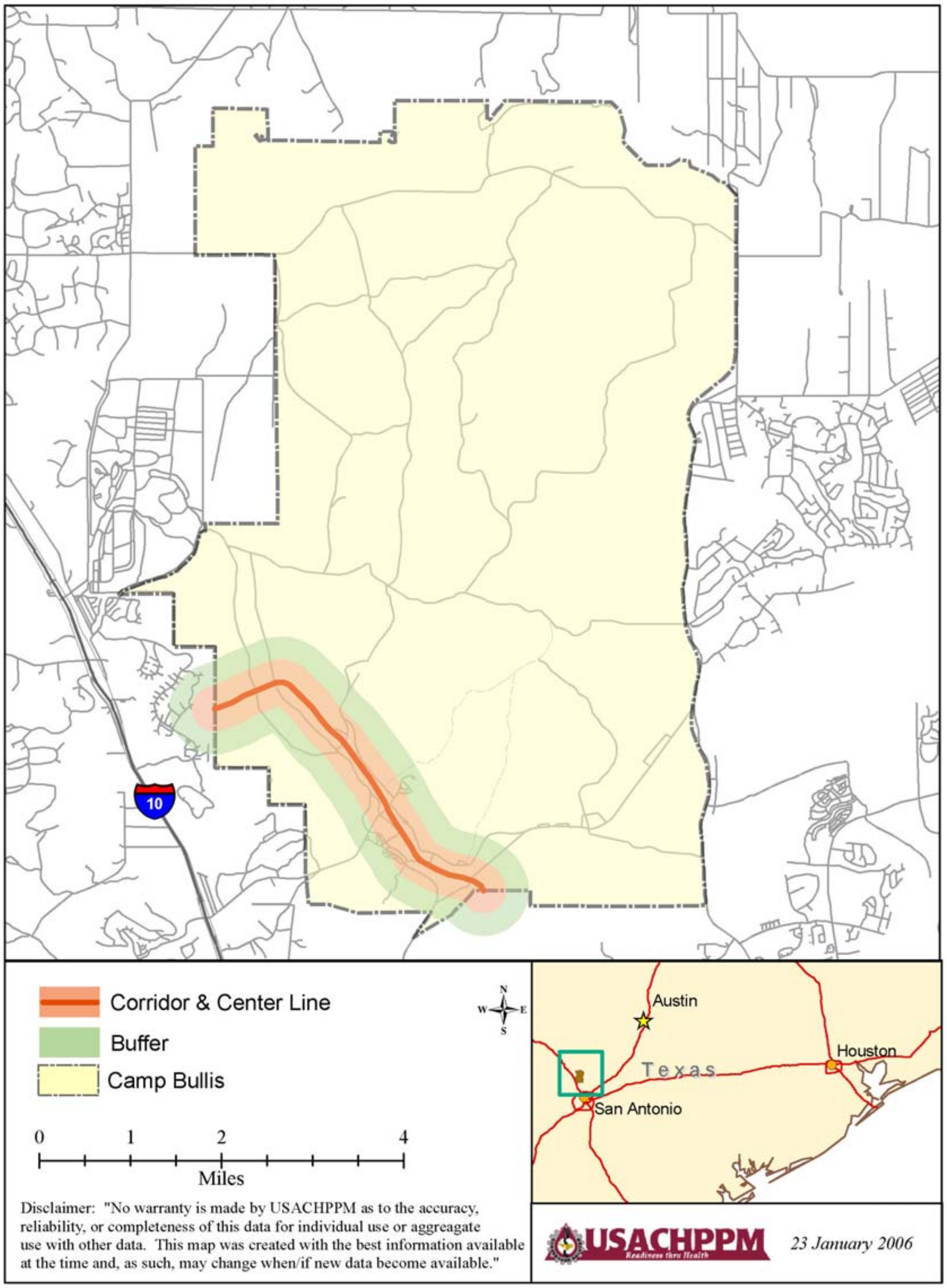


Disclaimer: "No warranty is made by USACHPPM as to the accuracy, reliability, or completeness of this data for individual use or aggreagate use with other data. This map was created with the best information available at the time and, as such, may change when/if new data become available."

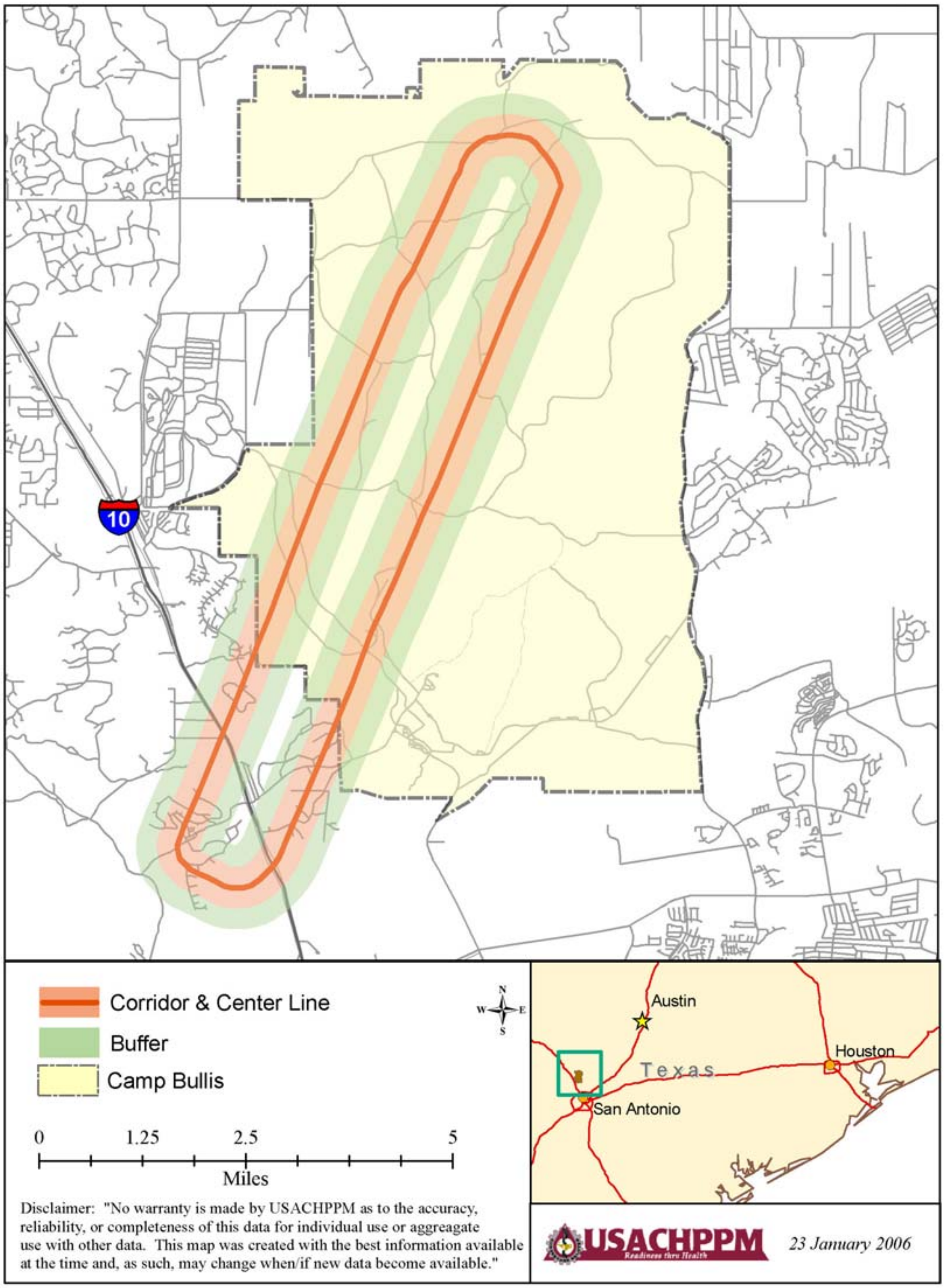
CAMP BULLIS
NAP OF THE EARTH FLIGHT CORRIDOR



CAMP BULLIS
HELIPAD FLIGHT CORRIDOR

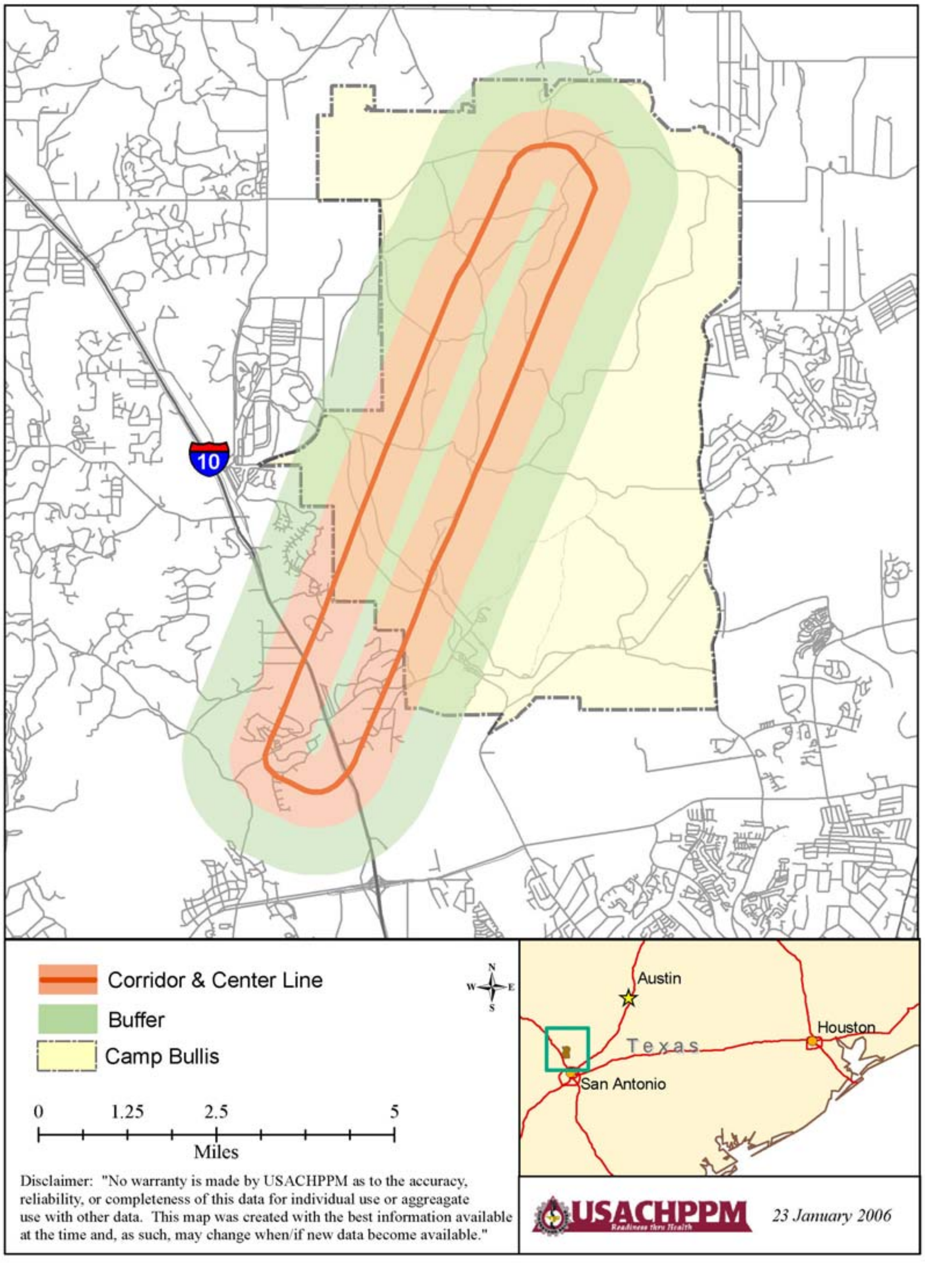


CAMP BULLIS
UH60 HELICOPTER
DROP ZONE FLIGHT CORRIDOR

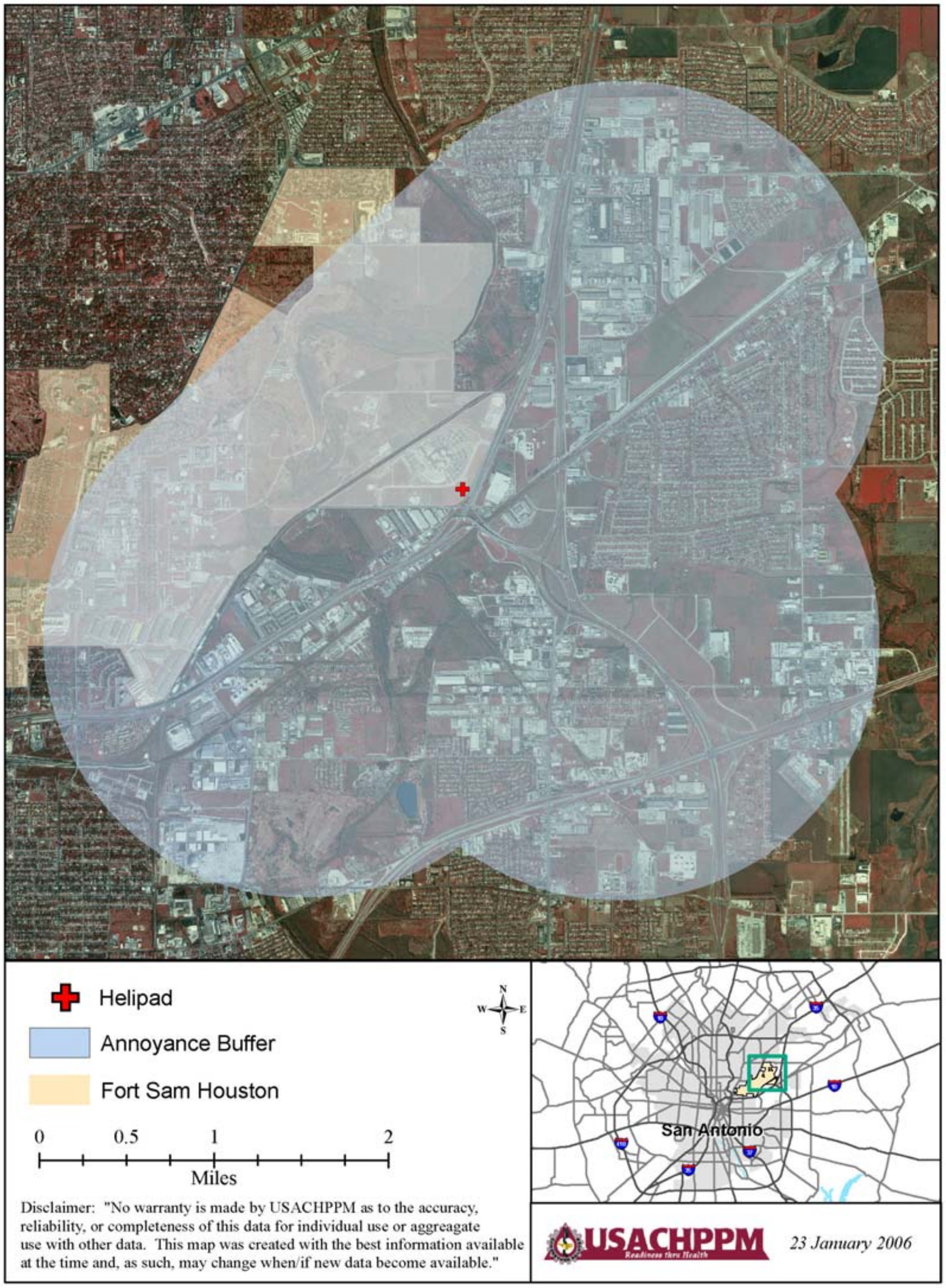


Enclosure 13

CAMP BULLIS
FIXED WING TRANSPORT AIRCRAFT
DROP ZONE FLIGHT CORRIDOR

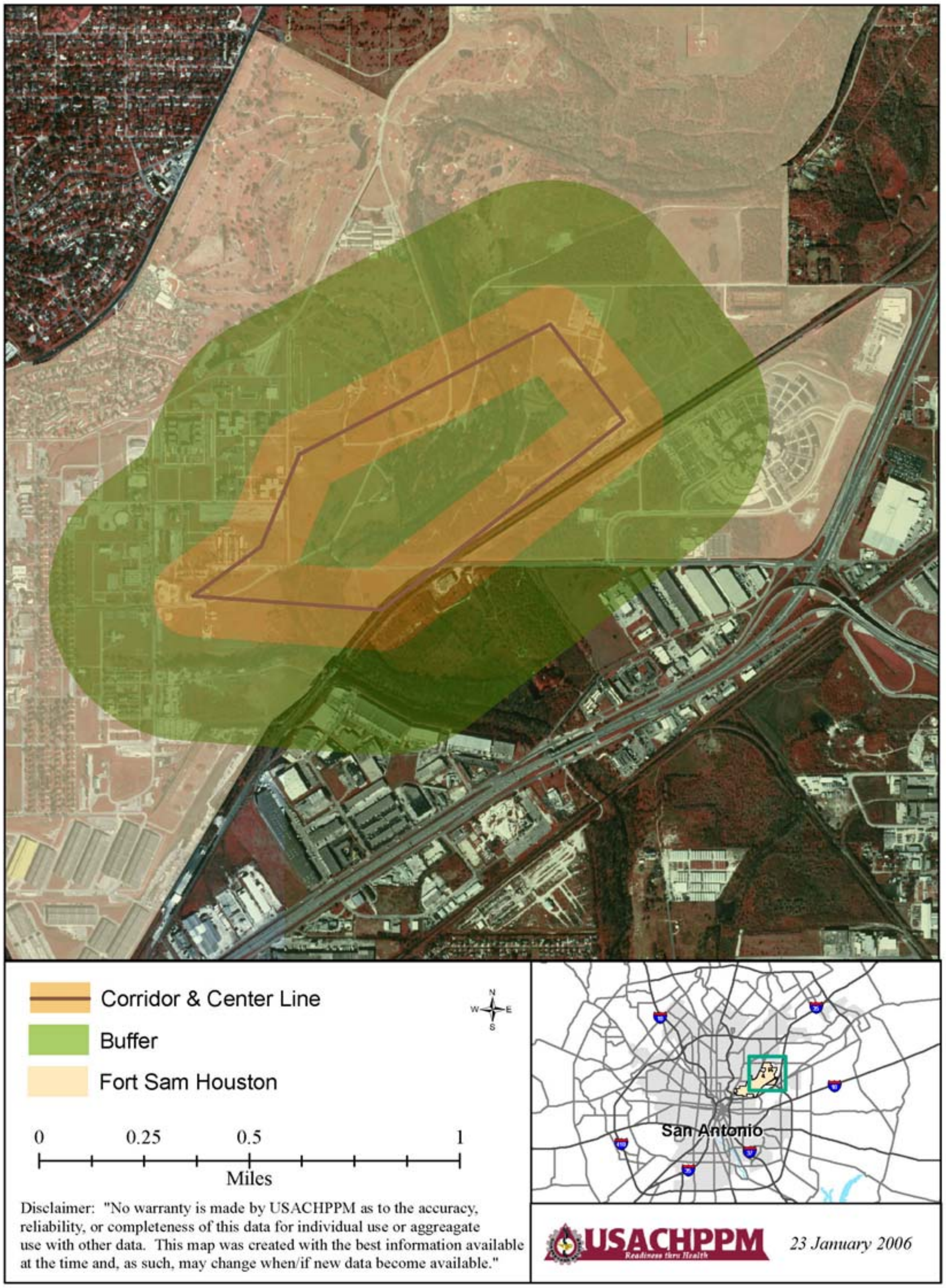


FORT SAM HOUSTON
BROOKS ARMY MEDICAL CENTER
LIFE FLIGHT HELIPAD ANNOYANCE BUFFER



Enclosure 15

FORT SAM HOUSTON
FLIGHT CORRIDOR ANNOYANCE BUFFER



APPENDIX D

BIOLOGICAL ASSESSMENT COORDINATION

From: Jenkins, Josh
Sent: Thursday, July 06, 2006 1:39 AM
To: Powers, Sarah
Subject: FW: USFWS Coordination - Add to Appendix "D"

Josh Jenkins
770.421.3412
-----Original Message-----
From: Rae Lynn Schneider [mailto:RSchneider@IESolutionsInc.com]
Sent: Wednesday, July 05, 2006 10:19 AM
To: Jenkins, Josh
Subject: FW: USFWS Coordination

Rae Lynn Schneider
Integrated Environmental Solutions, Inc.
-----Original Message-----
From: Schlatter, Jackie R Ms GARRISON-FSHTX
[mailto:Jackie.Schlatter@samhouston.army.mil]
Sent: Monday, June 26, 2006 12:34 PM
To: Rae Lynn Schneider; Cooksey, Matthew L Mr CTR-ESSEX GARRISON-FSHTX;
Schlatter, Jackie R Ms GARRISON-FSHTX
Cc: Fleming, Joe; Wu, Ching
Subject: RE: USFWS Coordination

We don't need to do any coordination for either the AFRC or the whole BRAC package...we have a 10-year BO that takes care of everything.

-----Original Message-----
From: Rae Lynn Schneider [mailto:RSchneider@IESolutionsInc.com]
Sent: Monday, June 26, 2006 11:39 AM
To: Cooksey, Matthew L Mr CTR-ESSEX GARRISON-FSHTX; Schlatter, Jackie R
Ms GARRISON-FSHTX
Cc: Fleming, Joe; Wu, Ching
Subject: USFWS Coordination

Jackie/Lucas,
Have y'all done or planning to do any coordination with USFWS on the preferred alternative location for the AFRC at Bullis or for the entire BRAC package at Bullis?

Rae Lynn Schneider
President

Integrated Environmental Solutions, Inc.
1651 North Collins Boulevard, Suite 170
Richardson, Texas 75080
ph: 972.562.7672
fax: 972.562.7673
cell: 214.284.4147

rschneider@iesolutionsinc.com

Table D-1 Habitat Requirements for State and Federally Listed Threatened and Endangered Species Occurring or Potentially Occurring in Bexar County, Texas

Common Name (*Scientific Name*)	Federal Status	State Status	General Habitat Description	Habitat Potentially Present on Camp Bullis?	Known Occurrence on Camp Bullis?
REPTILES					
Cagle's Map Turtle (*Graptemys caglei*)	C1	T	Endemic; Guadalupe River System; short stretches of shallow water with swift to moderate flow and gravel or cobble bottom, connected by deeper pools with a slower flow rate and a silt or mud bottom; gravel bar riffles and transition areas between riffles and pools especially important in providing insect prey items; nest on gently sloping sand banks within 30 feet of water's edge	No	No
Indigo Snake (*Drymarchon corais*)	--	T	Texas, south of the Guadalupe River and Balcones Escarpment; thornbush-chaparral woodlands of south Texas, in particular dense riparian corridors; can do well in suburban and irrigated croplands if not molested or indirectly poisoned; requires moist microhabitats, such as rodent burrows, for shelter	Yes[1]	No
Texas Horned Lizard (*Phrynosoma cornutum*)	--	T	Open, arid and semiarid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September	Yes[1]	No
Texas Tortoise (*Gopherus berlandieri*)	--	T	Open brush with a grass understory is preferred; open grass and bare ground are avoided; when inactive occupies shallow depressions at base of bush or cactus, sometimes in underground burrows or under objects; longevity greater than 50 years; active March-November; breeds April-November	No	No
BIRDS					
Arctic Peregrine Falcon (*Falco peregrinus tundrius*)	DL	T	Potential migrant	Yes[1]	No
Black-capped Vireo (*Vireo atricapilla*)	E	E	Oak-juniper woodlands with distinctive patchy, two-layered aspect; shrub and tree layer with open, grassy spaces; requires foliage reaching to ground level for nesting cover; return to same territory, or one nearby, year after year; deciduous and broad-leaved shrubs and trees provide insects for feeding; species composition less important than presence of adequate broad-leaved shrubs, foliage to ground level, and required structure; nests mid-April-late summer	Yes[1]	Yes[1]
Golden-cheeked Warbler (*Dendroica chrysoparia*)	E	E	Juniper-oak woodlands; dependent on Ashe juniper (*Juniperus asheii*) for long fine bark strips, only available from mature trees, used in nest construction; nests placed in various trees other than Ashe juniper; only a few mature junipers or nearby cedar breaks can provide the necessary nest material; forage for insects in broad-leaved trees and shrubs; nests late March-early summer	Yes[1]	Yes[1]

Common Name (*Scientific Name*)	Federal Status	State Status	General Habitat Description	Habitat Potentially Present on Camp Bullis?	Known Occurrence on Camp Bullis?
Interior Least Tern (*Sterna antillarum athalassos*)	--	E	this subspecies is listed only when inland (more than 50 miles from a coastline); nests along sand and gravel bars within braided streams, rivers; also know to nest on man-made structures (inland beaches, wastewater treatment plants, gravel mines, etc); eats small fish & crustaceans, when breeding forages within a few hundred feet of colony	No	No
White-faced Ibis (*Plegadis chihi*)	--	T	Prefers freshwater marshes, sloughs, and irrigated rice fields, but can be found in brackish and saltwater habitats	No	No
Whooping Crane (*Grus americana*)	--	E	Potential migrant	Yes[1]	No
Wood Stork (*Mycteria americana*)	--	T	Forages in prairie ponds, flooded pastures, or fields, ditches, and other shallow standing water, including saltwater; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e., active heronries); breeds in Mexico and birds move into Gulf States in search of mudflats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960	No	No
Zone-tailed Hawk (*Buteo albonotatus*)	--	T	Arid open country, including open deciduous or pine-oak woodland, mesa, or mountain country, often near watercourses, and wooded canyons and tree-lined rivers along middle slopes of desert mountains; nests in various habitats and sites, ranging from small trees in lower desert, giant cottonwoods in riparian areas, to mature conifers in high mountain regions	Yes[1]	No
MAMMALS					
Black Bear (*Ursus americanus*)	--	T	Within historical range of Louisiana black bear in eastern Texas, inhabits bottomland hardwoods and large tracts of undeveloped forested areas; in remainder of Texas, inhabits desert lowlands and high elevation forests and woodlands; dens in tree hollows, rock piles, cliff overhangs, caves, or under brush piles	No	No
AMPHIBIANS					
Black Spotted Newt (*Notophthalmus meridionalis*)	--	T	Can be found in wet or sometimes wet areas, such as arroyos, canals, ditches, or even shallow depressions; aestivates in the ground during dry periods; Gulf Coastal Plain south of the San Antonio River	No	No
Cascade Caverns Salamander (*Eurycea latitans* complex)	--	T	Endemic; subaquatic; springs and caves in Bexar, Comal, Kendall, and Kerr counties.	Yes[1]	No
Comal Blind Salamander (*Eurycea tridentifera*)	--	T	Endemic; semi-troglobitic; found in springs and waters of caves in Bexar and Comal counties	Yes[1]	Yes[1]

Common Name (*Scientific Name*)	**Federal Status**	**State Status**	**General Habitat Description**	**Habitat Potentially Present on Camp Bullis?**	**Known Occurrence on Camp Bullis?**
San Marcos Salamander (*Eurycea nana*)	T	--	The San Marcos Salamander is found only in Hays and Blanco Counties of Texas. Strictly aquatic, this salamander may be seen among algae in the spring-fed pool at head of the San Marcos River.	No	No
Texas Blind Salamander (*Typhlomolge rathbuni*)	E	--	The Texas Blind Salamander is found only in the Balcones Escarpment of the San Marcos, Texas area. This salamander is found in the subterranean streams of the Purgatory Creek system, and is only found above ground when water flow brings it to the surface.	No	No
ARACHNIDS					
Bracken Bat Cave Meshweaver (*Cicurina venii*)	E	--	Small, eyeless harvestman; karst features in north and northwest Bexar County	Yes[1]	No
Cokendolpher Cave Harvestman (*Texella cokendolpheri*)	E	--	Small, eyeless harvestman; karst features in north and northwest Bexar County	Yes[1]	No
Government Canyon Bat Cave Meshweaver (*Cicurina vespera*)	E	--	Small, eyeless, or essentially eyeless spider; karst features in northwestern Bexar County and northeastern Medina County	Yes[1]	No
Government Canyon Bat Cave Spider (*Neoleptoneta microps*)	E	--	Small, eyeless, or essentially eyeless spider; karst features in north and northwest Bexar County	Yes[1]	No
Madla's Cave Meshweaver (*Cicurina madla*)	E	--	Small, eyeless, or essentially eyeless spider; karst features in north and northwest Bexar County	Yes[1]	Yes[1]
Robber Baron Cave Meshweaver (*Cicurina baronia*)	E	--	Small, eyeless harvestman; karst features in north and northwest Bexar County	Yes[1]	No
INSECTS					
Comal Springs Dryopid Beetle (*Stygoparnus comalensis*)	E	--	Dryopids usually cling to objects in stream; dryopids are sometimes found crawling on stream bottoms or along shores; adults may leave the stream and fly about, especially at night; most dryopid larvae are vermiform and live in soil or decaying wood. Restricted to two springs that are experiencing a decrease in water quantity and quality due to water withdrawal and other human activities within the Edwards Aquifer.	No	No
Comal Springs Riffle Beetle (*Heterelmis comalensis*)	E	--	Restricted to two springs that are experiencing a decrease in water quantity and quality due to water withdrawal and other human activities within the Edwards Aquifer.	No	No
Helotes Mold Beetle (*Batrisodes venyivi*)	E	--	Small, eyeless mold beetle; karst features in north and northwest Bexar County.	Yes[1]	No
Ground Beetle (*Rhadine exilis*)	E	--	Small, essentially eyeless ground beetle; karst features in north and northwest Bexar County	Yes[1]	Yes[1]
Ground Beetle (*Rhadine infernalis*)	E	--	Small, essentially eyeless ground beetle; karst features in north and northwest Bexar County	Yes[1]	Yes[1]

Common Name (*Scientific Name*)	**Federal Status**	**State Status**	**General Habitat Description**	**Habitat Potentially Present on Camp Bullis?**	**Known Occurrence on Camp Bullis?**
FISHES					
Fountain Darter (*Etheostoma fonticola*)	E	--	The Fountain darter is the smallest species of darter, usually reaching less than 25mm (1in.) at maturity. Based on studies of fountain darters from the San Marcos River, the species feeds on small invertebrates. The present distribution of fountain darter in the San Marcos River is from Spring Lake to an area between the San Marcos wastewater treatment plant outfall and the confluence with the Blanco River. The species is also found virtually throughout the Comal River to its confluence with the Guadalupe River.	No	No
San Marcos Gambusia (*Gambusia georgei*)	E	--	San Marcos gambusia apparently is restricted to the approximately 1km portion of the San Marcos River between Interstate Highway 35 and the USGS gauging station immediately downstream from Thompson's Island.	No	No
Toothless Blindcat (*Trogloglanis pattersoni*)	--	T	Troglobitic, blind catfish endemic to the San Antonio pool of the Edwards Aquifer	Yes	No
Widemouth Blindcat (*Satan eurystomus*)	--	T	Troglobitic, blind catfish endemic to the San Antonio pool of the Edwards Aquifer	Yes	No
CRUSTACEANS					
Peck's Cave Amphipod (*Stygobromus pecki*)	E	--	Restricted to two subterranean springs that are experiencing a decrease in water quantity and quality due to water withdrawal and other human activities within the Edwards Aquifer.	Yes[1]	No
VASCULAR PLANTS					
Texas wild-rice (*Zizania texana*)	E	--	Endemic to the upper few km of the San Marcos River, where it was locally abundant as recently as the 1950s. This remnant population rarely flowers or produces seed in the wild. The decline of this grass, which is narrowly adapted to high quality, aquifer-fed waters, is the result of drastic draw-downs in the aquifer level to support human population growth in the area, combined with past dredging and vegetation removal, damming, increased siltation and sewage loads, trampling and removal by recreationists, and herbivory by native and introduced waterfowl and by the non-native nutria.	No	No

There are no state or federally threatened or endangered species at FSH.
1 = Occurrence of Camp Bullis
C1 = Federal candidate, category 1
E = Endangered
DL = De-listed
PT = Federally proposed endangered/threatened
T = Threatened
-- = Rare, but with no regulatory listing status
Source: USFWS, 2006b

Table D-2 Objectives and Actions of the ESMP

Objective Type	Objective Description	Action
All Federally Protected Species		
Compliance	The Army will continue to comply with all applicable sections of the Endangered Species Act (ESA) for all training, operations, maintenance, and construction activities conducted on Camp Bullis; regardless of habitat designation on the Training Area map	Camp Bullis conducted a biological assessment and received a BO from USFWS. Camp Bullis will continue to monitor its training activities to ensure compliance with the ESA.
Compliance	Camp Bullis will conduct an annual review/update of the ESMP, as necessary	Review annual monitoring data to ensure that current management practices meet the endangered species management goals.
Protection	Continue and increase internal environmental awareness with Integrated Training Area Management to foster protection of T&E species and habitat	Camp Bullis will continue to maintain, update, and distribute Training Area maps that clearly indicate conservation area which may or may not require training activity adjustment.
Protection	Develop external partnerships to enhance the management of T&E species	Camp Bullis will evaluate partnering with various local, state, and federal agencies. Camp Bullis is currently a partner in a feasibility research study for augmentation of groundwater recharge.
Protection	Implement ESMP enforcement measures	Training restrictions, habitat boundaries, and other requirements of the ESMP, upon approval of the FSH commander, will be incorporated into the Camp Bullis Training Regulations.
GCW		
M	Continue to document GCW population trends and monitor population status	conduct annual point count censuses record the presence/absence of female on each male territory for all nests, record the number of nestlings, fledglings, and nest fate
Mapping	Produce an annual habitat map, based on prior field season results, delineating “core” vs. “non-core” habitat	Updating these habitat designations will allow for training activity restrictions to remain current.
Population	Maintain sufficient habitat to support a minimum carrying capacity equal to the historic average installation-wide density of 7 singing male per 100 hectares of habitat and strive to continue the trend of increasing GCWs on Camp Bullis	Camp Bullis will implement designation of existing GCW habitat into “core” and “non-core” habitat areas. The goal of the designation is to create noise buffers and provide contiguous habitat for GCW.
Protection	Implement training restrictions in “core” GCW habitat and noise buffer areas in accordance with Camp Bullis Endangered Species Training Guidelines	Certain restrictions to non-compatible military training practices described in the ESMP will be implemented to ensure the continued survival of GCW within “core” habitat.
Protection	Continue training without restrictions consistent with essential mission requirements in designated “non-core” habitats while providing no habitat loss	All training activities, subject to the Camp Bullis range regulations, will be allowed in “non-core” areas.
Protection	Minimize incidental take for the 5-year term of this ESMP	Camp Bullis will implement the requirements of the USFWS 2005 BO
Management	Maintain and proactively manage GCW habitat consistent with carrying capacity goal and essential mission requirements	Camp Bullis will maintain currently available habitat by implementing the Endangered Species Training Guidelines.
Research	Evaluate correlation of habitat quality with GCW abundance and productivity	Camp Bullis will continue to evaluate the correlation of habitat quality with GCW abundance and productivity based on data collected in the annual surveys
Research	Continue to study the potential impacts of military training on GCW and measures to reduce potential impacts	Camp Bullis shall continue the study and implementation of the Tactical Concealment Areas (TCA) program
BCV		
Monitoring	Continue to document BCV population trends and monitor population status	determine numbers of singing males within habitat annually and record dominant vegetation characteristics within the breeding territories. annually visit and inspect all suspected sites of BCV occupation to document status and physical location of BCV on Camp Bullis ensure complete access to impact areas to adequately survey BCV status and physical location

Objective Type	Objective Description	Action
Monitoring	Continue to monitor and assess population status by monitoring demographic parameters	document territory size. document number of young with each adult for all nests located, record number of host and parasite eggs, nestlings, fledglings, and nest fate
Population	Maintain sufficient habitat to maintain carrying capacity of 11 BCV territories	Camp Bullis will designate and maintain designation of all BCV habitat
Protection	Implement training restrictions in all current BCV habitat in accordance with Camp Bullis Endangered Species Training Guidelines to prevent habitat loss	Certain restrictions to non-compatible military training practices described in the ESMP will be implement to ensure the continued survival of BCV
Protection	Minimize incidental take for the 5-year term of this ESMP	Camp Bullis will implement the requirements of the USFWS 2005 BO
Protection	Continue training without restrictions consistent with essential mission requirements in areas outside of BCV habitats while providing no habitat loss	All training activities, subject to the Camp Bullis range regulations, will be allowed in non-designated areas.
Mapping	Correlate annual population surveys, where accessible, in occupied and potential habitat with environmental factors to better define habitat for BCV	Camp Bullis will continue to evaluate the correlation of vegetation communities and other factors with BCV abundance and productivity based on data collected in the annual surveys
Cave-Adapted Species		
	Maintain the Karst Management Plan recommendations	
Other Species		
Monitoring	Continue to monitor and document the presence/absence of other listed rare and sensitive species	monitor any whooping cranes, bald eagles, or other listed species that appear on Camp Bullis for potential disturbance from human activity and notify USFWS conduct additional surveys to determine presence/absence and status of other listed rare and sensitive species revise ESMP if repeated sightings of any additional species occur
Protection	Provide and implement protection measures to minimize potential disturbance, harassment, or other impacts to species of concern from military training and other land use activities	notify range control and other appropriate organizational elements of any potential training conflicts with the location of the observed listed species suspend training activities in proximity to these species until they have departed installation lands

Source: Thompson and Schlatter, 2005

APPENDIX E

CULTURAL RESOURCES SURVEY

Fort Sam Houston, Texas
Phase I Cultural Resources Survey
Pershing Field

29 June 2006

Fort Sam Houston, Texas
Phase I Cultural Resources Survey
Pershing Field

Final Report

Prepared for:
U.S. Army Corps of Engineers
Mobile District
and
Fort Sam Houston, Texas

by:
MACTEC Engineering and Consulting, Inc.
3200 Town Point Drive, Suite100
Kennesaw, Georgia 30144

Contract No. W91278-04-D-0009
Task Order 0012

29 June 2006

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ACRONYMS AND ABBREVIATIONS

amsl	Above mean sea level
bgs	Below ground surface
BP	Before present
BRAC	Base Realignment and Closure
BT	Backhoe Trench
cm	Centimeter
DoD	Department of Defense
EIS	Environmental Impact Statement
FSH	Fort Sam Houston
ft	Foot
ICRMP	Integrated Cultural Resource Management Plan
km	Kilometer
MACTEC	MACTEC Engineering and Consulting, Inc.
m	Meter
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
ST	Shovel Test Pit
USGS	United States Geological Survey
UTM	Universal Transverse Mercator

1.0 PURPOSE, NEED, AND SCOPE

1.1 Introduction

The Army Basing Study (TABS) Group executed the Army analyses and coordinated the Army's BRAC 2005 effort under the direction of the Deputy Assistant Secretary of the Army for Infrastructure Analysis. The TABS Group's mission was to analyze Army installations comprehensively to evaluate alternatives and develop, document, and publish candidate recommendations for submission to the Office of the Secretary of Defense in compliance with established BRAC law and criteria. The TABS Group effort was consistent with the Defense Base Closure and Realignment Act of 1990 (Public Law 101-510), the BRAC selection criteria, the Department of Defense (DoD) force structure plan and the DoD installation inventory. On 8 September 2005, the Defense Base Realignment and Closure Commission ("BRAC Commission") recommended that certain realignment actions occur at Fort Sam Houston (FSH), Texas. These recommendations were approved by the President on 23 September 2005 and forwarded to Congress. The Congress did not alter any of the BRAC Commission's recommendations, and on 9 November 2005, the recommendations became law. The BRAC Commission recommendations must now be implemented.

To implement the applicable portions of the BRAC recommendations, FSH will be receiving facilities and personnel from various realignment and closure actions within the DoD. Additionally, the Army had planned to conduct a series of transformations to position its forces strategically for the future. These transformations require consideration in conjunction with the Base Realignment and Closure (BRAC) realignment initiatives at FSH. The BRAC realignment also considered part of another initiative to restructure the Army's overseas basing. This and other considerations (such as installation sustainability and security) that may affect any restructuring or reconfiguration at FSH must be considered as well. To enable implementation of the BRAC Commission recommendations and accommodation of the other concurrent Army initiatives, the Army must provide the necessary facilities and infrastructure to support the changes in force structure. Consequently, a Draft Environmental Impact Statement (EIS) is being prepared by MACTEC Engineering and Consulting, Inc. (MACTEC) for the BRAC-recommended actions at FSH. One of these actions includes construction of a new building at Pershing Field in FSH. To comply with the National Environmental Policy Act of 1969 (NEPA) (42 U.S.C. 4321 et seq.), as well as the National Historic Preservation Act of 1966 (NHPA), as amended, and its implementing regulations (36/CFR Part 800), MACTEC conducted a Phase I cultural resources investigation of the Pershing Field project area as part of the EIS preparation. This report describes the project location and setting, outlines the methods used in the investigation, describes and discusses the results, and provides recommendations concerning additional cultural resources investigations in the project area.

1.2 Project Goals

As partial fulfillment of the requirements under NEPA, the current project's main goal is to prepare a detailed statement, as part of the BRAC-Fort Sam Houston EIS, assessing the impacts of the BRAC-related actions to cultural resources in the project area. Although the scope of NEPA includes the cultural environment, it does not specify a process by which impacts to cultural resources are to be assessed. Therefore, it has become routine practice for agencies to follow the process outlined under Section 106 of NHPA to comply with NEPA in the context of an EIS. Section 106 outlines a phased process in steps:

- Initiation (identifying the undertaking, identifying the consulting parties, consultation)
- Identification (determining the scope of effects, identifying historic properties, evaluating project effects)
- Assessment of adverse effects
- Resolution of adverse effects

This Phase I cultural resources survey is designed to carry out the identification step of the Section 106 process, and the results will be incorporated into the detailed assessment of cultural resources in the EIS. The primary goal of this survey is to determine whether cultural resources exist within the project area. If such cultural resources are identified, the next two steps are to determine whether they qualify as historic properties eligible for listing on the National Register of Historic Places ("National Register") and to estimate potential project effects on those historic properties.

1.3 Project Location, Setting, and Land Use

Fort Sam Houston is a U.S. Army installation occupying 3,150 acres of land within the city of San Antonio in Bexar County, Texas, 4 kilometers (km; 2.5 miles) northeast of downtown. There are 1,493 buildings in FSH (Batzli and Siewers 1996), and these are concentrated in the eastern one-third of the installation. Pershing Field is an undeveloped area in the northeastern part of Fort Sam Houston (Figure 1-1). Pershing Field is bordered by W.W. White Road on the south, the installation boundary on the east, an abandoned paved road on the north, and the intersection of that road and W.W. White Road on the east. Salado Creek, which passes within 60 meters (m; 195 feet [ft]) of the project, marks the installation boundary to the north.

The potential project area is a square with an area of 19.95 acres within Pershing Field. It occupies the major part of a mostly-cleared, level area with no streams (Figure 1-2). This project area is shown demarcated with a red square in Figure 1-2. Vegetation consists of grass, forbs, and a few small copses of mesquite, live oak, and pecan trees. Thick stands of trees (mostly mesquite, hackberry, and live oak) lie just outside the project area's north, east, and west boundaries. Opposite W.W. White Road to the south is a recreational vehicle park with ornamental plantings. There are no roads or structures within the project area other than two portable toilets. The project area is currently used for land navigation training by Soldiers at the installation.

Table 1-1 Coordinates for the Project Area.

Coordinate system	Point	Coordinates
NAD83 UTM Zone 14 North	NW corner	556307 E, 3260058 N
	NE corner	556620 E, 3260067 N
	SW corner	556310 E, 3259780 N
	SE corner	556620 E, 3259780 N
Latitude	center	98.417776º W
Longitude	center	29.467468º N

Note: UTM (Universal Transverse Mercator) coordinates obtained by hand-held global positioning unit; latitude and longitude obtained from USGS 7.5′ San Antonio East quadrangle map.

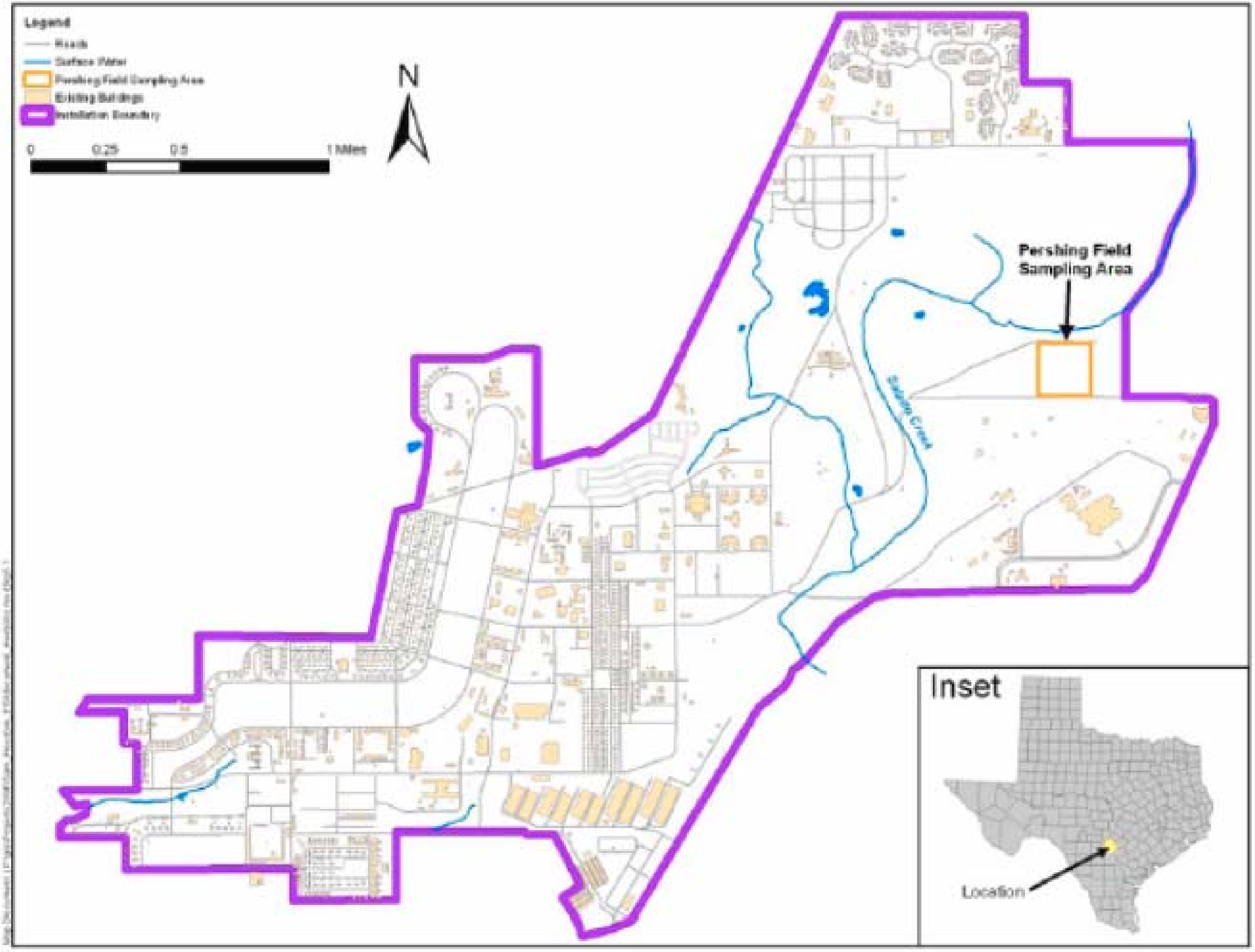

Figure 1-1 Project location ("Pershing Field Sampling Area").

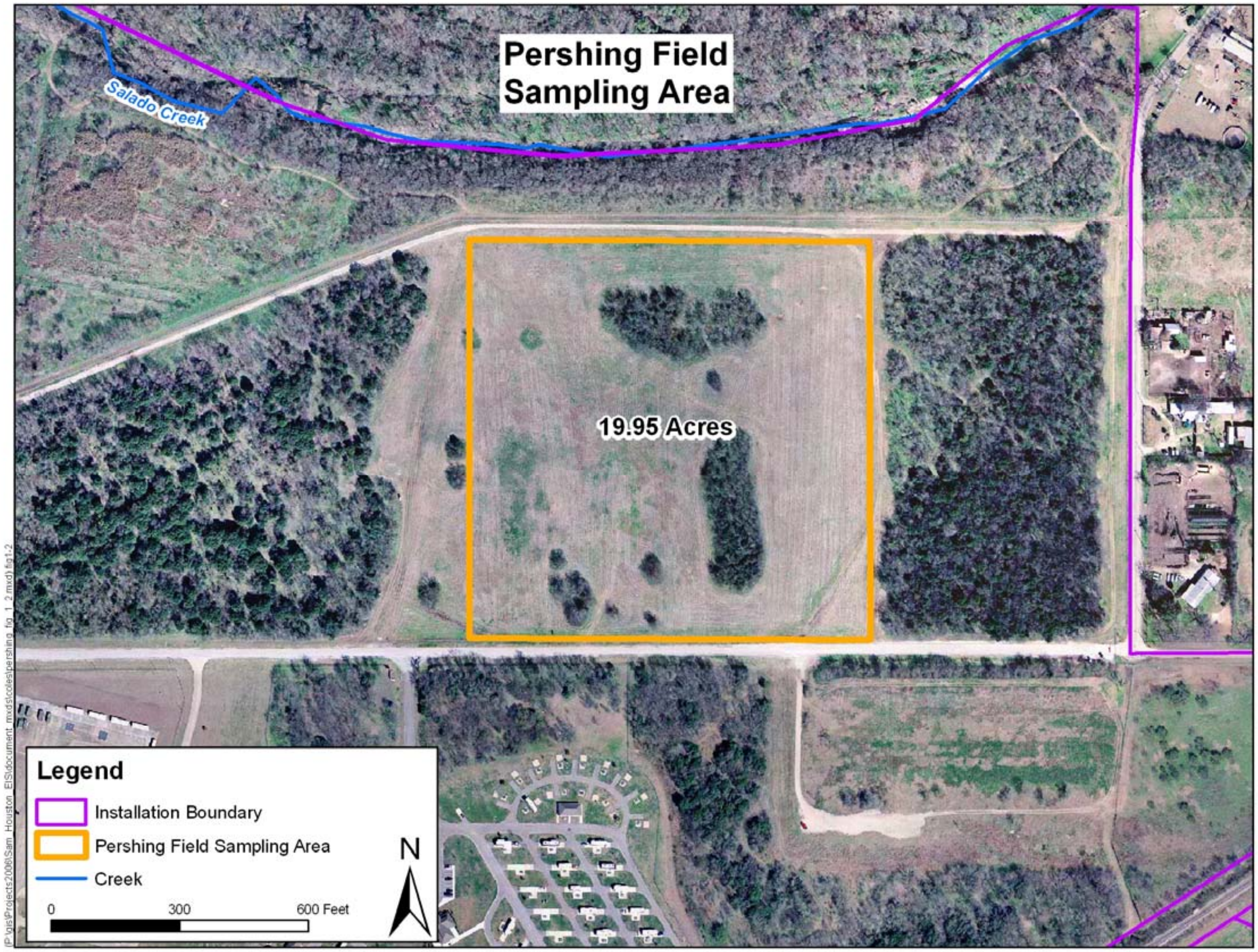

Figure 1-2 Project area boundary in Pershing Field

2.0 ENVIRONMENTAL SETTING AND CULTURAL BACKGROUND

2.1 Geology and Physiography of the Project Area

The project area is a short distance south of the Balcones Fault Zone, a band of extinct faults that formed in a Miocene orogeny. Faulting, subsidence, and uplift brought together formations of various ages and lithologies. The Balcones Fault Zone forms the southern and eastern boundary of the Edwards Plateau, a dissected plateau of lower Cretaceous limestones with elevations above 1,000 ft above mean sea level (amsl). South and east of the Balcones Fault Zone are Upper Cretaceous limestones of the Blackland Prairie and the Gulf Coastal Plain. According to Quigg and Abbott (1997), "Pershing Field is underlain by broad fluvial terrace deposits laid down by Salado Creek on the down-thrown side of the fault…At depth, these fluvial terraces rest on faulted Cretaceous bedrock." Several formations are exposed in and around FSH, including Upper Cretaceous Marlbrook Marl, Uvalde Gravels, Pleistocene terrace deposits, and Holocene valley fill (Barnes 1983, Hines 1993).

Two soil associations are in the project area. A narrow strip of Trinity and Frio soils in the Salado Creek floodplain extends a slight distance into the northern end of the project area. These soils exist in areas with less than 1 percent slope that are flooded annually. Trinity soils "are 3 to 5 feet deep. The surface layer ranges from clay loam to gravelly clay in texture. Ordinarily, the subsurface layer is clay, but in places it contains thin loamy strata" (Soil Conservation Service 1965). According to the Soil Conservation Service (1965):

The Frio series consists of limy alluvial soils that are moderately deep, grayish brown or dark grayish brown, and nearly level. These soils occur on the floodplains along the San Antonio River and the Medina River and their main tributaries. The surfaced layer is grayish-brown or dark grayish-brown clay loam and is about 20 inches thick…This limy layer contains few to many worm casts and snail fragments. The subsurface layer is light brownish gray. It is more loamy and more compacted than the surface layer; the texture is light clay loam or loam.

More than 95 percent of the project area, however, is covered by soils of the Lewisville series. The Soil Conservation Service (1965) states that:

The series is described as consisting of moderately deep, dark-colored, nearly level alluvial soils. These soils occur mainly on terraces bordering the San Antonio and Medina Rivers and their main tributaries. The surface layer is very dark grayish-brown to brown silty clay and is about 24 inches thick…This layer contains a few fine concretions of lime carbonate. The subsurface layer is brown silty clay and is about 20 inches thick…This layer is limy. The underlying material is reddish-yellow silty clay. It has weak, blocky structure, is very firm when moist, and contains large amounts of lime. Beneath this layer, there may be deep beds of water-rounded limestone gravel.

Several important springs in the San Antonio area bring water from the Edwards Aquifer, the water supply for San Antonio. Flows from the springs are highly dependent on the aquifer level, which is constantly being drained by modern water use. FSH is drained by south-flowing Salado Creek, a tributary to the San Antonio River. Salado Creek has a floodplain 500 to 800 m (1600 to 2500 ft) wide, and the channel is incised up to 10 m (32 ft) in places. Field observations made during the current investigation revealed that alluvial deposits in the project area contain a moderate amount of chert gravels. The cherts appear to be Edwards chert and were probably carried from the Edwards Plateau to the northwest, near the headwaters of Salado Creek. One large toolstone-quality cobble was found on the ground surface in the project area, but most of the observed chert cobbles were not of toolstone quality.

Physiographically, FSH is situated at the eastern edge of the Texas Hill Country, a relatively rugged landscape separating the Great Plains from the Edwards Plateau. The project area elevation is 665 ft amsl; the bed of Salado Creek 60 m (192 ft) north is 630 ft amsl. The steep embankment of the creek provides the only steep slopes in the project vicinity.

2.2 Climate, Flora, and Fauna—Current Conditions

The climate of the project area vicinity is modified human subtropical. Summer weather is hot and is influenced by Gulf of Mexico currents; winters are mild and influenced by continental currents. The mean daily minimum and maximum temperatures are 39ºF and 62ºF in January, and 74ºF and 95ºF in July. Mean annual precipitation is 32 inches, and falls as rain throughout the year but is heaviest during spring and fall thunderstorms. South-central Texas is one of the most flood-prone areas in the U.S. (Patton and Baker 1977), and flood gauges are common on low roads in San Antonio.

The project area vicinity is ecologically rich. It is the home of 54 mammal species, 36 snake species, 16 lizard species, and numerous bird species (Blair 1950). Among the carnivores are coyotes, grey fox, bobcat, raccoon, and striped skunk. There are also white-tailed deer, fox squirrels, eastern cottontails, and armadillos. FSH is located at the intersection of three biotic provinces: Balconian, Texan, and Tamaulipan. Dominant tree species are live oak, hackberry, cedar elm, and pecan; mesquite has become a dominant non-native tree. Prickly pear and yuccas occur in the area, although none were seen in the project area.

2.3 Prehistory of the Project Area Vicinity

Texas has a rich archaeological record demonstrating continuous occupation starting from the end of the Pleistocene, or last Great Ice Age, at circa 11,500 radiocarbon years ago before present (BP). Scientific explorations of Texas' past began around the turn of the twentieth century, being quite crude at first but becoming more systematic and detailed in the 1930s. With the passing of effective state and federal cultural resources laws in the 1960s and 1970s requiring government agencies to consider and mitigate the effects of their undertakings on the archaeological record, archaeological investigations increased markedly in number and intensity. At the same time, new methods and techniques were coming into use, increasing the sophistication with which hypotheses about the past could be tested.

The past of central Texas is commonly divided into four main periods:

- Paleoindian (11500 to 8000 BP)
- Archaic (8000 to 1300 BP)
- Late Prehistoric (1300 to 400 BP)
- Historic (400 BP to present)

With a view toward formulating expectations for the probability of cultural resources in the project area and the possible kinds of artifacts, sites, and features that might be expected, this section presents a very brief summary of the past 13,500 years of prehistory in central Texas. The primary sources consulted are Collins (1995, 2003), Hester and Turner (2001), Lundelius (1967), and Prewitt (1981).

2.3.1 Paleoindian Period

The earliest well-established human occupation of the New World began approximately 11,500 calendar years ago. At that time, much of the world's ice was tied up in massive ice sheets in the northern and southern hemispheres; now-extinct large mammals such as mastodont, giant ground sloths, and large bison roamed North America; and sea levels were over 100 m (320 ft) lower than today. Humans entered North America across the Bering Land Bridge, a narrow neck of dry land between eastern Siberia and western Alaska before melting ice raised sea levels, cutting off the flow of people and animals between Asia and North America.

Evidence from all over the continent shows that these earliest Americans were physically Asian people who lived in small groups; moved rapidly across the landscape, rarely staying for very long at any one location; and used throwing spears to hunt large game. Rare but convincing evidence from sites containing both Paleoindian weapons and extinct large mammals shows that the Paleoindians hunted mammoths, mastodonts, and large extinct bison, but accumulating evidence from places such as Dust Cave in northern Alabama also demonstrates that at least late Paleoindians also used a variety of foods including birds, small game, and plants (Walker et al., 2001). The subsistence of Paleoindian groups is still under debate, but it is clear that they were highly mobile hunter-gatherers for whom meat was an important staple.

Paleoindian sites are commonly found where sources of high-quality toolstone coincide with water sources such as springs in arid regions and stream confluences in much of the southeast. The distinctive marker of the early Paleoindian is the Clovis fluted point, a very finely-made spear point that is markedly similar in manufacture and shape throughout North America. Clovis people also manufactured large prismatic blades using a prepared core technology. At the Gault Site, several kilometers north of the project area in central Texas, there are massive remains of blade manufacture, many fluted points in various stages of manufacture, incised pebbles, and thousands of pieces of debris from the manufacture of blades and tools (Collins 2003). Two other early Paleoindian sites in Texas are the Aubrey Site in Denton County (north of Dallas) and the Miami mammoth kill site in Roberts County (in the panhandle). Slightly later in time, Folsom points are found, often in association with kill sites where the remains of extinct bison have been butchered. Toward the end of the Paleoindian period, projectile points diversified, resulting in a variety of types including Dalton, Patrice, Angostura, and Golondrina. These have smaller distributions, and from this time on, no single point type occurs continent-wide as Clovis does. Angostura points from the Richard Beene Site near San Antonio were dated to 8800 BP. The Paleoindian period coincides with the end of the Pleistocene, the retreat of the glaciers toward their modern latitudes, the extinction of 35 genera of animals from North America including proboscideans and horses, and the onset of relatively warm, modern climates.

2.3.2 Archaic Period

The Paleoindian-Archaic transition does not necessarily mark the change from one culture to another as much as a suite of technological, subsistence, and settlement changes coinciding with the onset of Holocene environmental conditions. The first appearance of the Archaic is signaled by changes in projectile point forms, which suggest a transition from thrown spears (javelins) to spear-throwers, or atlatls. Populations continued to be highly mobile and scattered. The major projectile point styles in the Early Archaic in central Texas are Martindale, Uvalde, Early Triangular, Andice, and Bell. During the Middle Archaic (4500 to 3000 BP), a significant increase in the number of sites and their densities indicates population growth. Pedernales points in Central Texas are diagnostic of the Middle Archaic. At this time, large burned-rock middens, which are the remains of large hearths where wild plant tubers were cooked repeatedly over long periods, also appear. These are often found as circular or donut-shaped mounds 10 to 15 m (32 to 48 ft) in diameter, full of broken fragments of burned rock. They suggest an intensification of plant food use and a shift away from the reliance on mobile large game. Cemeteries also appear, in which some individuals were buried with grave goods, suggesting the rise of status and perhaps an increase in social complexity. These trends continue into the Late Archaic (3000 to 1300 BP), which is marked by the appearance of new artifact styles including Ensor, Darl, Frio, and Fairland dart points.

2.3.3 Late Prehistoric Period

The beginning of the Late Prehistoric Period in central Texas is marked by the introduction of pottery, several new kinds of stone tools, and small projectile points that signal the introduction of bow-and-arrow technology. Bison hunting, which was important in the Archaic, continued to be an important subsistence component in central Texas and many other areas. Distinctive phases occur in the different regions of Texas. In central Texas, Scallorn (triangular) arrow points of the Austin Phase give way to Perdiz points of the Toyah Phase. The Toyah phase is marked by specialized stone tools for hide working and butchering and by bone-tempered ceramics.

In parts of Texas, the Late Prehistoric was a time of significant change. Some areas show evidence of long-distance trade with Mesoamerica. Agriculture appears in East Texas during the Gibson Aspect, the earliest manifestation of which is the Caddo Culture. Caddo includes burial mounds, many specific pottery types, sedentary villages, ceremonial sites, and evidence for social stratification.

2.4 History of the Project Area Vicinity

Unlike most parts of the country where Native American's first contacts with Europeans proved disastrous and provoked drastic social and demographic changes, the earliest Spanish expeditions into Texas in the seventeenth century appear to have had little initial effect on native cultures. It was not until the early to mid-eighteenth century that the presence of Spanish missions produced significant changes, and these changes spelled the end of the prehistoric past of Texas. French and Spanish explorers interacted with Native Americans, and several non-local Native American groups such as Apache came into Texas. The Caddo tradition continued with changes in pottery styles and without mound building and complex ceremonialism.

San Antonio is the home of the Alamo, the Spanish mission that was the site of the 12-day siege and the eventual massacre of 200 Texans by a Mexican force of 4,000 in 1836. After Mexico lost the struggle for Texas independence, Texas was annexed by the US as the twenty-eighth state in 1845 under the governorship of Sam Houston. In that same year, a post was established at the current location of FSH. This post was used as base of operations during the Mexican War (1846 to 1848). A Quartermaster Depot was established in 1846, serving as the main depot for the interior of the new state and supplying the military during the Mexican War. With the end of that war, San Antonio was made the headquarters of the U.S. Army Eighth Military District, but all of the buildings were rented from private owners. Efforts to build a permanent US military base in San Antonio failed until 1852, but were soon stalled by the Civil War. Those efforts resumed in 1866.

In the early 1870s, the City of San Antonio donated 93 acres of land for a military installation, and this was given the name Fort Sam Houston in 1890. This land is where the Quartermaster Depot, the Headquarters of the Department of Texas, the Staff Post, the Hospital, mess hall, pumping plant, corrals, and stables were built, beginning with the Depot in 1876.

In the late 1880s and early 1890s, the US consolidated the armed forces, lowering the number of installations from 117 to 96 (Corps of Engineers 2006). FSH grew in size and in the number of buildings as a result. FSH became the headquarters of the Fifth Military District in 1899.

Expansion continued during the first few decades of the twentieth century. In 1917, after troops were called back from Mexico to Texas and just before the US declared war on Germany, the army began construction of cantonment areas and training facilities for the training of 1.1 million troops. During this time, Camp Travis was constructed at FSH. Over 1,200 standardized buildings were built by 7,000 workers in less than one year. Another major building phase occurred between 1926 and 1932, when officers' and noncommissioned officers' housing was constructed, all in mission style. During World War II, over 400 emergency barracks were constructed at FSH. After World War II, FSH became the home of the Medical Field Service School and the Institute of Surgical Research. Medical research continues to be one of the main functions of FSH. The Brooke Army Medical Center was constructed less than 1 km south of the project area in the late 1980s.

2.5 Previous Investigations in Fort Sam Houston

As a federal agency, the U.S. Army maintains permits of all cultural resources investigations on its property and records on all cultural resources that have been documented during those investigations. At Fort Sam Houston, these records are maintained by the Environmental and Natural Resources Division. The archaeologist in this division, Dr. Peter Pagoulatos, was consulted for records of previous investigations and previously recorded cultural resources in the project area. These records were examined prior to field work.

Several previous cultural investigations, all sponsored by the U.S. Army Corps of Engineers, have taken place within FSH during the past 32 years. These investigations have resulted in the identification of 12 archaeological sites, none of which eventually were determined eligible for the National Register. Two of these sites are adjacent to the current project area and may extend inside its boundaries. A total of 1,377 buildings and structures are listed in the installation's historic properties database, and most of these are included within the Fort Sam Houston National Historic Landmark District. None of those buildings or structures are within or adjacent to the current project area.

Cultural resources investigations at FSH began in 1974 when a large, multi-component prehistoric site (41BX194) was recorded in the area of the golf course, approximately 1.0 km (0.6 mile) west of the project area prior to golf course construction (Hester 1974). In 1977, a general surface inspection was performed at FSH to provide a first inventory and evaluation of prehistoric and historic cultural resources in the installation (Gerstle et al. 1978). During that survey, 41BX194 was determined to have been destroyed by golf course construction. Two additional sites, 41BX389 and 41BX422, were identified and recorded in the floodplain of Salado Creek. Gibson et al. (1982) conducted a Phase I archaeological survey of areas to be affected by a proposed expansion of the National Cemetery at FSH, approximately 1.3 km (0.8 mile) northwest of the project area. One site containing prehistoric and historic material was identified.

Three related investigations (Gilmore and Allen 1987; Jackson and Prewitt 1988; Quigg 1988) were carried out in the mid-1980s in preparation for the proposed construction of the Brooke Army Medical Center, approximately 400 m (1,310 ft) south of the project area's south boundary. Those investigations resulted in the identification of three sites, all of which are outside the boundaries of the current project area. The Herman Eisenhauer farmstead and cemetery, 41BX778, was identified at the western extremity of Pershing Field west of Salado Creek. An early twentieth century refuse area, 41BX779, was identified west of Salado Creek approximately 2.0 km (1.2 miles) southwest of the project area. One small, prehistoric lithic scatter of unknown age (41BX780) was also identified.

A study of 280 acres of floodplain along Salado Creek was investigated with a Phase I cultural resources survey in 2000, in partial fulfillment of Section 110 of NHPA (Scott 2000). The study included surface survey and shovel tests. Four previously unrecorded sites were identified: 41BX1405, 41BX1406, 41BX1407, and 431BX1408. Three of these are prehistoric and one has both prehistoric and historic components. Scott (2000) indicates that site 41BX1406 was found within 50 to 70 m (160 to 225 ft) north of the northern boundary of the current project area (no coordinates are given in the report). The site consisted of six pieces of lithic debitage within an area of 4 square meters. Six shovel tests were completed to a depth of 60 to 80 centimeters (cm) (24 to 31 inches), and Pleistocene gravels were not reached. The study indicated that:

- No intact subsurface deposits were found, but the depths at which the artifacts were recovered were not indicated.
- The site was not recommended for inclusion in the National Register.
- The same conclusions were reached for the remaining newly discovered sites, the nearest of which was over 500 m (1,640 ft) southwest of the project area on the other side of the heliport.

Although the report stated that one previously recorded site, 41BX1209 (described below), was re-evaluated, the report gives no indication that any fieldwork was done at the site.

The U.S. Army Corps of Engineers sponsored a historic landscape inventory at FSH (Batzli and Siewers, 1996), which focused on the eastern third of the installation. Five historic landscapes were identified: the Quadrangle and Staff Post, the Infantry Post, the Cavalry and Artillery Post, the New Post, and the Camp Wilson/Camp Travis area. These were further studied in a historic landscapes master plan (U.S. Army Corps of Engineers 1999). None of the current project area is included in any of these historic landscapes.

Every five years the U.S. Army Corps of Engineers completes an Integrated Cultural Resource Management Plan (ICRMP) at FSH. A draft of the most recent study was completed in March 2006. It included Fort Sam Houston, Camp Bullis, and Canyon Lake Recreation Area. This study lists 12 prehistoric sites in FSH (including the abovementioned sites), all of which have been deemed ineligible for the National Register; 1,377 buildings of which 751 are listed or considered eligible for listing on the National Register; and a National Historic Landmark District (defined in 1975) that includes 103 buildings as contributing elements. In addition, 627 buildings and 21 structures outside this district are considered eligible for the National Register. The current project area is not included within this district and contains no buildings.

2.6 Previous Investigations within the Project Area

Three previous cultural resource studies have included the project area. The general surface inspection of FSH by Gerstle et al. (1978) included Pershing field, but the report does not specify the methods used or the location of shovel test pits. The survey identified no sites in Pershing Field.

One study related to the construction of the Brooke Army Medical Center (Quigg 1988) included two shovel test pits in the current project area, one near the center and another near the northern boundary. No cultural resources were identified, but the observed soils suggested a potential for deep, stratified Holocene deposits likely to contain prehistoric artifacts. Quigg excavated additional shovel tests in the floodplain of Salado Creek; all were negative and the overall results suggested little potential for buried archaeological sites.

In response to a proposed housing development in 1996, Quigg and Abbott (1997) conducted a geo-archaeological investigation of all 50 acres of Pershing Field. They excavated and examined 19 backhoe trenches 1.4 to 3.3 m (4.7 to 10.7 ft) deep and 9 shovel test pits. Six trenches (defined as BT1, BT2, BT3, BT11, BT12, and BT13) were aligned in north-south transects near the eastern and western boundaries of the current project, and one (BT10) was near the center of the current project (Figure 2-1). None of the shovel tests were placed within the current project area. A prehistoric site, 41BX1209, was identified and recorded in the northeastern corner of Pershing Field. The site lies immediately northeast of the northeastern corner of the current project area. It is unclear from the report whether any part of 41BX1209 was recorded within the current project area. Two artifacts were recovered from ST2 at a depth of 0 to 10 cm (0 to 4 inches), but that shovel test is shown just outside the current project boundaries. Trench BT3 lies immediately west of that shovel test, just inside the current project area, but the report does not state whether any cultural material was recovered from the trench. The test location map (see Figure 2-1) includes a dashed line indicating the approximate boundaries of the site, and the dashed line includes a small portion of the current project area, but that is probably an estimate of the distribution of artifacts.

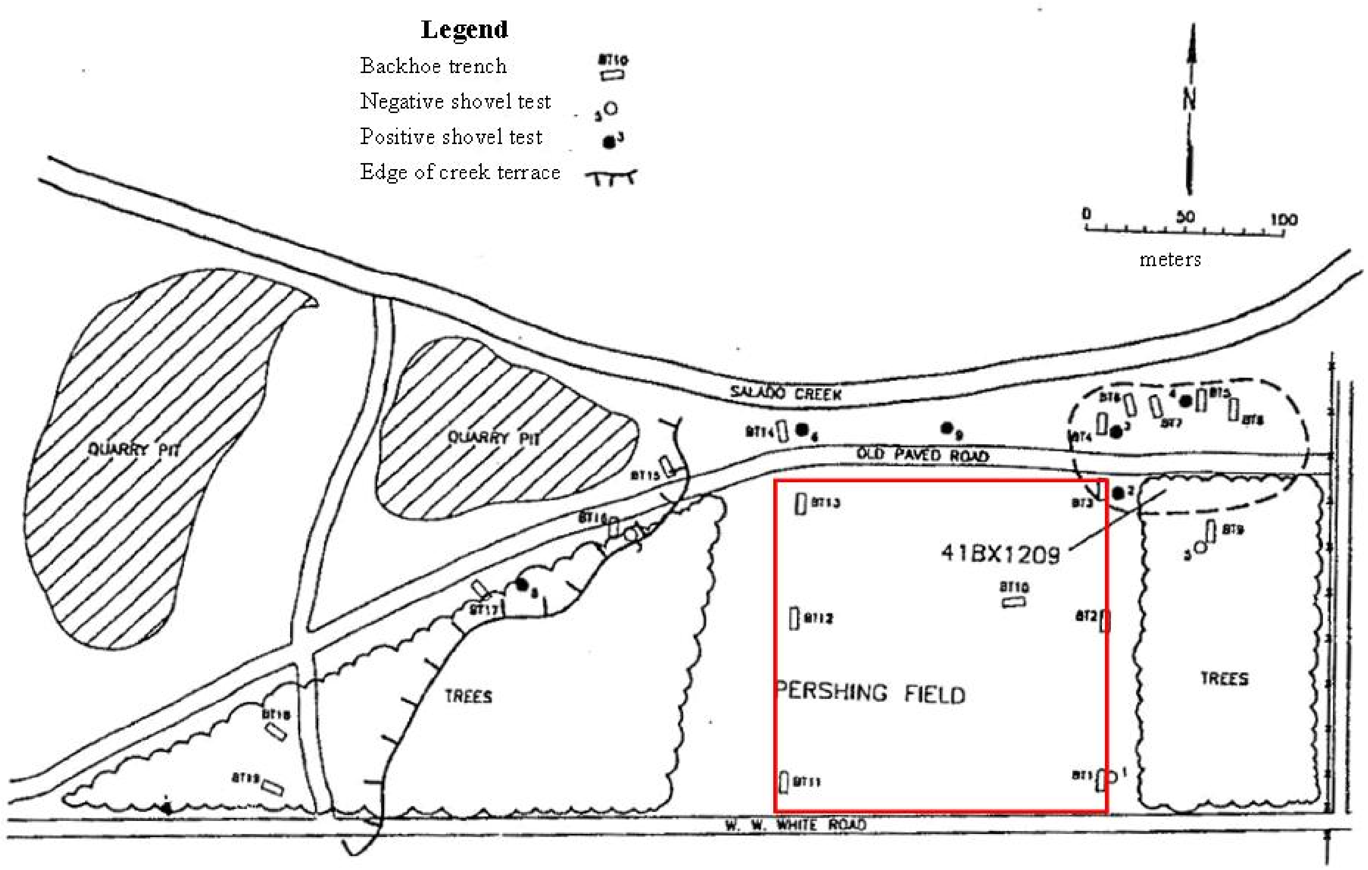

Figure 2-1 Location of backhoe trenches and shovel tests completed by Quigg and Abbott showing the approximate location of the current project boundary and the location of 41BX1209. Modified after Quigg and Abbott (1997, Figure 3).

Site 41BX1209 is a moderately dense lithic scatter exposed on the surface, with 20 artifacts buried as deeply as 60 cm (24 inches), deeper than the 30-cm (12-inch) deep plowzone. There were two bifaces, and most of the material was debitage. No diagnostics were identified and no features were observed. Historic debris, none indicating a historic site, was scattered on the surface of the site. Quigg and Abbott declined to evaluate the National Register eligibility of this site. They recommended avoidance or, if that was not possible, a phase II investigation of the site to determine eligibility. According to Ms. Jackie Schlatter, manager of Natural and Cultural Resources at FSH, the proposed construction did not take place in part due to the absence of utilities in the project area (personal communication, 16 May 2006).

The Quigg and Abbott study also presented interpretations of the ages of the deposits observed in the backhoe trenches. The sediments and soils observed were grouped into three units. Unit A was described as 1 to 2 m (3 to 6 ft) of loamy to clayey overbank (flood) deposits underlain by silts, loams, and gravels, with a total thickness of at least 4 m (13 ft). Unit A is exposed on the surface over much of Pershing Field, where it underlies the T2 terrace. Its colors included dark brown to brown to strong brown, and it possessed "common or abundant carbonate nodules and rhizoliths, and weak to moderate structural development" (Quigg and Abbott 1997). Land snail shells were prominent within this unit. Unit B, "a small wedge of clay loam sediment inset into the margin of the T2 terrace in the northeastern part of the tract, particularly within the boundary of site 41BX1209" (Quigg and Abbott 1997) was 2 to 3 m (7 to 10 ft) of dark grayish brown to dark brown clay loam alluvium. Quigg and Abbott interpreted that this unit might be partially draped over Unit A in the northern end of Pershing Field and that a thin veneer of this unit draped and welded to the terrace could be distinguished from Unit A. Unit C was described as a clay-to-clay loam unit underlying the T1 terrace in the western end of Pershing Field. It is a varied unit containing alluvial overbank and mixed alluvial/colluvial deposits ranging from very dark grayish brown (10YR 3/2) to dark brown. Based on comparisons with backhoe trench investigations in central Texas, Quigg and Abbott interpreted these units' ages as follows: Unit A, Late Pleistocene; Unit B, early-mid Holocene (8000 to 5000 BP); and Unit C, late Holocene (5000 to 600 BP). Quigg and Abbott concluded that most of Pershing Field contains only about 30 cm (12 inches) of Holocene sediment and that small, dispersed pockets of more deeply buried Holocene deposits are in the northern and northeastern parts of Pershing Field along the left descending bank of Salado Creek. Site 41BX1209 is located within one such pocket.

In response to a plan to construct a perimeter fence along the northern edge of Pershing Field, the U.S. Army Corps of Engineers, Fort Worth District, carried out a Phase II testing of sites

41BX1209 and 41BX1407, approximately 500 m (1,640 ft) southwest of the project area (McLoughlin 2000). The investigation included relocation of both sites, examination of backhoe trenches, manual excavation of test units, and site mapping. Four backhoe trenches and nine test units were excavated within the boundaries of 41BX1209. None of the trenches or units was placed within the current project area. The trenches and test units were concentrated in an area north of a dirt road that splits from the abandoned paved road that delineates the northern boundary of Pershing Field. The nearest trench and test unit are both more than 100 m (328 ft) northeast of the northeastern corner of the current project area. McLoughlin (2000) recovered 323 lithic artifacts. Most were found in the upper 40 cm (16 inches), but one was as deep as 60 to 80 cm (24 to 32 inches). No diagnostic artifacts or features were observed. The study concluded that the site was the location of a small occupation with a small number of activities and recommended that it be considered ineligible for the National Register.

2.7 Implications for the Current Investigation

The studies by Quigg (1988), Quigg and Abbott (1997), Scott (2000), and McLoughlin (2000) contain important information about the potential of Pershing Field to yield significant cultural resources, without answering the question of whether significant cultural resources exist in the project area. These studies suggest that little, if any, undisturbed ancient Holocene deposits or soils are found within the current project area and that plowing has disturbed up to 30 cm (12 inches) of most or all of the soil in the project area. Neither site 41BX1406 nor site 41BX1209 is eligible for the National Register; neither clearly extends into the project area; and both represent relatively small, short-term prehistoric occupations of unknown age.

At the same time, the deep testing by Quigg and Abbott (1997) and the Salado Creek floodplain study by Scott (2000) both suggest that there is an area along the left descending bank of Salado Creek with potential for deeply buried, undisturbed Holocene-age deposits. This area either borders or extends into the northern end of the current project area. If such deposits exist there, then this, along with the presence of level land and abundant cobbles and nodules of Edwards Plateau chert, would suggest some potential for additional prehistoric sites. In addition, although 41BX1209 is not eligible for the National Register, it is possible that portions of 41BX1209 that contain the potential to yield significant data on the past extend into the current project area. If so, that portion could be National Register-eligible. Therefore, a goal of this study was to test this hypothesis.

3.0 FIELD METHODS

Field investigations were completed 16 through 18 May 2006 with staff from MACTEC's Knoxville, Tennessee, and San Antonio, Texas offices.

3.1 Project Boundaries

Project area boundaries were indicated in the field by blue pin flags that had been placed during a recent study of the project area, and they corresponded with a project boundary map provided by FSH. The pin flags indicated the northwestern and southwestern corners and most of the northern, southern, and western borders. The eastern border was not flagged, so its location in the field was determined based on the map (Figure 1-2).

3.2 Pedestrian Survey

A systematic pedestrian survey in 30-m (98-ft) transects was carried out as the first stage of fieldwork. The archaeologist and his assistant walked transects slowly and deliberately, looking for any signs of historic or prehistoric archaeological sites. Ten north-south transects were walked. The positions of the transects were located by pacing from project boundaries. Three transects crossed a copse of trees in the north of the project area. Due to a venomous snake hazard, the copse was skirted, and the transects were resumed on the other side. The cleared areas of the project were fairly thickly covered with grass and forbs up to 24 inches high, which reduced ground visibility to approximately 50 percent in some areas and to nearly zero in other areas.

3.3 Shovel Test Pits

Seventeen numbered shovel test pits (ST) were excavated in the project area (Figure 3-1). The purposes of the shovel test pits were to: 1) examine subsurface deposits for evidence of intact, stratified, buried deposits capable of containing significant cultural resources; and 2) search for artifacts and cultural features not exposed on the ground surface.

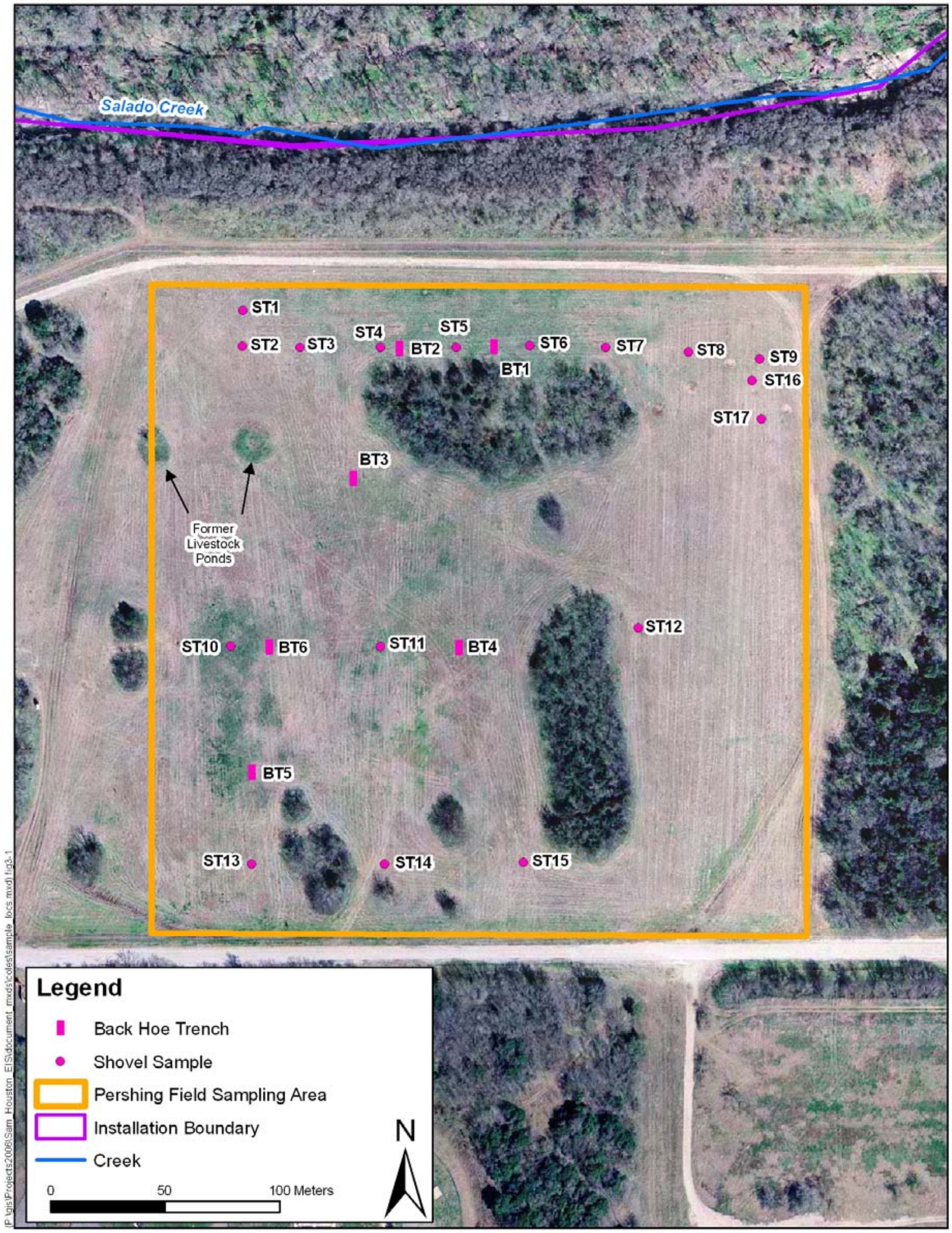

Figure 3-1 Location of shovel tests (ST) and backhoe trenches (BT) performed 16 - 18 May 2006 by MACTEC.

Eight of these (ST2 through ST9) were aligned in an east-west transect 20 m (66 ft) south of the project's northern boundary, with each shovel test paced 30 m (98 ft) apart. This area was considered to have the highest potential for buried prehistoric cultural resources based on the previous investigations. Six shovel tests (ST10 to ST15) were aligned along two other east-west transects, one through the center of the project and one near the southern boundary, with 60 m (197 ft) between shovel tests. The remaining shovel tests were placed in locations considered to have relatively higher potential, one (ST1) on the project's north boundary and two others (ST16 and ST17) near a previously recorded site near the northeastern corner of the project area.

Each shovel test was excavated with a shovel in 10-cm (4-inch) arbitrary levels. Spoils were screened through ¼-inch hardware mesh and searched for artifacts. Each shovel test was approximately 30 cm (12 inches) wide and up to 50 cm (20 inches) deep. However, several were not excavated to that depth due to the extreme hardness of some of the clay soils. Observed soils and sediments were described using a Munsell color chart and according to standard geo-archaeological terminology for texture and particle morphology.

3.4 Backhoe Trenches

Six trenches (BT1 to BT6, Figure 3-1) were excavated using a backhoe with a 24-inch, smooth-bladed bucket. Trenches were excavated up to 1.2 m (4 ft) deep, 0.8 m (30 inches) wide, and 3 m (10 ft) long. Trench profiles were examined, described, and photographed. Descriptions were recorded in the field notebook and included Munsell color, texture, grain morphology, and content. These descriptions were later compared with those generated during previous studies in and near the project area. The purpose of the backhoe trench analysis was to determine the potential for deeply buried cultural horizons capable of containing significant cultural resources, and to identify any artifacts or cultural features that may be present.

3.5 Documentation

Field observations were recorded by MACTEC's archaeologist in a field notebook and with the use of digital and film photography. The field notebook and photographs are currently stored at MACTEC's Knoxville, Tennessee, office. They are the property of the U.S. Army Corps of Engineers, Mobile District and FSH and will be included in the Administrative Record, Deliverable 13 of the Task Order.

4.0 RESULTS OF THE FIELD ANALYSIS

4.1 Pedestrian Survey

Figure 4-1 shows a typical view in the project area. One artifact was identified during the pedestrian survey, a flake of Edwards Plateau chert. This flake was found just outside the project area in the dirt road immediately east of the project's eastern boundary, near the northern boundary. The flake had been damaged by vehicular traffic. Small amounts of modern trash were seen in a few places within the project area: sandbags, black plastic, blank ammunition, food wrappers, a few machine-made bricks, fragments of concrete, and pieces of modern bottle glass. No historical artifacts or features were identified. Ground visibility was fair (50 to 75 percent) in some areas, but poor (0 to 30 percent) over most of the project due to heavy vegetation. No sign of any structures was seen.

Two features were identified and examined closely. In the northwestern quadrant of the project area are two low, circular mounds standing approximately 60 cm (24 inches) higher than the rest of the field. Each contained a depression, giving the features a donut shape with a diameter of approximately 11 to 14 m (35 to 45 feet). These are indicated in Figure 3-1; one is bisected by the project's western boundary. At first glance, they possessed a vague resemblance to the burned rock middens that occur on the Edwards Plateau and that date as early as the Early Archaic. Nevertheless, when the western feature was probed with a shovel, only silt loam was seen, and it was concluded that both features were abandoned livestock ponds dating from the time that the project area was an agricultural field.

4.2 Shovel Test Pits

Two shovel tests were positive; the rest were negative (Figure 3-1). ST4 contained one small flake fragment of brown, opaque, fine-grained Edwards Plateau chert at a depth of 20 to 30 cm (8 to 12 inches) bgs. The artifact was found within the presumed plowzone. ST16 contained two very small chert flakes at a depth of 30 to 40 cm (12 to 16 inches) bgs. None of the flakes showed any sign of use or of retouch.

Figure 4-1 Project area, view to south from MACTEC BT4

The typical soil profile in the shovel test pits displayed a dark brown or very dark brown (7.5YR 2.5/3, 7.5YR 2/3, or 10YR 3/2) clayey silt with varying amounts of sand to depths of 30 to 50 cm (12 to 20 inches). In some shovel tests, there was a transition to a 7.5 YR 3/4 at approximately 30 cm to 50 cm (12 to 20 inches). Moderate amounts of naturally-occurring rounded chert gravel were encountered in some shovel tests. Modern trash (a piece of black plastic film) was found in ST4 at a depth of 30 to 40 cm (12 to 16 inches).

Modern grading fill was seen in ST11, ST13, ST14, and ST15. This consisted of a very heterogeneous mixture of clay peds of various colors including 2.5YR 4/4, 2.5YR 5/4, 2.5YR 6/8, and 10YR 2/1, along with rounded and angular chert and limestone gravels and small amounts of modern trash (clear and brown bottle glass shards and fragments of modern terra cotta drain tiles). In ST11 at a depth of 24 to 29 cm (9.5 to 11 inches) bgs, there was a thick layer of fragments of what appeared to be clay pigeons, some of which had bright yellow, white, or orange paint mixed with a silty 7.5YR 2/3 matrix. The modern fill and trash was found at maximum depths of 14 cm (5.5 inches) bgs (ST14), 25 cm (10 inches) bgs (ST15), and 29 cm (11 inches) bgs (ST11 and ST13). The contact between these layers and the underlying soil was abrupt.

4.3 Backhoe Trenches

No artifacts other than small amounts of modern trash and no cultural features were identified in the six backhoe trenches. Figure 3-1 shows the location of each trench. The soil profile of each trench is described below.

Table 4-1 Backhoe Trench Stratigraphic Descriptions

Backhoe Trench	Depth (cm bgs)	Description
BT1	0-52	10YR3/2, clayey silt loam with abundant small (1-2 mm) flecks that are fragments of land snail shells; rare angular to rounded chert gravels.
	53-95	10YR 3/4, clayey silt loam with same texture and content as above unit
	96-130	10YR 4/6, clay with small (3-5 mm) carbonate nodules
BT2	0-41	10YR 3/2, clayey silt loam with abundant small (1-3 mm) white flecks that are fragments of land snail shells
	42-72	10YR 3/3, clayey silt with abundant fragments of snail shells; mottles and flecks of 10YR 5/8
	73-102	10YR 3/3 (primary) with mottles of 10YR 5/8, clay with silt and small (3-5 mm) carbonate nodules.

Backhoe Trench	Depth (cm bgs)	Description
BT3	0-15	10YR 2/2, friable silt with very abundant spherical, egg-shaped limestone gravel.
	16-102	10YR 2/2 Silty clay with carbonate nodules, a very small number of small snail shell fragments, absence of gravel.
BT4	0-2	10YR 4/1 with abundant organic material and living roots (A horizon)
	3-28	Very heterogeneous unit containing: 10YR 2/1 (black) clay, 5Y 6/6 (olive yellow) clay; 2.5 Y 6/8 (olive yellow) clay; and 2.5 Y 7/4 (pale yellow) clay. These occur as distinct peds that have been pressed together and mixed with rounded pebbles and cobbles of various lithologies. Abrupt contact with underlying unit; gradual contact with overlying A horizon.
	29-80	10YR 2/2 (dark brown) silt with clay, with mottles of 10YR 5/8 (yellow brown), abundant small (1 to 2 mm) fragments of snail shells.
	81-110	10YR 5/8 (yellow brown) clay with mottles of 10YR 2/2 (dark brown), abundant small fragments of snail shells. Diffuse boundary with above unit.
BT5	0-20	Very heterogeneous unit containing: 2.5YR (light olive brown) clay; 2.5YR 6/8 (olive yellow) clay; 2.5Y 2.5/1 (black) clay; a moderate quantity of rounded pebbles; and white carbonate deposits.
	21-125	10YR 2/2 (very dark brown) silt loam with clay and abundant snail shell fragments. Abrupt contact with above unit.
BT6	0-24	Very heterogeneous unit containing: 2.5YR (light olive brown) clay; 2.5YR 6/8 (olive yellow) clay; 2.5Y 2.5/1 (black) clay; a moderate quantity of rounded pebbles; and white carbonate deposits. Also contains a small number of shattered chert cobbles and pebbles.
	25-60	10YR 2/2 (very dark brown) silt loam with clay and abundant snail shell fragments. Mottles of 10YR 5/8 (yellow brown). Abrupt contact with above unit.
	61-120	10YR 5/8 (yellow brown) with mottles of 10YR 2/2 (very dark brown), wilt with clay. Diffuse contact with above unit.

4.4 Discussion

ST1 through ST3 (west of BT2) and ST7 through ST9 (east of BT1) contain a 30 to 40 cm (12 to 16 inches) deep A horizon underlain by a subsoil. ST4 through ST6 appear to contain Pleistocene subsoil from the surface down, which in one case (ST4) has evidence of modern disturbance to a depth of 45 cm (18 inches). This confirms the suggestion of Scott (2000) and Quigg and Abbott (1997) that middle to early Holocene soils are present in some areas in the Salado Creek floodplain, including part of the northern end of the current project area. The results from ST10 through ST12 (in the middle transect) and from ST13 through ST15 (in the southern transect) suggest that any Holocene soils that may have been present are eroded, leaving only Pleistocene yellowish brown or very dark brown silt loam. Further, all of the shovel tests in the middle and southern transects contain a 14 to 30 cm (5.5 to 11.8 inches) thick layer of modern construction fill. No evidence of grading fill was seen in the northern shovel test transect.

The positive finding in ST16, near the northeastern corner of the project area, shows that site 41BX1209 may extend slightly into the project area. However, two nearby shovel tests (ST9 and ST17) were negative, and the two flakes from ST16 appear to be from a disturbed context. The single flake from ST2 is of doubtful cultural significance. It may have resulted from plow blades striking a naturally occurring chert cobble, and may not be a prehistoric artifact.

The backhoe trenches can be divided into two groups, each of which is distinct with regard to depositional history. BT1 and BT2 display profiles that are roughly equivalent to profiles described inside the boundaries of 41BX1209 by Quigg and Abbott (1997) and McLoughlin (2000). The profile of BT2 is shown in Figure 4-2. The latter, for example, describes an A-Bwk-Bk soil profile, with a 10 to 25 cm (4 to 10 inches) thick, dark grayish brown to very dark grayish brown silty clay loam A horizon with 2 percent limestone and chert gravel; a 24 to 49 cm (9 to 19 inches) thick, brown silty clay loam Bwk horizon with few soft carbonate nodules; and a 104 to 118 cm (41 to 46 inches) thick reddish yellow to brownish yellow silt loam Bk horizon with common soft carbonate nodules. By reference to the chronological interpretations of Quigg and Abbott, this was interpreted as an early to mid-Holocene buried soil. BT1 and BT2 are closely comparable, and so MACTEC concludes that they contain deeply buried Holocene soils that have been strongly influenced by flood deposits from Salado Creek.

Figure 4-2 East profile of MACTEC backhoe trench BT2.

BT3 through BT6 have a strikingly distinct top layer that is heterogeneous and lies abruptly on top of a very dark brown clay or silty clay containing snail shell fragments. The profile of BT6 is shown in Figure 4-3. The underlying unit is closely similar to Unit A of Quigg and Abbott, which they interpreted as a Pleistocene deposit. Although Quigg and Abbott noted the presence of fragments of land snail shells in this unit, they did not state that those shells were diagnostic of the Pleistocene in this vicinity. The above results show that land snail shell fragments are nearly ubiquitous throughout all the deposits (excepting the topmost units in BT3 through BT6), and those shells may, therefore, have little chronological significance. Nevertheless, the shells indicate that these deposits were formed under moist terrestrial conditions. The topmost unit in these four trenches is clearly grading fill of some kind that was spread over the project area in modern times. This is particularly clear in the heterogeneous mass of mixed and compressed clays of varying colors in BT4 through BT6, which have been pressed together along with gravels. The grading fill was also seen in shovel tests in the central and southern portions of the project area. No evidence of grading fill was seen in BT1 and BT2.

Figure 4-3 West profile, MACTEC backhoe trench BT6

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5.0 CONCLUSIONS AND RECOMMENDATIONS

The two positive shovel tests are interpreted as isolated finds. Lacking intact cultural horizons, features, and dense concentrations of artifacts, neither find has the potential to yield scientific data of significance to the prehistory of the project area. The same conclusion holds for the isolated surface find that was identified on the dirt road outside the project area.

The shovel test and backhoe test results point to two conclusions. First, there are deeply buried Holocene deposits in the north part of the project area, possibly as old as 8,000 years and at least 1.4 m (4.5 ft) deep. In principle, such deposits have the potential to yield intact prehistoric sites. Second, large areas of the project area south of BT1 and BT2 have been affected by the placement of 14 to 30 cm (6 to 12 inches) of modern construction fill, which sits directly on top of Pleistocene deposits. Most of the project area has no potential for intact subsurface cultural horizons. Whether Holocene deposits originally existed there and were removed by cut and fill operations or welded into the underlying Pleistocene deposits as suggested by Quigg and Abbott (1997) is not clear.

The evidence from ST9, ST16, and ST17 (all near the northeastern corner of the project and the southwestern boundary of 41BX1209) provide equivocal support for that site boundary as it was shown by Quigg and Abbott (1997). Only one of those tests (ST16) was positive; it contained two small flakes from a depth of 30 to 40 cm (12 to 16 inches) in what appeared to be Pleistocene subsoil. This suggests that the scatter of artifacts that makes up site 41BX1209 extends slightly into the current project area, but the portion of the site within the current project area is very small. It is also very sparsely distributed and disturbed by plowing. Although a portion of 41BX1209 extends into the project area, it does not change the finding of McLoughlin (2000) that the site is not eligible for the National Register.

Given the failure to identify intact buried cultural horizons in the only part of the project area that has potential to yield such material, MACTEC concludes that no such sites exist in the project area. In all likelihood, the small section of intact Holocene-age Salado Creek floodplain in the northern part of the project area was not the locus of any sustained prehistoric occupation. Whether or not the remainder of the project area was inhabited in the past, residues of those habitations probably have been erased by modern disturbance including cultivation, land clearing, erosion, grading, and fill emplacement.

Although there is a National Historic Landmark District at FSH, as well as many other structures that are eligible for or listed on the National Register, none of these buildings is within the project area. The proposed BRAC-related actions in the project area have no potential to affect the district or any of the listed or eligible buildings.

MACTEC concludes that BRAC-related actions in the project area will have no effects to cultural resources in the project area. MACTEC recommends that further cultural resources investigations are not necessary for the EIS.

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APPENDIX F

ECONOMIC IMPACT FORECAST SYSTEM (EIFS) METHODOLOGY

Economic Impact Forecast System

The model used in this appendix was created by the U.S. Army Corps of Engineers – Construction and Engineering Research Laboratory to assess the projected socioeconomic impacts associated with military projects and activities. This model is known as the Economic Impact Forecast System (EIFS) and was developed in the early to mid-1970s to assess socioeconomic effects from military actions. The EIFS model was developed utilizing economic and social flows both into and out of a specific region. This type of model is known as an economic base model. The revised EIFS guidance (2001) describes this model as being based on the idea that, "a local economy depends upon an external demand for its services and supplies to sustain its internal welfare." The primary technique used by this model to determine socioeconomics effects is the location quotient (LQ). The LQ is a method to calculate the ratio between the local economy and the economy of a reference unit (i.e., the United States or the State of Texas). The EIFS model defines local economic activity as either an export (basic) sector or a service sector. The export sector is comprised of those economic activities that surpass the local need (i.e., self-sufficiency). The LQ is used to develop regional economic multipliers, which in turn describe how additional investment in one portion of the regional economy would spread throughout. Therefore, the EIFS model output is the regional effect from the specific project additional investment in dollars and people.

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Economic Impact Forecast System
US Army Corps of Engineers
Mobile District

EIFS REPORT

PROJECT NAME

FSH EIS - San Antonio MSA 03

STUDY AREA

48013 Atascosa, TX
48019 Bandera, TX
48029 Bexar, TX
48091 Comal, TX
48187 Guadalupe, TX
48259 Kendall, TX
48325 Medina, TX
48493 Wilson, TX

FORECAST INPUT

Change In Local Expenditures	$1,800,000,000
Change In Civilian Employment	2367
Average Income of Affected Civilian	$48,684
Percent Expected to Relocate	100
Change In Military Employment	2812
Average Income of Affected Military	$35,169
Percent of Militart Living On-post	0

FORECAST OUTPUT

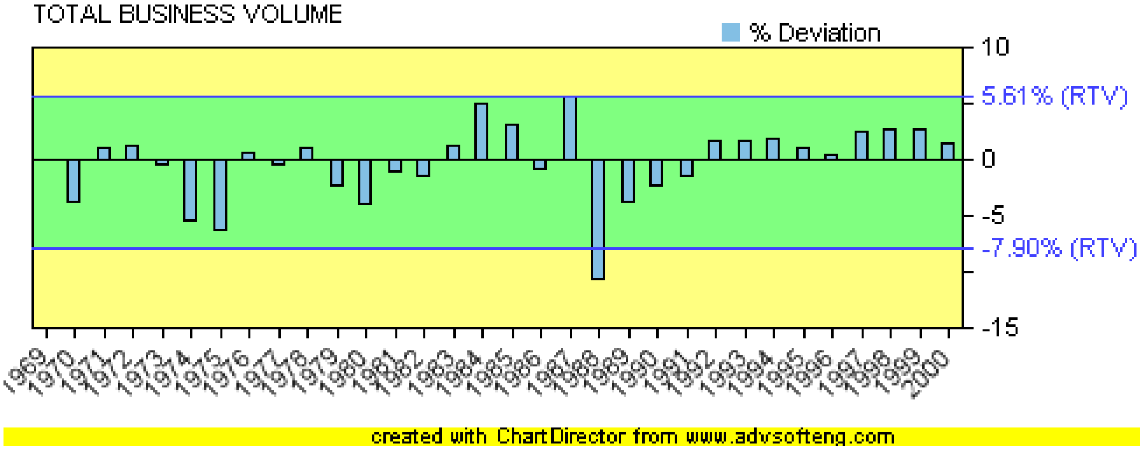
Employment Multiplier	4.46	
Income Multiplier	4.46	
Sales Volume - Direct	$1,941,009,000	
Sales Volume - Induced	$6,715,890,000	
Sales Volume - Total	$8,656,899,000	12.33%
Income - Direct	$552,354,100	
Income - Induced)	$1,261,930,000	
Income - Total(place of work)	$1,814,284,000	4.95%
Employment - Direct	14018	
Employment - Induced	30582	
Employment - Total	44599	4.85%
Local Population	12896	
Local Off-base Population	12896	0.79%

RTV SUMMARY

	Sales Volume	Income	Employment	Population
Positive RTV	5.61 %	5.82 %	2.81 %	1.1 %
Negative RTV	-7.9 %	-7.18 %	-3.44 %	-0.7 %

RTV DETAILED

SALES VOLUME



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1974	3925891	12759146	-70758	-685037	-5.37
1975	4227508	12597974	-161172	-775451	-6.16
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1977	5240744	13835565	542618	-71661	-0.52
1978	5936447	14603660	768095	153816	1.05
1979	6733990	14882118	278458	-335821	-2.26
1980	7689902	14918410	36292	-577987	-3.87
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1982	9509752	15786188	398753	-215526	-1.37
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1984	11783222	18146161	1530696	916417	5.05
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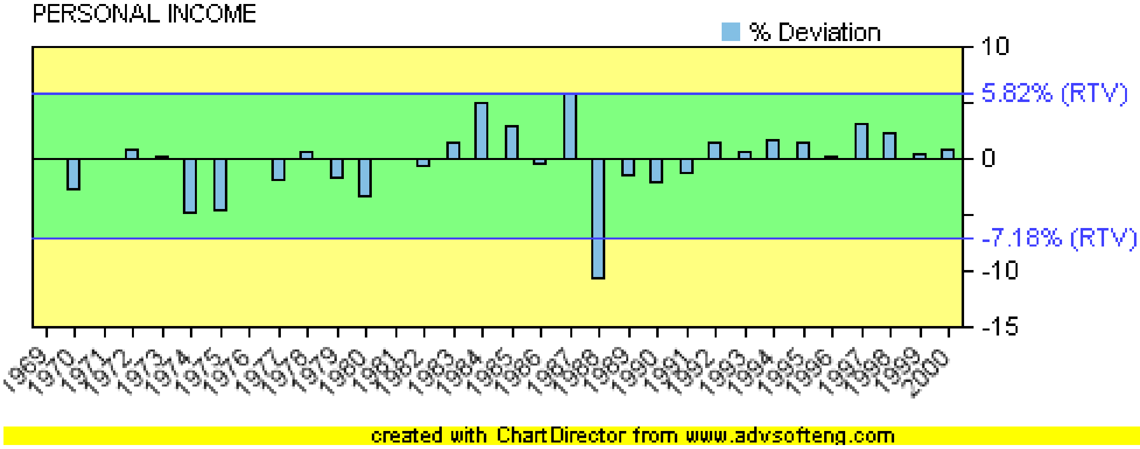

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1974	5036967	16370143	96649	-767895	-4.69
1975	5526128	16467862	97719	-766825	-4.66
1976	6142176	17320936	853074	-11470	-0.07
1977	6766676	17864025	543089	-321455	-1.8
1978	7662111	18848793	984768	120224	0.64
1979	8776525	19396121	547327	-317217	-1.64
1980	10106123	19605879	209759	-654785	-3.34
1981	11634050	20475928	870049	5505	0.03
1982	12777741	21211050	735122	-129422	-0.61
1983	13912541	22399191	1188142	323598	1.44
1984	15913377	24506600	2107409	1242865	5.07
1985	17549297	26148453	1641853	777309	2.97
1986	18433298	26912616	764163	-100381	-0.37
1987	19028939	29494855	2582239	1717695	5.82
1988	20163460	27422306	-2072549	-2937093	-10.71
1989	21593104	27855103	432797	-431747	-1.55
1990	22867870	28127481	272377	-592167	-2.11
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1995	32141769	33748856	1326926	462382	1.37
1996	33987005	34666744	917889	53345	0.15
1997	36642667	36642667	1975923	1111379	3.03
1998	39181900	38398263	1755596	891052	2.32
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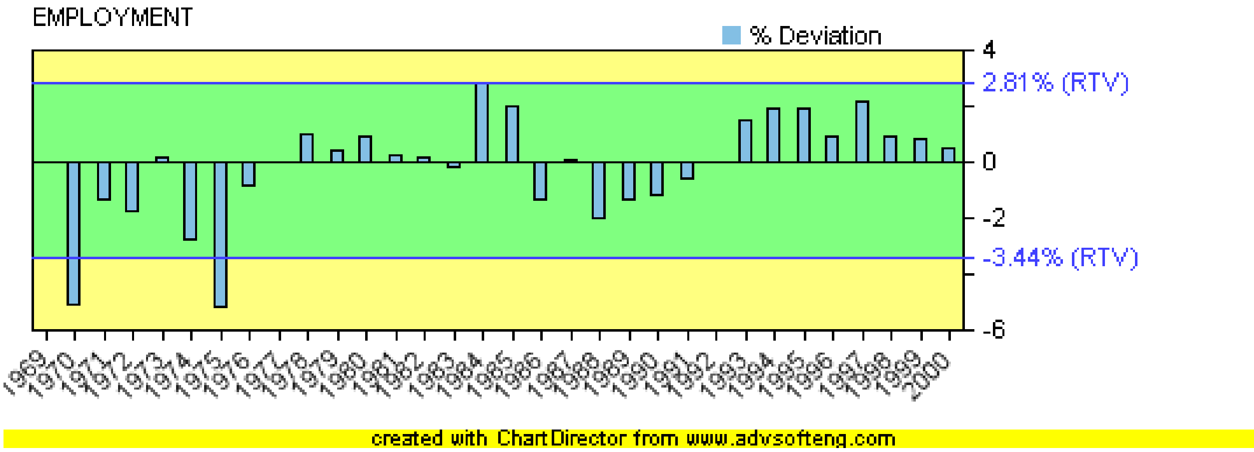
2000	43705339	40645966	1233395	368851	0.91

EMPLOYMENT



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1975	461539	-5858	-23656	-5.13
1976	475282	13743	-4055	-0.85
1977	493060	17778	-20	0
1978	515853	22793	4995	0.97
1979	535886	20033	2235	0.42
1980	558635	22749	4951	0.89
1981	577739	19104	1306	0.23
1982	596332	18593	795	0.13
1983	613220	16888	-910	-0.15
1984	649256	36036	18238	2.81
1985	680470	31214	13416	1.97
1986	689130	8660	-9138	-1.33
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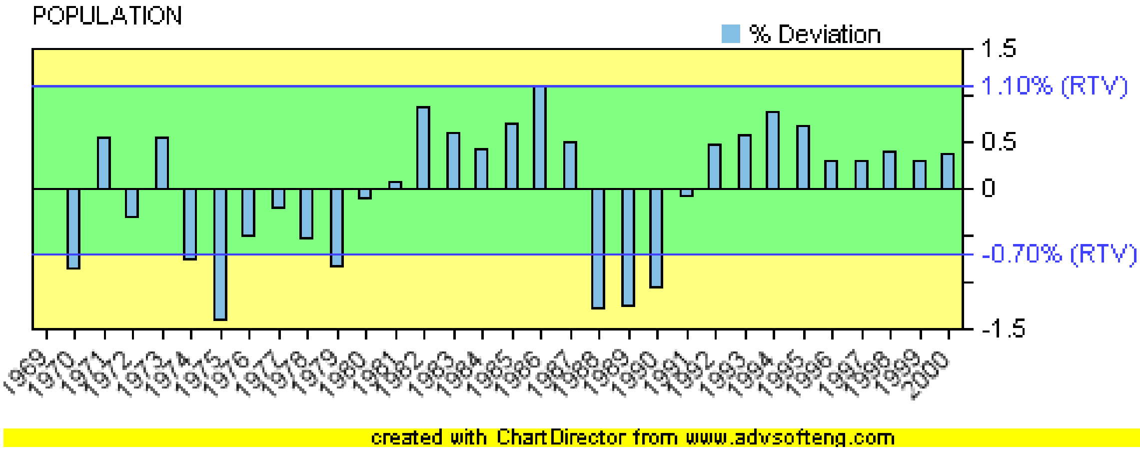
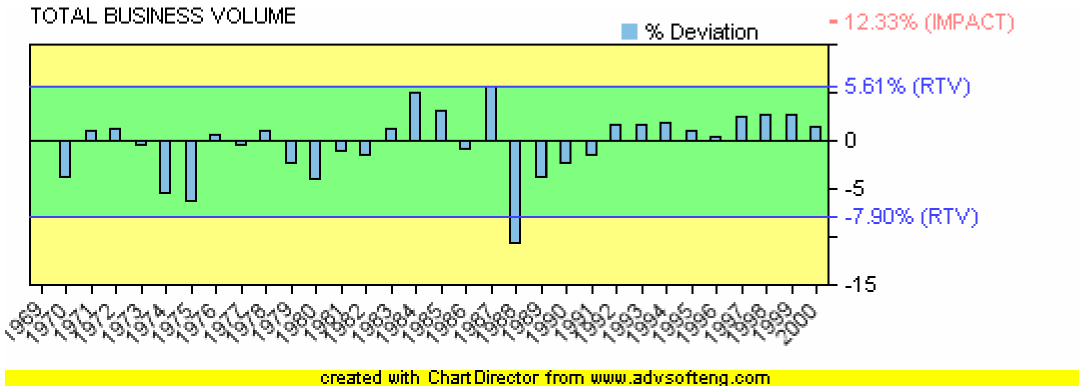
1990	728541	9549	-8249	-1.13
1991	741827	13286	-4512	-0.61
1992	759401	17574	-224	-0.03
1993	788779	29378	11580	1.47
1994	822088	33309	15511	1.89
1995	856422	34334	16536	1.93
1996	882254	25832	8034	0.91
1997	919710	37456	19658	2.14
1998	946081	26371	8573	0.91
1999	972052	25971	8173	0.84
2000	994748	22696	4898	0.49

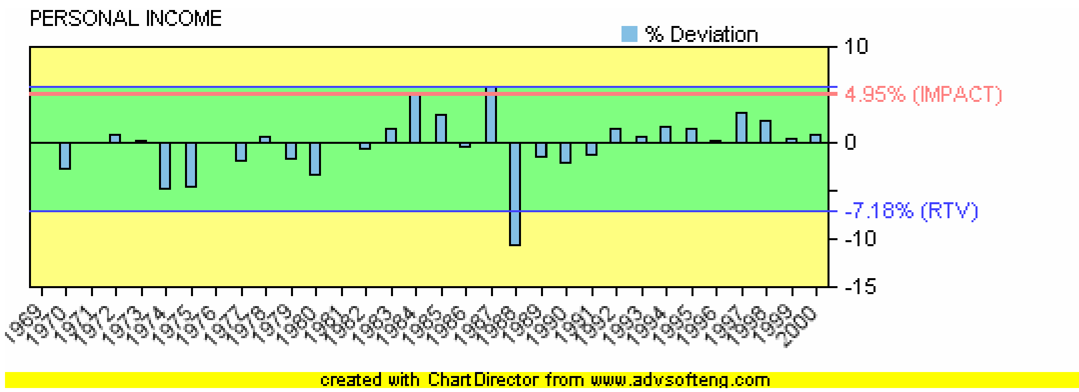
POPULATION

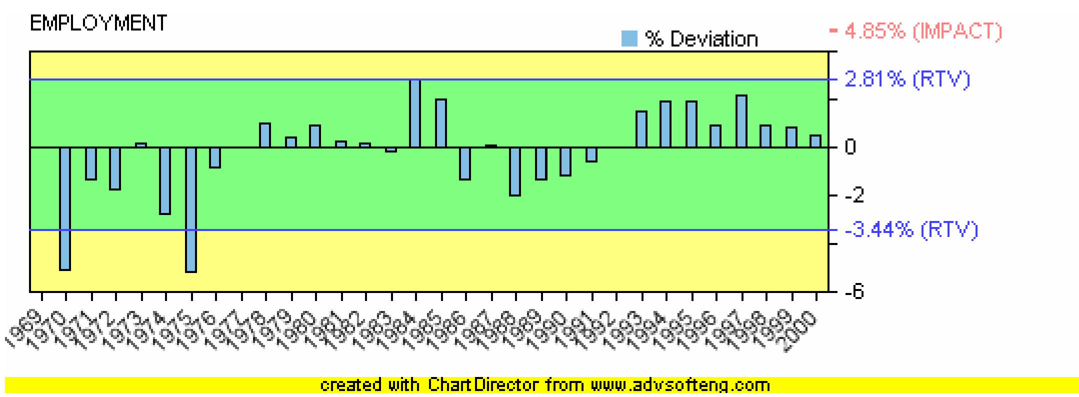


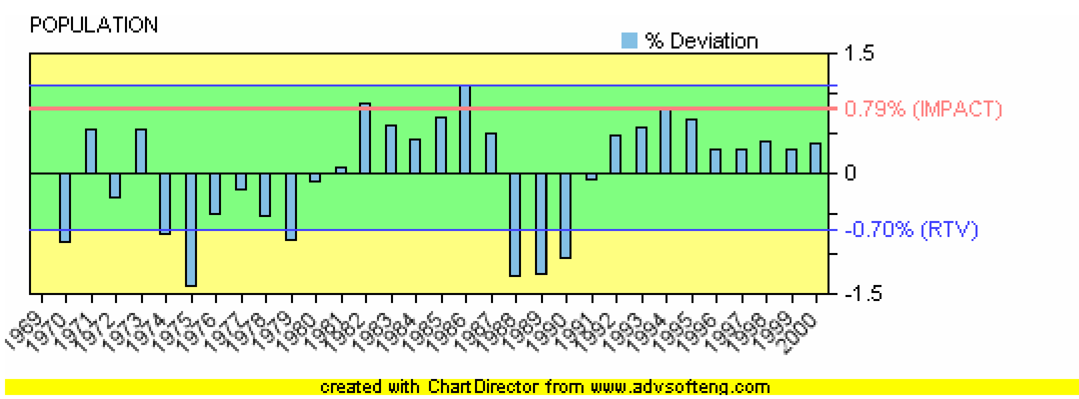
Year	Value	Change	Deviation	% Deviation
1969	941515	0	0	0
1970	957715	16200	-8116	-0.85
1971	987523	29808	5492	0.56
1972	1008844	21321	-2995	-0.3
1973	1038887	30043	5727	0.55
1974	1055225	16338	-7978	-0.76
1975	1064486	9261	-15055	-1.41
1976	1083489	19003	-5313	-0.49
1977	1105551	22062	-2254	-0.2
1978	1123898	18347	-5969	-0.53
1979	1138722	14824	-9492	-0.83
1980	1161968	23246	-1070	-0.09
1981	1187117	25149	833	0.07
1982	1222136	35019	10703	0.88
1983	1254044	31908	7592	0.61
1984	1283925	29881	5565	0.43
1985	1317439	33514	9198	0.7
1986	1356676	39237	14921	1.1
1987	1387997	31321	7005	0.5
1988	1394458	6461	-17855	-1.28
1989	1401286	6828	-17488	-1.25
1990	1410902	9616	-14700	-1.04
1991	1434060	23158	-1158	-0.08
1992	1465365	31305	6989	0.48
1993	1498269	32904	8588	0.57
1994	1535185	36916	12600	0.82
1995	1570083	34898	10582	0.67
1996	1599427	29344	5028	0.31
1997	1628676	29249	4933	0.3
1998	1659847	31171	6855	0.41
1999	1689009	29162	4846	0.29
2000	1719641	30632	6316	0.37

******** End of Report ********


TOTAL BUSINESS VOLUME
% Deviation
12.33% (IMPACT)
5.61% (RTV)
0
-5
-7.90% (RTV)
-15
1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000
created with ChartDirector from www.advsofteng.com


PERSONAL INCOME
% Deviation
10
4.95% (IMPACT)
0
-7.18% (RTV)
-10
-15
1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000
created with ChartDirector from www.advsofteng.com


EMPLOYMENT
% Deviation
4.85% (IMPACT)
2.81% (RTV)
0
-2
-3.44% (RTV)
-6
1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000
created with ChartDirector from www.advsofteng.com


POPULATION
% Deviation
1.5
0.79% (IMPACT)
0
-0.70% (RTV)
-1.5
1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000
created with ChartDirector from www.advsofteng.com

APPENDIX G

TRAFFIC CALCULATIONS

APPENDIX G
TRANSPORTATION

The information shown in this Appendix is the back-up calculations discussed and summarized in Section 4.11 of the EIS. The calculations are computer generated analysis using Highway Capacity Software (HCS) and SYNCHRO 5 / SimTraffic 5. The relevant output is generally described as the Level of Service (LOS) which is further described, along with other traffic related nomenclature and methodologies, in Section 4.11 of the EIS.

The tables in Appendix G.1 summarize the computer generated calculations and analysis in Appendix G.2 and G.3 for the existing conditions in the METC Area. This information is also reflected in the discussion regarding the existing analysis of the METC Area intersections in Section 4.11 and Table 4-44 of the EIS.

The proposed analysis of the METC Area is summarized in Table 4-50 of the EIS from the calculations in Appendix G.4

The tables at the beginning of Appendix G.5 summarize the existing and proposed calculations and analysis for the roadway segments for the HQ / Administrative area and are also shown on Table 4-45 and 4-51 of the EIS.

The BAMC roadway segment calculations are shown in Appendix G.7 and also on Tables 4-46 and 4-52 of the EIS.

G.1 METC AREA – SUMMARY

Region
METC

Existing and Proposed Conditions
Methodology: Intersection Capacity Utilization (ICU)

Intersection	Existing LOS		Proposed LOS	
	AM Peak	PM Peak	AM Peak	PM Peak
Hardee Rd. & Stanley Rd.	A	A	A	B
Hardee Rd. & Scott Rd.	A	C	F	H
Hardee Rd. & Patch Rd.	A	A	A	A
Hardee Rd. & Garden Ave.	A	A	A	A
Hardee Rd. & Williams Rd.	A	A	A	A
Schofield Rd. & Williams Rd.	A	B	A	B
Schofield Rd. & Scott Rd.	A	A	C	B
Schofield Rd. & Stanley Rd.	A	A	B	B
Schofield Rd. & Patch Rd.	A	A	D	A
Schofield Rd. & Garden Ave.	A	A	B	A
Harney Rd. & Stanley Rd.	A	A	A	A

Region
METC

Existing and Proposed Conditions
Methodology: HCM

Intersection	Existing LOS		Proposed LOS	
	AM Peak	PM Peak	AM Peak	PM Peak
Hardee Rd. & Stanley Rd.	A	B	A	F
Hardee Rd. & Scott Rd.	B	C	F	F
Hardee Rd. & Patch Rd.	A	A	A	A
Hardee Rd. & Garden Ave.	A	A	A	A
Hardee Rd. & Williams Rd.	A	A	A	A
Schofield Rd. & Williams Rd.	A	B	A	B
Schofield Rd. & Scott Rd.	B	B	C	C
Schofield Rd. & Stanley Rd.	B	B	C	C
Schofield Rd. & Patch Rd.	A	A	D	A
Schofield Rd. & Garden Ave.	B	B	B	B
Harney Rd. & Stanley Rd.	A	A	A	A

G.2 EXISTING AM PEAK INTERSECTION ANALYSIS – METC AREA

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↱		↰	↱	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	0.99	1.00		0.99	1.00		0.99	1.00		0.99	1.00	
Frt	1.00	0.97		1.00	0.97		1.00	0.98		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1757	1804		1754	1801		1754	1816		1755	1755	
Flt Permitted	0.57	1.00		0.63	1.00		0.62	1.00		0.61	1.00	
Satd. Flow (perm)	1053	1804		1170	1801		1142	1816		1123	1755	
Volume (vph)	81	139	28	34	138	30	28	133	20	32	102	46
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	95	164	33	40	162	35	33	156	24	38	120	54
Lane Group Flow (vph)	95	197	0	40	197	0	33	180	0	38	174	0
Confl. Peds. (#/hr)	10	10	10	10	10	10	10	10	10	10	10	10
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	25.0	20.0		23.0	19.0		20.0	16.0		20.0	16.0	
Effective Green, g (s)	25.0	20.0		23.0	19.0		20.0	16.0		20.0	16.0	
Actuated g/C Ratio	0.42	0.33		0.38	0.32		0.33	0.27		0.33	0.27	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)	497	601		487	570		421	484		416	468	
v/s Ratio Prot	c0.02	0.11		0.01	c0.11		0.01	0.10		c0.01	c0.10	
v/s Ratio Perm	0.06			0.03			0.02			0.02		
v/c Ratio	0.19	0.33		0.08	0.35		0.08	0.37		0.09	0.37	
Uniform Delay, d1	10.8	15.0		11.7	15.7		14.2	17.9		14.4	17.9	
Progression Factor	0.51	0.53		0.66	0.58		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.8	1.4		0.3	1.6		0.4	2.2		0.4	2.3	
Delay (s)	6.4	9.4		8.1	10.8		14.6	20.1		14.8	20.2	
Level of Service	A	A		A	B		B	C		B	C	
Approach Delay (s)		8.4			10.4			19.2			19.2	
Approach LOS		A			B			B			B	

Intersection Summary			
HCM Average Control Delay	13.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.31		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	41.9%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↱		↰	↱	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	0.98		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	0.99	1.00		0.99	1.00		0.99	1.00		0.99	1.00	
Frt	1.00	0.98		1.00	0.94		1.00	0.96		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1755	1818		1754	1725		1751	1773		1759	1819	
Flt Permitted	0.61	1.00		0.63	1.00		0.67	1.00		0.51	1.00	
Satd. Flow (perm)	1126	1818		1171	1725		1243	1773		952	1819	
Volume (vph)	2	125	18	38	94	61	7	153	52	21	96	14
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	2	147	21	45	111	72	8	180	61	25	113	16
Lane Group Flow (vph)	2	168	0	45	183	0	8	241	0	25	129	0
Confl. Peds. (#/hr)	10	10	10	10	10	10	10	10	10	10	10	10
Confl. Bikes (#/hr)			2			2			2			2
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	22.0	17.0		22.0	17.0		22.0	17.0		22.0	17.0	
Effective Green, g (s)	22.0	17.0		22.0	17.0		22.0	17.0		22.0	17.0	
Actuated g/C Ratio	0.37	0.28		0.37	0.28		0.37	0.28		0.37	0.28	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)	465	515		478	489		498	502		416	515	
v/s Ratio Prot	0.00	0.09		c0.01	c0.11		0.00	c0.14		c0.01	0.07	
v/s Ratio Perm	0.00			0.03			0.00			0.02		
v/c Ratio	0.00	0.33		0.09	0.37		0.02	0.48		0.06	0.25	
Uniform Delay, d1	12.6	17.0		12.8	17.2		12.1	17.8		12.3	16.6	
Progression Factor	1.00	1.00		0.61	0.43		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.0	1.7		0.4	2.1		0.1	3.3		0.3	1.2	
Delay (s)	12.6	18.7		8.2	9.6		12.1	21.1		12.5	17.7	
Level of Service	B	B		A	A		B	C		B	B	
Approach Delay (s)		18.6			9.3			20.8			16.9	
Approach LOS		B			A			C			B	

Intersection Summary			
HCM Average Control Delay	16.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	33.5%	ICU Level of Service	A
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↱		↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	0.97		1.00	1.00	0.96
Flpb, ped/bikes	0.99	1.00		0.99	1.00		0.99	1.00		0.99	1.00	1.00
Frt	1.00	0.96		1.00	0.99		1.00	0.91		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1757	1779		1752	1850		1748	1643		1755	1863	1518
Flt Permitted	0.57	1.00		0.67	1.00		0.72	1.00		0.62	1.00	1.00
Satd. Flow (perm)	1056	1779		1238	1850		1316	1643		1136	1863	1518
Volume (vph)	35	87	27	114	179	7	10	55	94	9	54	33
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	41	102	32	134	211	8	12	65	111	11	64	39
Lane Group Flow (vph)	41	134	0	134	219	0	12	176	0	11	64	39
Confl. Peds. (#/hr)	10	10	10	10	10	10	10	10	10	10	10	10
Confl. Bikes (#/hr)			2			2			2			2
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8			4		4
Actuated Green, G (s)	23.0	19.0		25.0	20.0		20.0	16.0		20.0	16.0	16.0
Effective Green, g (s)	23.0	19.0		25.0	20.0		20.0	16.0		20.0	16.0	16.0
Actuated g/C Ratio	0.38	0.32		0.42	0.33		0.33	0.27		0.33	0.27	0.27
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Grp Cap (vph)	452	563		559	617		467	438		420	497	405
v/s Ratio Prot	0.01	0.08		c0.02	c0.12		0.00	c0.11		c0.00	0.03	
v/s Ratio Perm	0.03			0.08			0.01			0.01		0.03
v/c Ratio	0.09	0.24		0.24	0.35		0.03	0.40		0.03	0.13	0.10
Uniform Delay, d1	12.8	15.2		11.4	15.1		13.4	18.1		13.4	16.7	16.6
Progression Factor	0.40	0.63		1.00	1.00		1.00	1.00		1.02	1.01	1.03
Incremental Delay, d2	0.4	1.0		1.0	1.6		0.1	2.7		0.1	0.5	0.5
Delay (s)	5.5	10.6		12.5	16.7		13.5	20.8		13.8	17.4	17.5
Level of Service	A	B		B	B		B	C		B	B	B
Approach Delay (s)		9.4			15.1			20.3			17.1	
Approach LOS		A			B			C			B	

Intersection Summary			
HCM Average Control Delay	15.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.31		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	44.1%	ICU Level of Service	A
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱	↰	↑	↰	↱
Sign Control	Stop			Stop	Stop	
Volume (veh/h)	39	27	29	53	39	53
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (veh/h)	46	32	34	62	46	62

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2
Volume Total (vph)	46	32	34	62	46	62
Volume Left (vph)	0	0	34	0	46	0
Volume Right (vph)	0	32	0	0	0	62
Hadj (s)	0.0	-0.6	0.2	0.0	0.2	-0.6
Departure Headway (s)	4.9	4.3	5.3	5.1	5.2	4.4
Degree Utilization, x	0.06	0.04	0.05	0.09	0.07	0.08
Capacity (veh/h)	721	814	516	536	673	792
Control Delay (s)	7.0	6.2	7.4	7.4	7.3	6.5
Approach Delay (s)	6.7		7.4		6.9	
Approach LOS	A		A		A	

Intersection Summary			
Delay	7.0		
HCM Level of Service	A		
Intersection Capacity Utilization	20.1%	ICU Level of Service	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Volume (veh/h)	65	59	15	17	52	3	58	95	15	62	156	92
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (veh/h)	76	69	18	20	61	4	68	112	18	73	184	108

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	164	85	198	365
Volume Left (vph)	76	20	68	73
Volume Right (vph)	18	4	18	108
Hadj (s)	0.1	0.1	0.0	-0.1
Departure Headway (s)	5.4	4.9	5.0	4.7
Degree Utilization, x	0.24	0.11	0.28	0.47
Capacity (veh/h)	615	541	678	742
Control Delay (s)	10.1	8.5	9.9	11.8
Approach Delay (s)	10.1	8.5	9.9	11.8
Approach LOS	B	A	A	B

Intersection Summary			
Delay	10.7		
HCM Level of Service	B		
Intersection Capacity Utilization	57.9%	ICU Level of Service	A

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	53	33	44	135	44	24
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (veh/h)	62	39	52	159	52	28
Pedestrians	10			10	10	
Lane Width (ft)	12.0			12.0	11.0	
Walking Speed (ft/s)	4.0			4.0	4.0	
Percent Blockage	1			1	1	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
vC, conflicting volume			111		364	102
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			96		91	97
cM capacity (veh/h)			1467		603	938

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	101	211	80
Volume Left	0	52	52
Volume Right	39	0	28
cSH	1700	1467	690
Volume to Capacity	0.06	0.04	0.12
Queue Length (ft)	0	3	10
Control Delay (s)	0.0	2.1	10.9
Lane LOS		A	B
Approach Delay (s)	0.0	2.1	10.9
Approach LOS			B

Intersection Summary			
Average Delay	3.3		
Intersection Capacity Utilization	31.9%	ICU Level of Service	A

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Yield	
Grade	0%			0%	0%	
Volume (veh/h)	47	42	71	40	53	88
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (veh/h)	55	49	84	47	62	104
Pedestrians	10			10	10	
Lane Width (ft)	12.0			12.0	11.0	
Walking Speed (ft/s)	4.0			4.0	4.0	
Percent Blockage	1			1	1	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
vC, conflicting volume			115		314	100
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			94		90	89
cM capacity (veh/h)			1463		630	940

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	105	131	166
Volume Left	0	84	62
Volume Right	49	0	104
cSH	1700	1463	793
Volume to Capacity	0.06	0.06	0.21
Queue Length (ft)	0	5	20
Control Delay (s)	0.0	5.0	10.7
Lane LOS		A	B
Approach Delay (s)	0.0	5.0	10.7
Approach LOS			B

Intersection Summary			
Average Delay	6.1		
Intersection Capacity Utilization	31.7%	ICU Level of Service	A

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	72	32	29	61	32	42
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (veh/h)	85	38	34	72	38	49
Pedestrians	10			10	10	
Lane Width (ft)	12.0			11.0	11.0	
Walking Speed (ft/s)	4.0			4.0	4.0	
Percent Blockage	1			1	1	
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	222	82	97			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	88	96	98			
cM capacity (veh/h)	736	962	1484			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	122	106	87
Volume Left	85	34	0
Volume Right	38	0	49
cSH	794	1484	1700
Volume to Capacity	0.15	0.02	0.05
Queue Length (ft)	14	2	0
Control Delay (s)	10.4	2.5	0.0
Lane LOS	B	A	
Approach Delay (s)	10.4	2.5	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	4.9		
Intersection Capacity Utilization	24.4%	ICU Level of Service	A

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	22	57	98	52	31	25
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (veh/h)	26	67	115	61	36	29
Pedestrians		10	10		10	
Lane Width (ft)		12.0	12.0		11.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		1	1		1	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
vC, conflicting volume	186				285	166
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				95	97
cM capacity (veh/h)	1377				681	865

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	93	176	66
Volume Left	26	0	36
Volume Right	0	61	29
cSH	1377	1700	752
Volume to Capacity	0.02	0.10	0.09
Queue Length (ft)	1	0	7
Control Delay (s)	2.2	0.0	10.2
Lane LOS	A		B
Approach Delay (s)	2.2	0.0	10.2
Approach LOS			B

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	24.6%	ICU Level of Service	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	16	185	8	11	283	7	6	10	4	7	8	11
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (veh/h)	19	218	9	13	333	8	7	12	5	8	9	13
Pedestrians		10			10			10			10	
Lane Width (ft)		12.0			12.0			11.0			11.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		1			1			1			1	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
vC, conflicting volume	351			237			661	647	242	654	648	357
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			99			98	97	99	98	97	98
cM capacity (veh/h)	1198			1320			345	374	784	352	374	676

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	246	354	24	31
Volume Left	19	13	7	8
Volume Right	9	8	5	13
cSH	1198	1320	406	452
Volume to Capacity	0.02	0.01	0.06	0.07
Queue Length (ft)	1	1	5	5
Control Delay (s)	0.8	0.4	14.4	13.5
Lane LOS	A	A	B	B
Approach Delay (s)	0.8	0.4	14.4	13.5
Approach LOS			B	B

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	35.8%	ICU Level of Service	A

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	39	52	126	34	25	98
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (veh/h)	46	61	148	40	29	115
Pedestrians	10		10			10
Lane Width (ft)	11.0		12.0			12.0
Walking Speed (ft/s)	4.0		4.0			4.0
Percent Blockage	1		1			1
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	362	188			198	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	93	93			98	
cM capacity (veh/h)	613	840			1364	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	107	188	29	115
Volume Left	46	0	29	0
Volume Right	61	40	0	0
cSH	725	1700	1364	1700
Volume to Capacity	0.15	0.11	0.02	0.07
Queue Length (ft)	13	0	2	0
Control Delay (s)	10.8	0.0	7.7	0.0
Lane LOS	B		A	
Approach Delay (s)	10.8	0.0	1.6	
Approach LOS	B			

Intersection Summary			
Average Delay	3.1		
Intersection Capacity Utilization	26.7%	ICU Level of Service	A

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱	↰	↑	↰	↱
Volume (vph)	39	27	29	53	39	53
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10
Ped Button	Yes				Yes	
Pedestrian Timing (s)	16.0				16.0	
Free Right		No				No
Ideal Flow	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120					
Adjusted Volume (vph)	46	32	34	62	46	62
Volume Combined (vph)	46	32	34	62	46	62
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	1.00	0.85	0.95	1.00	0.95	0.85
Saturated Flow (vph)	1900	1615	1805	1900	1805	1615
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.0	1.2	0.0	0.0	0.0	1.2
Pedestrian Frequency (%)	0.28			0.00	0.28	
Protected Option Allowed	Yes			Yes	No	
Reference Time (s)	2.9	3.6	2.3	3.9		5.9
Adj Reference Time (s)	11.4	11.4	8.0	8.0		12.7
Permitted Option Allowed	Yes			Yes	No	
Adj Saturation A (vph)	1900			1900		
Reference Time A (s)	2.9			3.9		
Adj Saturation B (vph	1900		0	1900		
Reference Time B (s)	2.9		10.3	3.9		
Reference Time (s)	2.9			3.9		
Adj Reference Time (s)	11.4			8.0		
Split Option						
Ref Time Combined (s)	2.9		2.3	3.9	3.1	
Ref Time Seperate (s)	2.9		2.3	3.9	3.1	
Reference Time (s)	2.9		3.9	3.9	3.1	
Adj Reference Time (s)	11.4		8.0	8.0	11.4	

Summary	EB WB	NB	Combined
Protected Option (s)	19.4	NA	
Permitted Option (s)	11.4	NA	
Split Option (s)	19.4	11.4	
Minimum (s)	11.4	11.4	22.8

Right Turns	EBR	NBR
Adj Reference Time (s)	11.4	12.7
Cross Thru Ref Time (s)	0.0	11.4
Oncoming Left Ref Time (s)	8.0	0.0
Combined (s)	19.4	24.1

Intersection Summary

Intersection Capacity Utilization 20.1% ICU Level of Service A

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Volume (vph)	65	59	15	17	52	3	58	95	15	62	156	92
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10	10	10	10	10	10	10
Ped Button		Yes			Yes			Yes			Yes	
Pedestrian Timing (s)		16.0			16.0			16.0			16.0	
Free Right			No			No			No			No
Ideal Flow	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120											
Adjusted Volume (vph)	76	69	18	20	61	4	68	112	18	73	184	108
Volume Combined (vph)	0	164	0	0	85	0	0	198	0	0	365	0
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.95	0.96	0.85	0.95	0.98	0.85	0.95	0.97	0.85	0.95	0.95	0.85
Saturated Flow (vph)	0	1826	0	0	1866	0	0	1842	0	0	1797	0
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.0	0.1	1.2	0.0	0.1	1.2	0.0	0.1	1.2	0.0	0.4	1.2
Pedestrian Frequency (%)		0.28			0.28			0.28			0.28	
Protected Option Allowed		No			No			No			No	
Reference Time (s)			0.0			0.0			0.0			0.0
Adj Reference Time (s)			0.0			0.0			0.0			0.0
Permitted Option Allowed		Yes			Yes			No			No	
Adj Saturation A (vph)		NA			1256							
Reference Time A (s)		NA			6.2							
Adj Saturation B (vph	0	0		0	0							
Reference Time B (s)	13.1	18.9		9.3	13.5							
Reference Time (s)		18.9			6.2							
Adj Reference Time (s)		22.9			13.0							
Split Option												
Ref Time Combined (s)	0.0	10.9		0.0	5.5		0.0	13.0		0.0	24.7	
Ref Time Seperate (s)	5.1	4.7		1.3	3.9		4.5	7.3		4.8	12.6	
Reference Time (s)	10.9	10.9		5.5	5.5		13.0	13.0		24.7	24.7	
Adj Reference Time (s)	16.3	16.3		12.5	12.5		17.8	17.8		28.7	28.7	

Summary	EB WB	NB SB	Combined
Protected Option (s)	NA	NA	
Permitted Option (s)	22.9	NA	
Split Option (s)	28.8	46.6	
Minimum (s)	22.9	46.6	69.4

Right Turns
Adj Reference Time (s)
Cross Thru Ref Time (s)
Oncoming Left Ref Time (s)
Combined (s)

Intersection Summary			
Intersection Capacity Utilization	57.9%	ICU Level of Service	A

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	53	33	44	135	44	24
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10
Ped Button	Yes				Yes	
Pedestrian Timing (s)	16.0				16.0	
Free Right		No				No
Ideal Flow	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120					
Adjusted Volume (vph)	62	39	52	159	52	28
Volume Combined (vph)	101	0	0	211	80	0
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.94	0.85	0.95	0.99	0.92	0.85
Saturated Flow (vph)	1791	0	0	1877	1741	0
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.5	1.2	0.0	0.0	0.4	1.2
Pedestrian Frequency (%)	0.28			0.00	0.28	
Protected Option Allowed	No			No	No	
Reference Time (s)		0.0				0.0
Adj Reference Time (s)		0.0				0.0
Permitted Option Allowed	Yes			Yes	No	
Adj Saturation A (vph)	1791			261		
Reference Time A (s)	7.3			73.1		
Adj Saturation B (vph	NA		0	0		
Reference Time B (s)	NA		11.4	21.5		
Reference Time (s)	7.3			21.5		
Adj Reference Time (s)	13.7			25.5		
Split Option						
Ref Time Combined (s)	7.3		0.0	13.5	6.0	
Ref Time Seperate (s)	4.7		3.4	10.0	4.0	
Reference Time (s)	7.3		13.5	13.5	6.0	
Adj Reference Time (s)	13.7		17.5	17.5	12.8	

Summary	EB WB	NB	Combined
Protected Option (s)	NA	NA	
Permitted Option (s)	25.5	NA	
Split Option (s)	31.2	12.8	
Minimum (s)	25.5	12.8	38.3

Right Turns
Adj Reference Time (s)
Cross Thru Ref Time (s)
Oncoming Left Ref Time (s)
Combined (s)

Intersection Summary			
Intersection Capacity Utilization	31.9%	ICU Level of Service	A

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	47	42	71	40	53	88
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10
Ped Button	Yes				Yes	
Pedestrian Timing (s)	16.0				16.0	
Free Right		No				No
Ideal Flow	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120					
Adjusted Volume (vph)	55	49	84	47	62	104
Volume Combined (vph)	105	0	0	131	166	0
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.93	0.85	0.95	0.97	0.89	0.85
Saturated Flow (vph)	1766	0	0	1839	1690	0
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.6	1.2	0.0	0.0	0.8	1.2
Pedestrian Frequency (%)	0.28			0.00	0.28	
Protected Option Allowed	No			No	No	
Reference Time (s)		0.0				0.0
Adj Reference Time (s)		0.0				0.0
Permitted Option Allowed	Yes			Yes	No	
Adj Saturation A (vph)	1766			NA		
Reference Time A (s)	7.7			NA		
Adj Saturation B (vph	1766		0	0		
Reference Time B (s)	7.7		13.6	16.5		
Reference Time (s)	7.7			16.5		
Adj Reference Time (s)	14.1			20.5		
Split Option						
Ref Time Combined (s)	7.7		0.0	8.5	12.6	
Ref Time Seperate (s)	4.3		5.6	3.0	5.2	
Reference Time (s)	7.7		8.5	8.5	12.6	
Adj Reference Time (s)	14.1		12.5	12.5	17.5	

Summary	EB WB	NB	Combined
Protected Option (s)	NA	NA	
Permitted Option (s)	20.5	NA	
Split Option (s)	26.6	17.5	
Minimum (s)	20.5	17.5	38.1

Right Turns	
Adj Reference Time (s)	
Cross Thru Ref Time (s)	
Oncoming Left Ref Time (s)	
Combined (s)	

Intersection Summary

Intersection Capacity Utilization 31.7% ICU Level of Service A

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	72	32	29	61	32	42
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10
Ped Button	Yes				Yes	
Pedestrian Timing (s)	16.0				16.0	
Free Right		No				No
Ideal Flow	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120					
Adjusted Volume (vph)	85	38	34	72	38	49
Volume Combined (vph)	122	0	0	106	87	0
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.92	0.85	0.95	0.98	0.91	0.85
Saturated Flow (vph)	1750	0	0	1869	1738	0
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.4	1.2	0.0	0.0	0.7	1.2
Pedestrian Frequency (%)	0.28			0.00	0.28	
Protected Option Allowed	No			No	No	
Reference Time (s)		0.0				0.0
Adj Reference Time (s)		0.0				0.0
Permitted Option Allowed	No			Yes	Yes	
Adj Saturation A (vph)				820	1738	
Reference Time A (s)				10.5	6.7	
Adj Saturation B (vph			0	0	1738	
Reference Time B (s)			10.3	14.8	6.7	
Reference Time (s)				10.5	6.7	
Adj Reference Time (s)				14.5	13.3	
Split Option						
Ref Time Combined (s)	8.8		0.0	6.8	6.7	
Ref Time Seperate (s)	6.2		2.3	4.5	3.3	
Reference Time (s)	8.8		6.8	6.8	6.7	
Adj Reference Time (s)	14.8		10.8	10.8	13.3	

Summary	EB	NB SB	Combined
Protected Option (s)	NA	NA	
Permitted Option (s)	NA	14.5	
Split Option (s)	14.8	24.1	
Minimum (s)	14.8	14.5	29.3

Right Turns	
Adj Reference Time (s)	
Cross Thru Ref Time (s)	
Oncoming Left Ref Time (s)	
Combined (s)	

Intersection Summary			
Intersection Capacity Utilization	24.4%	ICU Level of Service	A

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	22	57	98	52	31	25
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10
Ped Button			Yes		Yes	
Pedestrian Timing (s)			16.0		16.0	
Free Right				No		No
Ideal Flow	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120					
Adjusted Volume (vph)	26	67	115	61	36	29
Volume Combined (vph)	0	93	176	0	66	0
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.95	0.99	0.95	0.85	0.91	0.85
Saturated Flow (vph)	0	1874	1801	0	1724	0
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.0	0.0	0.4	1.2	0.6	1.2
Pedestrian Frequency (%)		0.00	0.28		0.28	
Protected Option Allowed		No	No		No	
Reference Time (s)				0.0		0.0
Adj Reference Time (s)				0.0		0.0
Permitted Option Allowed		Yes	Yes		No	
Adj Saturation A (vph)		1080	1801			
Reference Time A (s)		7.4	12.2			
Adj Saturation B (vph	NA	NA	1801			
Reference Time B (s)	NA	NA	12.2			
Reference Time (s)		7.4	12.2			
Adj Reference Time (s)		11.4	17.3			
Split Option						
Ref Time Combined (s)	0.0	6.0	12.2		5.1	
Ref Time Seperate (s)	1.7	4.2	8.1		3.1	
Reference Time (s)	6.0	6.0	12.2		5.1	
Adj Reference Time (s)	10.0	10.0	17.3		12.2	

Summary	EB WB	SB	Combined
Protected Option (s)	NA	NA	
Permitted Option (s)	17.3	NA	
Split Option (s)	27.2	12.2	
Minimum (s)	17.3	12.2	29.5

Right Turns	
Adj Reference Time (s)	
Cross Thru Ref Time (s)	
Oncoming Left Ref Time (s)	
Combined (s)	

Intersection Summary			
Intersection Capacity Utilization	24.6%	ICU Level of Service	A

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↱		↰	↱	
Volume (vph)	81	139	28	34	138	30	28	133	20	32	102	46
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10	10	10	10	10	10	10
Ped Button		No			No			No			No	
Pedestrian Timing (s)		16.0			16.0			16.0			16.0	
Free Right			No			No			No			No
Ideal Flow	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120											
Adjusted Volume (vph)	95	164	33	40	162	35	33	156	24	38	120	54
Volume Combined (vph)	95	196	0	40	198	0	33	180	0	38	174	0
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.95	0.97	0.85	0.95	0.97	0.85	0.95	0.98	0.85	0.95	0.95	0.85
Saturated Flow (vph)	1805	1852	0	1805	1849	0	1805	1863	0	1805	1811	0
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.0	0.2	1.2	0.0	0.2	1.2	0.0	0.2	1.2	0.0	0.4	1.2
Pedestrian Frequency (%)		1.00			1.00			1.00			1.00	
Protected Option Allowed		Yes			Yes			Yes			Yes	
Reference Time (s)	6.3	12.9	0.0	2.7	13.0	0.0	2.2	11.8	0.0	2.5	11.9	0.0
Adj Reference Time (s)	10.3	20.0	0.0	8.0	20.0	0.0	8.0	20.0	0.0	8.0	20.0	0.0
Permitted Option Allowed		No			No			Yes			Yes	
Adj Saturation A (vph)								1863			1811	
Reference Time A (s)								11.8			11.9	
Adj Saturation B (vph							NA	NA		NA	NA	
Reference Time B (s)							NA	NA		NA	NA	
Reference Time (s)								11.8			11.9	
Adj Reference Time (s)								20.0			20.0	
Split Option												
Ref Time Combined (s)	6.3	12.9		2.7	13.0		2.2	11.8		2.5	11.9	
Ref Time Seperate (s)	6.3	10.8		2.7	10.8		2.2	10.2		2.5	8.3	
Reference Time (s)	12.9	12.9		13.0	13.0		11.8	11.8		11.9	11.9	
Adj Reference Time (s)	20.0	20.0		20.0	20.0		20.0	20.0		20.0	20.0	

Summary	EB WB	NB SB	Combined
Protected Option (s)	30.3	28.0	
Permitted Option (s)	NA	20.0	
Split Option (s)	40.0	40.0	
Minimum (s)	30.3	20.0	50.3

Right Turns
Adj Reference Time (s)
Cross Thru Ref Time (s)
Oncoming Left Ref Time (s)
Combined (s)

Intersection Summary

Intersection Capacity Utilization 41.9% ICU Level of Service A

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↱		↰	↱	
Volume (vph)	2	125	18	38	94	61	7	153	52	21	96	14
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10	10	10	10	10	10	10
Ped Button		No			No			No			No	
Pedestrian Timing (s)		16.0			16.0			16.0			16.0	
Free Right			No			No			No			No
Ideal Flow	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120											
Adjusted Volume (vph)	2	147	21	45	111	72	8	180	61	25	113	16
Volume Combined (vph)	2	168	0	45	182	0	8	241	0	25	129	0
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.95	0.98	0.85	0.95	0.94	0.85	0.95	0.96	0.85	0.95	0.98	0.85
Saturated Flow (vph)	1805	1864	0	1805	1788	0	1805	1828	0	1805	1864	0
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.0	0.2	1.2	0.0	0.5	1.2	0.0	0.3	1.2	0.0	0.2	1.2
Pedestrian Frequency (%)		1.00			1.00			1.00			1.00	
Protected Option Allowed		Yes			Yes			Yes			Yes	
Reference Time (s)	0.2	11.0	0.0	3.0	12.7	0.0	0.5	16.1	0.0	1.6	8.5	0.0
Adj Reference Time (s)	8.0	20.0	0.0	8.0	20.0	0.0	8.0	20.1	0.0	8.0	20.0	0.0
Permitted Option Allowed		Yes			Yes			Yes			Yes	
Adj Saturation A (vph)		1864			1788			1828			1864	
Reference Time A (s)		11.0			12.7			16.1			8.5	
Adj Saturation B (vph	NA	NA		NA	NA		NA	NA		NA	NA	
Reference Time B (s)	NA	NA		NA	NA		NA	NA		NA	NA	
Reference Time (s)		11.0			12.7			16.1			8.5	
Adj Reference Time (s)		20.0			20.0			20.1			20.0	
Split Option												
Ref Time Combined (s)	0.2	11.0		3.0	12.7		0.5	16.1		1.6	8.5	
Ref Time Seperate (s)	0.2	9.6		3.0	7.9		0.5	12.1		1.6	7.4	
Reference Time (s)	11.0	11.0		12.7	12.7		16.1	16.1		8.5	8.5	
Adj Reference Time (s)	20.0	20.0		20.0	20.0		20.1	20.1		20.0	20.0	

Summary	EB WB	NB SB	Combined
Protected Option (s)	28.0	28.1	
Permitted Option (s)	20.0	20.1	
Split Option (s)	40.0	40.1	
Minimum (s)	20.0	20.1	40.1

Right Turns	
Adj Reference Time (s)	
Cross Thru Ref Time (s)	
Oncoming Left Ref Time (s)	
Combined (s)	

Intersection Summary			
Intersection Capacity Utilization	33.5%	ICU Level of Service	A

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Volume (vph)	16	185	8	11	283	7	6	10	4	7	8	11
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10	10	10	10	10	10	10
Ped Button		Yes			Yes			Yes			Yes	
Pedestrian Timing (s)		16.0			16.0			16.0			16.0	
Free Right			No			No			No			No
Ideal Flow	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120											
Adjusted Volume (vph)	19	218	9	13	333	8	7	12	5	8	9	13
Volume Combined (vph)	0	246	0	0	354	0	0	24	0	0	31	0
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.95	0.99	0.85	0.95	0.99	0.85	0.95	0.96	0.85	0.95	0.92	0.85
Saturated Flow (vph)	0	1882	0	0	1890	0	0	1815	0	0	1755	0
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.0	0.0	1.2	0.0	0.0	1.2	0.0	0.2	1.2	0.0	0.5	1.2
Pedestrian Frequency (%)		0.28			0.28			0.28			0.28	
Protected Option Allowed		No			No			No			No	
Reference Time (s)			0.0			0.0			0.0			0.0
Adj Reference Time (s)			0.0			0.0			0.0			0.0
Permitted Option Allowed		Yes			Yes			Yes			Yes	
Adj Saturation A (vph)		1296			1485			1605			1497	
Reference Time A (s)		21.1			27.6			1.5			2.3	
Adj Saturation B (vph	NA	NA		NA	NA		0	0		0	0	
Reference Time B (s)	NA	NA		NA	NA		8.5	9.8		8.5	10.6	
Reference Time (s)		21.1			27.6			1.5			2.3	
Adj Reference Time (s)		25.1			31.6			11.4			11.4	
Split Option												
Ref Time Combined (s)	0.0	15.7		0.0	22.5		0.0	1.8		0.0	2.6	
Ref Time Seperate (s)	1.3	13.9		0.9	21.1		0.5	1.0		0.5	1.2	
Reference Time (s)	15.7	15.7		22.5	22.5		1.8	1.8		2.6	2.6	
Adj Reference Time (s)	19.8	19.8		26.5	26.5		11.4	11.4		11.4	11.4	

Summary	EB WB	NB SB	Combined
Protected Option (s)	NA	NA	
Permitted Option (s)	31.6	11.4	
Split Option (s)	46.3	22.8	
Minimum (s)	31.6	11.4	43.0

Right Turns
Adj Reference Time (s)
Cross Thru Ref Time (s)
Oncoming Left Ref Time (s)
Combined (s)

Intersection Summary			
Intersection Capacity Utilization	35.8%	ICU Level of Service	A

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱		↰	↑↱		↰	↑	↱
Volume (vph)	35	87	27	114	179	7	10	55	94	9	54	33
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10	10	10	10	10	10	10
Ped Button		No			No			No			No	
Pedestrian Timing (s)		16.0			16.0			16.0			16.0	
Free Right			No			No			No			No
Ideal Flow	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120											
Adjusted Volume (vph)	41	102	32	134	211	8	12	65	111	11	64	39
Volume Combined (vph)	41	134	0	134	219	0	12	175	0	11	64	39
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.95	0.96	0.85	0.95	0.99	0.85	0.95	0.91	0.85	0.95	1.00	0.85
Saturated Flow (vph)	1805	1833	0	1805	1889	0	1805	1720	0	1805	1900	1615
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.0	0.3	1.2	0.0	0.0	1.2	0.0	0.8	1.2	0.0	0.0	1.2
Pedestrian Frequency (%)		1.00			1.00			1.00			1.00	
Protected Option Allowed		Yes			Yes			Yes			Yes	
Reference Time (s)	2.7	9.1	0.0	8.9	13.9	0.0	0.8	13.0	0.0	0.7	4.0	4.1
Adj Reference Time (s)	8.0	20.0	0.0	12.9	20.0	0.0	8.0	20.0	0.0	8.0	20.0	20.0
Permitted Option Allowed		No			No			Yes			Yes	
Adj Saturation A (vph)								1720			1900	
Reference Time A (s)								13.0			4.0	
Adj Saturation B (vph							0	1720		NA	NA	
Reference Time B (s)							8.8	13.0		NA	NA	
Reference Time (s)								13.0			4.0	
Adj Reference Time (s)								20.0			20.0	
Split Option												
Ref Time Combined (s)	2.7	9.1		8.9	13.9		0.8	13.0		0.7	4.0	
Ref Time Seperate (s)	2.7	7.0		8.9	13.4		0.8	5.3		0.7	4.0	
Reference Time (s)	9.1	9.1		13.9	13.9		13.0	13.0		4.0	4.0	
Adj Reference Time (s)	20.0	20.0		20.0	20.0		20.0	20.0		20.0	20.0	

Summary	EB WB	NB SB	Combined
Protected Option (s)	32.9	28.0	
Permitted Option (s)	NA	20.0	
Split Option (s)	40.0	40.0	
Minimum (s)	32.9	20.0	52.9

Right Turns	SBR
Adj Reference Time (s)	20.0
Cross Thru Ref Time (s)	20.0
Oncoming Left Ref Time (s)	8.0
Combined (s)	48.0

Intersection Summary			
Intersection Capacity Utilization	44.1%	ICU Level of Service	A

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	39	52	126	34	25	98
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10
Ped Button	Yes		Yes			
Pedestrian Timing (s)	16.0		16.0			
Free Right		No		No		
Ideal Flow	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120					
Adjusted Volume (vph)	46	61	148	40	29	115
Volume Combined (vph)	107	0	188	0	29	115
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.89	0.85	0.97	0.85	0.95	1.00
Saturated Flow (vph)	1700	0	1839	0	1805	1900
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.7	1.2	0.3	1.2	0.0	0.0
Pedestrian Frequency (%)	0.28		0.28			0.00
Protected Option Allowed	No		Yes			Yes
Reference Time (s)		0.0	12.5	0.0	2.0	7.3
Adj Reference Time (s)		0.0	17.5	0.0	8.0	11.3
Permitted Option Allowed	No		Yes			Yes
Adj Saturation A (vph)			1839			1900
Reference Time A (s)			12.5			7.3
Adj Saturation B (vph			1839		NA	NA
Reference Time B (s)			12.5		NA	NA
Reference Time (s)			12.5			7.3
Adj Reference Time (s)			17.5			11.3
Split Option						
Ref Time Combined (s)	8.3		12.5		2.0	7.3
Ref Time Seperate (s)	3.9		9.9		2.0	7.3
Reference Time (s)	8.3		12.5		7.3	7.3
Adj Reference Time (s)	14.5		17.5		11.3	11.3

Summary	WB	NB SB	Combined
Protected Option (s)	NA	25.5	
Permitted Option (s)	NA	17.5	
Split Option (s)	14.5	28.8	
Minimum (s)	14.5	17.5	32.0

Right Turns
Adj Reference Time (s)
Cross Thru Ref Time (s)
Oncoming Left Ref Time (s)
Combined (s)

Intersection Summary			
Intersection Capacity Utilization	26.7%	ICU Level of Service	A

Reference Times and Phasing Options do not represent an optimized timing plan.

G.3 EXISTING PM PEAK INTERSECTION ANALYSIS – METC AREA

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	0.99		1.00	1.00	
Flpb, ped/bikes	0.99	1.00		0.99	1.00		0.99	1.00		0.99	1.00	
Frt	1.00	0.96		1.00	0.95		1.00	0.97		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1751	1767		1751	1740		1754	1788		1757	1849	
Flt Permitted	0.68	1.00		0.68	1.00		0.62	1.00		0.55	1.00	
Satd. Flow (perm)	1249	1767		1250	1740		1147	1788		1020	1849	
Volume (vph)	12	76	29	63	68	37	12	145	40	23	144	6
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	14	89	34	74	80	44	14	171	47	27	169	7
Lane Group Flow (vph)	14	123	0	74	124	0	14	218	0	27	176	0
Confl. Peds. (#/hr)	10	10	10	10	10	10	10	10	10	10	10	10
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	22.0	17.0		22.0	17.0		22.0	17.0		22.0	17.0	
Effective Green, g (s)	22.0	17.0		22.0	17.0		22.0	17.0		22.0	17.0	
Actuated g/C Ratio	0.37	0.28		0.37	0.28		0.37	0.28		0.37	0.28	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)	500	501		500	493		471	507		435	524	
v/s Ratio Prot	0.00	0.07		c0.01	c0.07		0.00	c0.12		c0.01	0.10	
v/s Ratio Perm	0.01			0.04			0.01			0.02		
v/c Ratio	0.03	0.25		0.15	0.25		0.03	0.43		0.06	0.34	
Uniform Delay, d1	12.2	16.6		12.8	16.6		12.1	17.5		12.3	17.0	
Progression Factor	0.83	0.59		0.60	0.50		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	1.1		0.6	1.2		0.1	2.7		0.3	1.7	
Delay (s)	10.2	10.9		8.4	9.5		12.3	20.2		12.5	18.8	
Level of Service	B	B		A	A		B	C		B	B	
Approach Delay (s)		10.8			9.1			19.7			17.9	
Approach LOS		B			A			B			B	

Intersection Summary			
HCM Average Control Delay	14.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.29		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	40.8%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↱		↰	↱	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.99	1.00		0.99	1.00		0.99	1.00		0.99	1.00	
Frt	1.00	0.99		1.00	0.95		1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1752	1836		1752	1746		1757	1836		1752	1831	
Flt Permitted	0.67	1.00		0.66	1.00		0.56	1.00		0.66	1.00	
Satd. Flow (perm)	1236	1836		1225	1746		1035	1836		1225	1831	
Volume (vph)	15	115	9	26	77	38	16	115	9	65	165	16
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	18	135	11	31	91	45	19	135	11	76	194	19
Lane Group Flow (vph)	18	146	0	31	136	0	19	146	0	76	213	0
Confl. Peds. (#/hr)	10	10	10	10	10	10	10	10	10	10	10	10
Confl. Bikes (#/hr)			2			2			2			2
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	22.0	17.0		22.0	17.0		22.0	17.0		22.0	17.0	
Effective Green, g (s)	22.0	17.0		22.0	17.0		22.0	17.0		22.0	17.0	
Actuated g/C Ratio	0.37	0.28		0.37	0.28		0.37	0.28		0.37	0.28	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)	496	520		493	495		440	520		493	519	
v/s Ratio Prot	0.00	c0.08		c0.01	0.08		0.00	0.08		c0.01	c0.12	
v/s Ratio Perm	0.01			0.02			0.01			0.04		
v/c Ratio	0.04	0.28		0.06	0.27		0.04	0.28		0.15	0.41	
Uniform Delay, d1	12.2	16.7		12.3	16.7		13.4	16.7		12.8	17.4	
Progression Factor	1.00	1.00		0.68	0.61		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	1.3		0.2	1.4		0.2	1.3		0.7	2.4	
Delay (s)	12.3	18.1		8.5	11.5		13.6	18.1		13.5	19.8	
Level of Service	B	B		A	B		B	B		B	B	
Approach Delay (s)		17.5			10.9			17.6			18.2	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	16.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.29		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	40.9%	ICU Level of Service	A
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↱		↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	12	12	12
Total Lost time (s)		4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes		1.00		1.00	1.00		1.00	0.97		1.00	1.00	0.96
Flpb, ped/bikes		1.00		0.99	1.00		0.99	1.00		0.99	1.00	1.00
Frt		1.00		1.00	0.99		1.00	0.88		1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1855		1750	1831		1745	1574		1749	1863	1519
Flt Permitted		1.00		0.69	1.00		0.75	1.00		0.71	1.00	1.00
Satd. Flow (perm)		1855		1280	1831		1384	1574		1300	1863	1519
Volume (vph)	0	80	2	38	95	9	8	11	55	22	6	3
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	0	94	2	45	112	11	9	13	65	26	7	4
Lane Group Flow (vph)	0	96	0	45	123	0	9	78	0	26	7	4
Confl. Peds. (#/hr)	10	10	10	10	10	10	10	10	10	10	10	10
Confl. Bikes (#/hr)			2			2			2			2
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8			4		4
Actuated Green, G (s)		17.0		22.0	17.0		22.0	17.0		22.0	17.0	17.0
Effective Green, g (s)		17.0		22.0	17.0		22.0	17.0		22.0	17.0	17.0
Actuated g/C Ratio		0.28		0.37	0.28		0.37	0.28		0.37	0.28	0.28
Clearance Time (s)		4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Grp Cap (vph)		526		509	519		538	446		514	528	430
v/s Ratio Prot		0.05		c0.01	c0.07		0.00	c0.05		c0.00	0.00	
v/s Ratio Perm				0.03			0.00			0.01		0.00
v/c Ratio		0.18		0.09	0.24		0.02	0.17		0.05	0.01	0.01
Uniform Delay, d1		16.2		12.4	16.5		12.1	16.2		12.2	15.5	15.4
Progression Factor		0.64		1.00	1.00		1.00	1.00		0.99	0.99	1.00
Incremental Delay, d2		0.8		0.3	1.1		0.1	0.9		0.2	0.0	0.0
Delay (s)		11.2		12.7	17.6		12.2	17.1		12.3	15.4	15.4
Level of Service		B		B	B		B	B		B	B	B
Approach Delay (s)		11.2			16.3			16.6			13.2	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	14.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.17		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	40.0%	ICU Level of Service	A
c Critical Lane Group			

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱	↰	↑	↰	↱
Sign Control	Stop			Stop	Stop	
Volume (veh/h)	18	36	165	2	5	338
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (veh/h)	21	42	194	2	6	398

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2
Volume Total (vph)	21	42	194	2	6	398
Volume Left (vph)	0	0	194	0	6	0
Volume Right (vph)	0	42	0	0	0	398
Hadj (s)	0.0	-0.6	0.2	0.0	0.2	-0.6
Departure Headway (s)	5.8	5.2	6.3	6.1	5.5	4.7
Degree Utilization, x	0.03	0.06	0.34	0.00	0.01	0.52
Capacity (veh/h)	574	639	481	483	629	743
Control Delay (s)	7.8	7.3	11.3	7.9	7.4	11.5
Approach Delay (s)	7.5		11.2		11.4	
Approach LOS	A		B		B	

Intersection Summary			
Delay	11.0		
HCM Level of Service	B		
Intersection Capacity Utilization	38.5%	ICU Level of Service	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Volume (veh/h)	187	83	45	25	48	65	69	226	22	35	140	45
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (veh/h)	220	98	53	29	56	76	81	266	26	41	165	53

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	371	162	373	259
Volume Left (vph)	220	29	81	41
Volume Right (vph)	53	76	26	53
Hadj (s)	0.1	-0.2	0.0	-0.1
Departure Headway (s)	6.0	5.9	5.9	6.1
Degree Utilization, x	0.62	0.27	0.62	0.44
Capacity (veh/h)	565	459	571	556
Control Delay (s)	18.4	11.0	18.0	13.7
Approach Delay (s)	18.4	11.0	18.0	13.7
Approach LOS	C	B	C	B

Intersection Summary			
Delay	16.2		
HCM Level of Service	C		
Intersection Capacity Utilization	79.3%	ICU Level of Service	C

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	59	24	19	80	49	25
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (veh/h)	69	28	22	94	58	29
Pedestrians	10			10	10	
Lane Width (ft)	12.0			12.0	11.0	
Walking Speed (ft/s)	4.0			4.0	4.0	
Percent Blockage	1			1	1	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
vC, conflicting volume			108		242	104
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		92	97
cM capacity (veh/h)			1472		723	936

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	98	116	87
Volume Left	0	22	58
Volume Right	28	0	29
cSH	1700	1472	783
Volume to Capacity	0.06	0.02	0.11
Queue Length (ft)	0	1	9
Control Delay (s)	0.0	1.5	10.2
Lane LOS		A	B
Approach Delay (s)	0.0	1.5	10.2
Approach LOS			B

Intersection Summary			
Average Delay	3.5		
Intersection Capacity Utilization	22.2%	ICU Level of Service	A

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Yield	
Grade	0%			0%	0%	
Volume (veh/h)	35	7	29	47	39	26
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (veh/h)	41	8	34	55	46	31
Pedestrians	10			10	10	
Lane Width (ft)	12.0			12.0	11.0	
Walking Speed (ft/s)	4.0			4.0	4.0	
Percent Blockage	1			1	1	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
vC, conflicting volume			59		189	65
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		94	97
cM capacity (veh/h)			1533		770	983

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	49	89	76
Volume Left	0	34	46
Volume Right	8	0	31
cSH	1700	1533	843
Volume to Capacity	0.03	0.02	0.09
Queue Length (ft)	0	2	7
Control Delay (s)	0.0	2.9	9.7
Lane LOS		A	A
Approach Delay (s)	0.0	2.9	9.7
Approach LOS			A

Intersection Summary			
Average Delay	4.7		
Intersection Capacity Utilization	20.7%	ICU Level of Service	A

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	13	15	20	17	40	70
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (veh/h)	15	18	24	20	47	82
Pedestrians	10			10	10	
Lane Width (ft)	12.0			11.0	11.0	
Walking Speed (ft/s)	4.0			4.0	4.0	
Percent Blockage	1			1	1	
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	175	108	139			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	98	98	98			
cM capacity (veh/h)	788	931	1432			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	33	44	129
Volume Left	15	24	0
Volume Right	18	0	82
cSH	859	1432	1700
Volume to Capacity	0.04	0.02	0.08
Queue Length (ft)	3	1	0
Control Delay (s)	9.4	4.1	0.0
Lane LOS	A	A	
Approach Delay (s)	9.4	4.1	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	2.4		
Intersection Capacity Utilization	22.5%	ICU Level of Service	A

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	23	500	235	20	71	35
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (veh/h)	27	588	276	24	84	41
Pedestrians		10	10		10	
Lane Width (ft)		12.0	12.0		11.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		1	1		1	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
vC, conflicting volume	310				951	308
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				70	94
cM capacity (veh/h)	1241				278	720

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	615	300	125
Volume Left	27	0	84
Volume Right	0	24	41
cSH	1241	1700	348
Volume to Capacity	0.02	0.18	0.36
Queue Length (ft)	2	0	40
Control Delay (s)	0.6	0.0	21.0
Lane LOS	A		C
Approach Delay (s)	0.6	0.0	21.0
Approach LOS			C

Intersection Summary			
Average Delay	2.9		
Intersection Capacity Utilization	67.7%	ICU Level of Service	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	12	138	2	0	202	6	4	8	10	4	15	16
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (veh/h)	14	162	2	0	238	7	5	9	12	5	18	19
Pedestrians		10			10			10			10	
Lane Width (ft)		12.0			12.0			11.0			11.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		1			1			1			1	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
vC, conflicting volume	255			175			481	456	184	469	454	261
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			99	98	99	99	96	98
cM capacity (veh/h)	1300			1391			454	487	845	473	489	765

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	179	245	26	41
Volume Left	14	0	5	5
Volume Right	2	7	12	19
cSH	1300	1391	594	583
Volume to Capacity	0.01	0.00	0.04	0.07
Queue Length (ft)	1	0	3	6
Control Delay (s)	0.7	0.0	11.3	11.6
Lane LOS	A		B	B
Approach Delay (s)	0.7	0.0	11.3	11.6
Approach LOS			B	B

Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	25.9%	ICU Level of Service	A

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	47	53	122	30	29	141
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (veh/h)	55	62	144	35	34	166
Pedestrians	10		10			10
Lane Width (ft)	11.0		12.0			12.0
Walking Speed (ft/s)	4.0		4.0			4.0
Percent Blockage	1		1			1
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	415	181			189	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	90	93			98	
cM capacity (veh/h)	570	848			1375	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	118	179	34	166
Volume Left	55	0	34	0
Volume Right	62	35	0	0
cSH	690	1700	1375	1700
Volume to Capacity	0.17	0.11	0.02	0.10
Queue Length (ft)	15	0	2	0
Control Delay (s)	11.3	0.0	7.7	0.0
Lane LOS	B		A	
Approach Delay (s)	11.3	0.0	1.3	
Approach LOS	B			

Intersection Summary			
Average Delay	3.2		
Intersection Capacity Utilization	26.7%	ICU Level of Service	A

Intersection Capacity Utilization
1: Hardee Rd. & Stanley Rd. 8/29/2006

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱	↰	↑	↰	↱
Volume (vph)	18	36	165	2	5	338
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10
Ped Button	Yes				Yes	
Pedestrian Timing (s)	16.0				16.0	
Free Right		No				No
Ideal Flow	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120					
Adjusted Volume (vph)	21	42	194	2	6	398
Volume Combined (vph)	21	42	194	2	6	398
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	1.00	0.85	0.95	1.00	0.95	0.85
Saturated Flow (vph)	1900	1615	1805	1900	1805	1615
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.0	1.2	0.0	0.0	0.0	1.2
Pedestrian Frequency (%)	0.28			0.00	0.28	
Protected Option Allowed	Yes			Yes	No	
Reference Time (s)	1.3	4.4	12.9	0.1		30.8
Adj Reference Time (s)	11.4	11.7	16.9	8.0		34.8
Permitted Option Allowed	Yes			Yes	No	
Adj Saturation A (vph)	1900			NA		
Reference Time A (s)	1.3			NA		
Adj Saturation B (vph	1900		0	1900		
Reference Time B (s)	1.3		20.9	0.1		
Reference Time (s)	1.3			20.9		
Adj Reference Time (s)	11.4			24.9		
Split Option						
Ref Time Combined (s)	1.3		12.9	0.1	0.4	
Ref Time Seperate (s)	1.3		12.9	0.1	0.4	
Reference Time (s)	1.3		12.9	12.9	0.4	
Adj Reference Time (s)	11.4		16.9	16.9	11.4	

Summary	EB WB	NB	Combined
Protected Option (s)	28.3	NA	
Permitted Option (s)	24.9	NA	
Split Option (s)	28.3	11.4	
Minimum (s)	24.9	11.4	36.3

Right Turns	EBR	NBR
Adj Reference Time (s)	11.7	34.8
Cross Thru Ref Time (s)	0.0	11.4
Oncoming Left Ref Time (s)	16.9	0.0
Combined (s)	28.6	46.2

Intersection Summary			
Intersection Capacity Utilization	38.5%	ICU Level of Service	A

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Volume (vph)	187	83	45	25	48	65	69	226	22	35	140	45
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10	10	10	10	10	10	10
Ped Button		Yes			Yes			Yes			Yes	
Pedestrian Timing (s)		16.0			16.0			16.0			16.0	
Free Right			No			No			No			No
Ideal Flow	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120											
Adjusted Volume (vph)	220	98	53	29	56	76	81	266	26	41	165	53
Volume Combined (vph)	0	371	0	0	162	0	0	373	0	0	259	0
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.95	0.95	0.85	0.95	0.92	0.85	0.95	0.98	0.85	0.95	0.96	0.85
Saturated Flow (vph)	0	1804	0	0	1750	0	0	1860	0	0	1827	0
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.0	0.2	1.2	0.0	0.6	1.2	0.0	0.1	1.2	0.0	0.3	1.2
Pedestrian Frequency (%)		0.28			0.28			0.28			0.28	
Protected Option Allowed		No			No			No			No	
Reference Time (s)			0.0			0.0			0.0			0.0
Adj Reference Time (s)			0.0			0.0			0.0			0.0
Permitted Option Allowed		No			No			No			No	
Adj Saturation A (vph)												
Reference Time A (s)												
Adj Saturation B (vph												
Reference Time B (s)												
Reference Time (s)												
Adj Reference Time (s)												
Split Option												
Ref Time Combined (s)	0.0	24.8		0.0	11.7		0.0	24.1		0.0	17.3	
Ref Time Seperate (s)	14.6	6.7		2.0	4.5		5.4	17.1		2.7	11.1	
Reference Time (s)	24.8	24.8		11.7	11.7		24.1	24.1		17.3	17.3	
Adj Reference Time (s)	28.8	28.8		16.9	16.9		28.1	28.1		21.3	21.3	

Summary	EB WB	NB SB	Combined
Protected Option (s)	NA	NA	
Permitted Option (s)	NA	NA	
Split Option (s)	45.8	49.4	
Minimum (s)	45.8	49.4	95.2

Right Turns	
Adj Reference Time (s)	
Cross Thru Ref Time (s)	
Oncoming Left Ref Time (s)	
Combined (s)	

Intersection Summary			
Intersection Capacity Utilization	79.3%	ICU Level of Service	C

Reference Times and Phasing Options do not represent an optimized timing plan.

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↳			↲	Y	
Volume (vph)	59	24	19	80	49	25
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10
Ped Button	Yes				Yes	
Pedestrian Timing (s)	16.0				16.0	
Free Right		No				No
Ideal Flow	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120					
Adjusted Volume (vph)	69	28	22	94	58	29
Volume Combined (vph)	98	0	0	116	87	0
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.96	0.85	0.95	0.99	0.92	0.85
Saturated Flow (vph)	1818	0	0	1882	1744	0
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.4	1.2	0.0	0.0	0.4	1.2
Pedestrian Frequency (%)	0.28			0.00	0.28	
Protected Option Allowed	No			No	No	
Reference Time (s)		0.0				0.0
Adj Reference Time (s)		0.0				0.0
Permitted Option Allowed	Yes			Yes	No	
Adj Saturation A (vph)	1818			1192		
Reference Time A (s)	6.8			9.5		
Adj Saturation B (vph	1818		0	0		
Reference Time B (s)	6.8		9.5	15.4		
Reference Time (s)	6.8			9.5		
Adj Reference Time (s)	13.4			13.5		
Split Option						
Ref Time Combined (s)	6.8		0.0	7.4	6.4	
Ref Time Seperate (s)	4.9		1.5	5.9	4.4	
Reference Time (s)	6.8		7.4	7.4	6.4	
Adj Reference Time (s)	13.4		11.4	11.4	13.1	

Summary	EB WB	NB	Combined
Protected Option (s)	NA	NA	
Permitted Option (s)	13.5	NA	
Split Option (s)	24.8	13.1	
Minimum (s)	13.5	13.1	26.6

Right Turns
Adj Reference Time (s)
Cross Thru Ref Time (s)
Oncoming Left Ref Time (s)
Combined (s)

Intersection Summary			
Intersection Capacity Utilization	22.2%	ICU Level of Service	A

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	35	7	29	47	39	26
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10
Ped Button	Yes				Yes	
Pedestrian Timing (s)	16.0				16.0	
Free Right		No				No
Ideal Flow	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120					
Adjusted Volume (vph)	41	8	34	55	46	31
Volume Combined (vph)	49	0	0	89	76	0
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.98	0.85	0.95	0.98	0.91	0.85
Saturated Flow (vph)	1853	0	0	1864	1732	0
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.2	1.2	0.0	0.0	0.5	1.2
Pedestrian Frequency (%)	0.28			0.00	0.28	
Protected Option Allowed	No			No	No	
Reference Time (s)		0.0				0.0
Adj Reference Time (s)		0.0				0.0
Permitted Option Allowed	Yes			Yes	No	
Adj Saturation A (vph)	1853			820		
Reference Time A (s)	3.4			8.1		
Adj Saturation B (vph	1853		0	0		
Reference Time B (s)	3.4		10.3	13.8		
Reference Time (s)	3.4			8.1		
Adj Reference Time (s)	11.4			12.1		
Split Option						
Ref Time Combined (s)	3.4		0.0	5.8	5.8	
Ref Time Seperate (s)	2.9		2.3	3.5	3.7	
Reference Time (s)	3.4		5.8	5.8	5.8	
Adj Reference Time (s)	11.4		9.8	9.8	12.7	

Summary	EB WB	NB	Combined
Protected Option (s)	NA	NA	
Permitted Option (s)	12.1	NA	
Split Option (s)	21.2	12.7	
Minimum (s)	12.1	12.7	24.8

Right Turns	
Adj Reference Time (s)	
Cross Thru Ref Time (s)	
Oncoming Left Ref Time (s)	
Combined (s)	

Intersection Summary			
Intersection Capacity Utilization	20.7%	ICU Level of Service	A

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	13	15	20	17	40	70
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10
Ped Button	Yes				Yes	
Pedestrian Timing (s)	16.0				16.0	
Free Right		No				No
Ideal Flow	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120					
Adjusted Volume (vph)	15	18	24	20	47	82
Volume Combined (vph)	33	0	0	44	129	0
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.90	0.85	0.95	0.97	0.90	0.85
Saturated Flow (vph)	1707	0	0	1849	1719	0
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.7	1.2	0.0	0.0	0.8	1.2
Pedestrian Frequency (%)	0.28			0.00	0.28	
Protected Option Allowed	No			No	No	
Reference Time (s)		0.0				0.0
Adj Reference Time (s)		0.0				0.0
Permitted Option Allowed	No			Yes	Yes	
Adj Saturation A (vph)				1155	1719	
Reference Time A (s)				2.1	9.8	
Adj Saturation B (vph			NA	NA	1719	
Reference Time B (s)			NA	NA	9.8	
Reference Time (s)				2.1	9.8	
Adj Reference Time (s)				8.0	15.6	
Split Option						
Ref Time Combined (s)	3.0		0.0	2.8	9.8	
Ref Time Seperate (s)	1.7		1.6	1.3	4.1	
Reference Time (s)	3.0		2.8	2.8	9.8	
Adj Reference Time (s)	11.4		8.0	8.0	15.6	

Summary	EB	NB SB	Combined
Protected Option (s)	NA	NA	
Permitted Option (s)	NA	15.6	
Split Option (s)	11.4	23.6	
Minimum (s)	11.4	15.6	27.0

Right Turns	
Adj Reference Time (s)	
Cross Thru Ref Time (s)	
Oncoming Left Ref Time (s)	
Combined (s)	

Intersection Summary			
Intersection Capacity Utilization	22.5%	ICU Level of Service	A

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	23	500	235	20	71	35
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10
Ped Button			Yes		Yes	
Pedestrian Timing (s)			16.0		16.0	
Free Right				No		No
Ideal Flow	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120					
Adjusted Volume (vph)	27	588	276	24	84	41
Volume Combined (vph)	0	615	300	0	125	0
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.95	1.00	0.99	0.85	0.92	0.85
Saturated Flow (vph)	0	1896	1878	0	1745	0
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.0	0.0	0.1	1.2	0.4	1.2
Pedestrian Frequency (%)		0.00	0.28		0.28	
Protected Option Allowed		No	No		No	
Reference Time (s)				0.0		0.0
Adj Reference Time (s)				0.0		0.0
Permitted Option Allowed		Yes	Yes		No	
Adj Saturation A (vph)		1043	1878			
Reference Time A (s)		67.7	19.3			
Adj Saturation B (vph	NA	NA	NA			
Reference Time B (s)	NA	NA	NA			
Reference Time (s)		67.7	19.3			
Adj Reference Time (s)		71.7	23.3			
Split Option						
Ref Time Combined (s)	0.0	38.9	19.3		9.0	
Ref Time Seperate (s)	1.8	37.2	17.8		6.2	
Reference Time (s)	38.9	38.9	19.3		9.0	
Adj Reference Time (s)	42.9	42.9	23.3		15.0	

Summary	EB WB	SB	Combined
Protected Option (s)	NA	NA	
Permitted Option (s)	71.7	NA	
Split Option (s)	66.2	15.0	
Minimum (s)	66.2	15.0	81.2

Right Turns	
Adj Reference Time (s)	
Cross Thru Ref Time (s)	
Oncoming Left Ref Time (s)	
Combined (s)	

Intersection Summary			
Intersection Capacity Utilization	67.7%	ICU Level of Service	B

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	12	76	29	63	68	37	12	145	40	23	144	6
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10	10	10	10	10	10	10
Ped Button		No			No			No			No	
Pedestrian Timing (s)		16.0			16.0			16.0			16.0	
Free Right			No			No			No			No
Ideal Flow	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120											
Adjusted Volume (vph)	14	89	34	74	80	44	14	171	47	27	169	7
Volume Combined (vph)	14	124	0	74	124	0	14	218	0	27	176	0
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.95	0.96	0.85	0.95	0.95	0.85	0.95	0.97	0.85	0.95	0.99	0.85
Saturated Flow (vph)	1805	1821	0	1805	1800	0	1805	1838	0	1805	1889	0
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.0	0.3	1.2	0.0	0.4	1.2	0.0	0.3	1.2	0.0	0.0	1.2
Pedestrian Frequency (%)		1.00			1.00			1.00			1.00	
Protected Option Allowed		Yes			Yes			Yes			Yes	
Reference Time (s)	0.9	8.5	0.0	4.9	8.7	0.0	0.9	14.5	0.0	1.8	11.3	0.0
Adj Reference Time (s)	8.0	20.0	0.0	8.9	20.0	0.0	8.0	20.0	0.0	8.0	20.0	0.0
Permitted Option Allowed		No			No			Yes			Yes	
Adj Saturation A (vph)								1838			1889	
Reference Time A (s)								14.5			11.3	
Adj Saturation B (vph							NA	NA		NA	NA	
Reference Time B (s)							NA	NA		NA	NA	
Reference Time (s)								14.5			11.3	
Adj Reference Time (s)								20.0			20.0	
Split Option												
Ref Time Combined (s)	0.9	8.5		4.9	8.7		0.9	14.5		1.8	11.3	
Ref Time Seperate (s)	0.9	6.2		4.9	5.8		0.9	11.4		1.8	10.8	
Reference Time (s)	8.5	8.5		8.7	8.7		14.5	14.5		11.3	11.3	
Adj Reference Time (s)	20.0	20.0		20.0	20.0		20.0	20.0		20.0	20.0	

Summary	EB WB	NB SB	Combined
Protected Option (s)	28.9	28.0	
Permitted Option (s)	NA	20.0	
Split Option (s)	40.0	40.0	
Minimum (s)	28.9	20.0	48.9

Right Turns	
Adj Reference Time (s)	
Cross Thru Ref Time (s)	
Oncoming Left Ref Time (s)	
Combined (s)	

Intersection Summary			
Intersection Capacity Utilization	40.8%	ICU Level of Service	A

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↱		↰	↱	
Volume (vph)	15	115	9	26	77	38	16	115	9	65	165	16
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10	10	10	10	10	10	10
Ped Button		No			No			No			No	
Pedestrian Timing (s)		16.0			16.0			16.0			16.0	
Free Right			No			No			No			No
Ideal Flow	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120											
Adjusted Volume (vph)	18	135	11	31	91	45	19	135	11	76	194	19
Volume Combined (vph)	18	146	0	31	135	0	19	146	0	76	213	0
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.95	0.99	0.85	0.95	0.95	0.85	0.95	0.99	0.85	0.95	0.99	0.85
Saturated Flow (vph)	1805	1879	0	1805	1806	0	1805	1879	0	1805	1875	0
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.0	0.1	1.2	0.0	0.4	1.2	0.0	0.1	1.2	0.0	0.1	1.2
Pedestrian Frequency (%)		1.00			1.00			1.00			1.00	
Protected Option Allowed		Yes			Yes			Yes			Yes	
Reference Time (s)	1.2	9.4	0.0	2.0	9.4	0.0	1.3	9.4	0.0	5.1	13.7	0.0
Adj Reference Time (s)	8.0	20.0	0.0	8.0	20.0	0.0	8.0	20.0	0.0	9.1	20.0	0.0
Permitted Option Allowed		Yes			Yes			No			No	
Adj Saturation A (vph)		1879			1806							
Reference Time A (s)		9.4			9.4							
Adj Saturation B (vph	NA	NA		NA	NA							
Reference Time B (s)	NA	NA		NA	NA							
Reference Time (s)		9.4			9.4							
Adj Reference Time (s)		20.0			20.0							
Split Option												
Ref Time Combined (s)	1.2	9.4		2.0	9.4		1.3	9.4		5.1	13.7	
Ref Time Seperate (s)	1.2	8.7		2.0	6.4		1.3	8.7		5.1	12.5	
Reference Time (s)	9.4	9.4		9.4	9.4		9.4	9.4		13.7	13.7	
Adj Reference Time (s)	20.0	20.0		20.0	20.0		20.0	20.0		20.0	20.0	

Summary	EB WB	NB SB	Combined
Protected Option (s)	28.0	29.1	
Permitted Option (s)	20.0	NA	
Split Option (s)	40.0	40.0	
Minimum (s)	20.0	29.1	49.1

Right Turns	
Adj Reference Time (s)	
Cross Thru Ref Time (s)	
Oncoming Left Ref Time (s)	
Combined (s)	

Intersection Summary

Intersection Capacity Utilization 40.9% ICU Level of Service A

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Volume (vph)	12	138	2	0	202	6	4	8	10	4	15	16
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10	10	10	10	10	10	10
Ped Button		Yes			Yes			Yes			Yes	
Pedestrian Timing (s)		16.0			16.0			16.0			16.0	
Free Right			No			No			No			No
Ideal Flow	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120											
Adjusted Volume (vph)	14	162	2	0	238	7	5	9	12	5	18	19
Volume Combined (vph)	0	179	0	0	245	0	0	26	0	0	41	0
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.95	0.99	0.85	0.95	1.00	0.85	0.95	0.92	0.85	0.95	0.93	0.85
Saturated Flow (vph)	0	1889	0	0	1892	0	0	1754	0	0	1760	0
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.0	0.0	1.2	0.0	0.0	1.2	0.0	0.6	1.2	0.0	0.6	1.2
Pedestrian Frequency (%)		0.28			0.28			0.28			0.28	
Protected Option Allowed		No			No			No			No	
Reference Time (s)			0.0			0.0			0.0			0.0
Adj Reference Time (s)			0.0			0.0			0.0			0.0
Permitted Option Allowed		Yes			Yes			Yes			Yes	
Adj Saturation A (vph)		1450			1892			1605			1615	
Reference Time A (s)		13.6			15.6			2.1			3.3	
Adj Saturation B (vph	NA	NA		NA	NA		0	0		0	0	
Reference Time B (s)	NA	NA		NA	NA		8.3	10.3		8.3	11.4	
Reference Time (s)		13.6			15.6			2.1			3.3	
Adj Reference Time (s)		18.3			19.7			11.4			11.4	
Split Option												
Ref Time Combined (s)	0.0	11.4		0.0	15.6		0.0	2.3		0.0	3.4	
Ref Time Seperate (s)	0.9	10.3		0.0	15.1		0.3	1.2		0.3	1.8	
Reference Time (s)	11.4	11.4		15.6	15.6		2.3	2.3		3.4	3.4	
Adj Reference Time (s)	16.7	16.7		19.7	19.7		11.4	11.4		11.4	11.4	

Summary	EB WB	NB SB	Combined
Protected Option (s)	NA	NA	
Permitted Option (s)	19.7	11.4	
Split Option (s)	36.4	22.8	
Minimum (s)	19.7	11.4	31.1

Right Turns
Adj Reference Time (s)
Cross Thru Ref Time (s)
Oncoming Left Ref Time (s)
Combined (s)

Intersection Summary			
Intersection Capacity Utilization	25.9%	ICU Level of Service	A

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱		↰	↑↱		↰	↑	↱
Volume (vph)	0	80	2	38	95	9	8	11	55	22	6	3
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10	10	10	10	10	10	10
Ped Button		No			No			No			No	
Pedestrian Timing (s)		16.0			16.0			16.0			16.0	
Free Right			No			No			No			No
Ideal Flow	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120											
Adjusted Volume (vph)	0	94	2	45	112	11	9	13	65	26	7	4
Volume Combined (vph)	0	96	0	45	122	0	9	78	0	26	7	4
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.95	1.00	0.85	0.95	0.99	0.85	0.95	0.88	0.85	0.95	1.00	0.85
Saturated Flow (vph)	1805	1893	0	1805	1875	0	1805	1663	0	1805	1900	1615
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.0	0.0	1.2	0.0	0.1	1.2	0.0	1.0	1.2	0.0	0.0	1.2
Pedestrian Frequency (%)		1.00			1.00			1.00			1.00	
Protected Option Allowed		Yes			Yes			Yes			Yes	
Reference Time (s)	0.0	6.1	0.0	3.0	7.9	0.0	0.6	6.6	0.0	1.7	0.4	1.5
Adj Reference Time (s)	8.0	20.0	0.0	8.0	20.0	0.0	8.0	20.0	0.0	8.0	20.0	20.0
Permitted Option Allowed		Yes			Yes			Yes			Yes	
Adj Saturation A (vph)		1893			1875			1663			1900	
Reference Time A (s)		6.1			7.9			6.6			0.4	
Adj Saturation B (vph	NA	NA		0	1875		0	1663		0	1900	
Reference Time B (s)	NA	NA		11.0	7.9		8.6	6.6		9.7	0.4	
Reference Time (s)		6.1			7.9			6.6			0.4	
Adj Reference Time (s)		20.0			20.0			20.0			20.0	
Split Option												
Ref Time Combined (s)	0.0	6.1		3.0	7.9		0.6	6.6		1.7	0.4	
Ref Time Seperate (s)	0.0	6.0		3.0	7.3		0.6	2.0		1.7	0.4	
Reference Time (s)	6.1	6.1		7.9	7.9		6.6	6.6		1.7	1.7	
Adj Reference Time (s)	20.0	20.0		20.0	20.0		20.0	20.0		20.0	20.0	

Summary	EB WB	NB SB	Combined
Protected Option (s)	28.0	28.0	
Permitted Option (s)	20.0	20.0	
Split Option (s)	40.0	40.0	
Minimum (s)	20.0	20.0	40.0

Right Turns	SBR
Adj Reference Time (s)	20.0
Cross Thru Ref Time (s)	20.0
Oncoming Left Ref Time (s)	8.0
Combined (s)	48.0

Intersection Summary			
Intersection Capacity Utilization	40.0%	ICU Level of Service	A

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	47	53	122	30	29	141
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10
Ped Button	Yes		Yes			
Pedestrian Timing (s)	16.0		16.0			
Free Right		No		No		
Ideal Flow	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120					
Adjusted Volume (vph)	55	62	144	35	34	166
Volume Combined (vph)	118	0	179	0	34	166
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.90	0.85	0.97	0.85	0.95	1.00
Saturated Flow (vph)	1708	0	1844	0	1805	1900
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.7	1.2	0.2	1.2	0.0	0.0
Pedestrian Frequency (%)	0.28		0.28			0.00
Protected Option Allowed	No		Yes			Yes
Reference Time (s)		0.0	11.9	0.0	2.3	10.5
Adj Reference Time (s)		0.0	17.1	0.0	8.0	14.5
Permitted Option Allowed	No		Yes			Yes
Adj Saturation A (vph)			1844			1900
Reference Time A (s)			11.9			10.5
Adj Saturation B (vph			NA		NA	NA
Reference Time B (s)			NA		NA	NA
Reference Time (s)			11.9			10.5
Adj Reference Time (s)			17.1			14.5
Split Option						
Ref Time Combined (s)	8.9		11.9		2.3	10.5
Ref Time Seperate (s)	4.5		9.6		2.3	10.5
Reference Time (s)	8.9		11.9		10.5	10.5
Adj Reference Time (s)	14.9		17.1		14.5	14.5

Summary	WB	NB SB	Combined
Protected Option (s)	NA	25.1	
Permitted Option (s)	NA	17.1	
Split Option (s)	14.9	31.5	
Minimum (s)	14.9	17.1	32.0

Right Turns
Adj Reference Time (s)
Cross Thru Ref Time (s)
Oncoming Left Ref Time (s)
Combined (s)

Intersection Summary			
Intersection Capacity Utilization	26.7%	ICU Level of Service	A

Reference Times and Phasing Options do not represent an optimized timing plan.

G.4 PROPOSED SYNCHRO/HCM/ICU ANALYSIS – METC AREA

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↱		↰	↱	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.97		1.00	0.98		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1767	1805		1761	1800		1767	1817		1767	1754	
Flt Permitted	0.29	1.00		0.50	1.00		0.25	1.00		0.25	1.00	
Satd. Flow (perm)	531	1805		931	1800		465	1817		465	1754	
Volume (vph)	186	320	64	78	317	69	64	306	46	74	235	106
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	219	376	75	92	373	81	75	360	54	87	276	125
Lane Group Flow (vph)	219	451	0	92	454	0	75	414	0	87	401	0
Confl. Peds. (#/hr)	10	10	10	10	10	10	10	10	10	10	10	10
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	20.0	20.0		18.0	18.0		20.0	16.0		20.0	16.0	
Effective Green, g (s)	20.0	20.0		18.0	18.0		20.0	16.0		20.0	16.0	
Actuated g/C Ratio	0.33	0.33		0.30	0.30		0.33	0.27		0.33	0.27	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)	301	602		335	540		242	485		242	468	
v/s Ratio Prot	0.07	c0.25		0.02	c0.25		0.02	0.23		c0.02	c0.23	
v/s Ratio Perm	0.17			0.06			0.08			0.10		
v/c Ratio	0.73	0.75		0.27	0.84		0.31	0.85		0.36	0.86	
Uniform Delay, d1	27.7	17.8		16.3	19.7		14.6	20.9		14.8	20.9	
Progression Factor	1.00	1.00		0.53	0.54		1.00	1.00		1.00	1.00	
Incremental Delay, d2	14.3	8.3		1.9	13.7		3.3	17.2		4.1	18.0	
Delay (s)	42.0	26.1		10.6	24.3		17.9	38.1		18.9	38.9	
Level of Service	D	C		B	C		B	D		B	D	
Approach Delay (s)		31.3			22.0			35.0			35.3	
Approach LOS		C			C			C			D	

Intersection Summary			
HCM Average Control Delay	30.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	77.4%	ICU Level of Service	C

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱		↰	↑↱		↰	↑↱	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	0.98		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.99	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.94		1.00	0.96		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1767	1817		1766	1719		1761	1772		1770	1817	
Flt Permitted	0.22	1.00		0.25	1.00		0.46	1.00		0.16	1.00	
Satd. Flow (perm)	406	1817		465	1719		847	1772		292	1817	
Volume (vph)	5	300	43	91	216	146	17	367	125	50	230	34
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	6	353	51	107	254	172	20	432	147	59	271	40
Lane Group Flow (vph)	6	404	0	107	426	0	20	579	0	59	311	0
Confl. Peds. (#/hr)	10	10	10	10	10	10	10	10	10	10	10	10
Confl. Bikes (#/hr)			2			2			2			2
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	24.0	20.0		24.0	20.0		30.0	26.0		30.0	26.0	
Effective Green, g (s)	24.0	20.0		24.0	20.0		30.0	26.0		30.0	26.0	
Actuated g/C Ratio	0.34	0.29		0.34	0.29		0.43	0.37		0.43	0.37	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)	217	519		234	491		415	658		210	675	
v/s Ratio Prot	0.00	0.22		c0.03	c0.25		0.00	c0.33		c0.02	0.17	
v/s Ratio Perm	0.01			0.13			0.02			0.10		
v/c Ratio	0.03	0.78		0.46	0.87		0.05	0.88		0.28	0.46	
Uniform Delay, d1	16.1	23.0		17.0	23.7		11.8	20.5		14.0	16.7	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.2	11.0		6.3	18.4		0.2	15.6		3.3	2.3	
Delay (s)	16.4	33.9		23.3	42.1		12.0	36.1		17.3	18.9	
Level of Service	B	C		C	D		B	D		B	B	
Approach Delay (s)		33.7			38.3			35.3			18.7	
Approach LOS		C			D			D			B	

Intersection Summary			
HCM Average Control Delay	32.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	69.6%	ICU Level of Service	B
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	0.97		1.00	1.00	0.96
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.99	1.00		1.00	1.00	1.00
Frt	1.00	0.96		1.00	0.99		1.00	0.91		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1766	1779		1763	1849		1752	1643		1766	1863	1518
Flt Permitted	0.28	1.00		0.42	1.00		0.67	1.00		0.29	1.00	1.00
Satd. Flow (perm)	528	1779		773	1849		1239	1643		547	1863	1518
Volume (vph)	74	183	57	239	376	15	21	116	197	19	113	69
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	87	215	67	281	442	18	25	136	232	22	133	81
Lane Group Flow (vph)	87	282	0	281	460	0	25	368	0	22	133	81
Confl. Peds. (#/hr)	10	10	10	10	10	10	10	10	10	10	10	10
Confl. Bikes (#/hr)			2			2			2			2
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8			4		4
Actuated Green, G (s)	22.0	18.0		26.0	20.0		20.0	16.0		20.0	16.0	16.0
Effective Green, g (s)	22.0	18.0		26.0	20.0		20.0	16.0		20.0	16.0	16.0
Actuated g/C Ratio	0.37	0.30		0.43	0.33		0.33	0.27		0.33	0.27	0.27
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Grp Cap (vph)	276	534		434	616		447	438		264	497	405
v/s Ratio Prot	0.02	0.16		c0.06	c0.25		0.00	c0.22		c0.01	0.07	
v/s Ratio Perm	0.09			0.22			0.01			0.02		0.05
v/c Ratio	0.32	0.53		0.65	0.75		0.06	0.84		0.08	0.27	0.20
Uniform Delay, d1	13.2	17.5		12.2	17.8		13.5	20.8		14.0	17.4	17.0
Progression Factor	0.44	0.42		1.00	1.00		1.00	1.00		1.01	1.00	1.02
Incremental Delay, d2	2.4	2.9		7.3	8.0		0.2	17.4		0.6	1.3	1.1
Delay (s)	8.1	10.4		19.4	25.8		13.8	38.2		14.7	18.8	18.5
Level of Service	A	B		B	C		B	D		B	B	B
Approach Delay (s)		9.8			23.4			36.6			18.3	
Approach LOS		A			C			D			B	

Intersection Summary			
HCM Average Control Delay	22.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	63.3%	ICU Level of Service	B
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Stop			Stop	Stop	
Volume (veh/h)	86	59	64	117	86	117
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (veh/h)	101	69	75	138	101	138

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2
Volume Total (vph)	101	69	75	138	101	138
Volume Left (vph)	0	0	75	0	101	0
Volume Right (vph)	0	69	0	0	0	138
Hadj (s)	0.0	-0.6	0.2	0.0	0.2	-0.6
Departure Headway (s)	5.4	4.8	6.1	5.9	5.7	4.9
Degree Utilization, x	0.15	0.09	0.13	0.22	0.16	0.19
Capacity (veh/h)	635	715	476	496	601	694
Control Delay (s)	8.1	7.1	8.7	9.4	8.6	7.8
Approach Delay (s)	7.7		9.1		8.2	
Approach LOS	A		A		A	

Intersection Summary			
Delay	8.4		
HCM Level of Service	A		
Intersection Capacity Utilization	25.3%	ICU Level of Service	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Sign Control		Stop			Stop			Stop			Stop	
Volume (veh/h)	137	124	32	36	109	6	122	200	32	130	328	193
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (veh/h)	161	146	38	42	128	7	144	235	38	153	386	227

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	345	178	416	766
Volume Left (vph)	161	42	144	153
Volume Right (vph)	38	7	38	227
Hadj (s)	0.1	0.1	0.0	-0.1
Departure Headway (s)	7.4	6.8	7.0	6.6
Degree Utilization, x	0.71	0.34	0.81	1.40
Capacity (veh/h)	472	407	503	555
Control Delay (s)	26.3	13.3	33.5	212.1
Approach Delay (s)	26.3	13.3	33.5	212.1
Approach LOS	D	B	D	F

Intersection Summary			
Delay	110.2		
HCM Level of Service	F		
Intersection Capacity Utilization	108.6%	ICU Level of Service	F

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	111	69	92	284	92	50
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (veh/h)	131	81	108	334	108	59
Pedestrians	10			10	10	
Lane Width (ft)	12.0			12.0	11.0	
Walking Speed (ft/s)	4.0			4.0	4.0	
Percent Blockage	1			1	1	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
vC, conflicting volume			222		742	191
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			92		69	93
cM capacity (veh/h)			1337		347	837

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	212	442	167
Volume Left	0	108	108
Volume Right	81	0	59
cSH	1700	1337	437
Volume to Capacity	0.12	0.08	0.38
Queue Length (ft)	0	7	44
Control Delay (s)	0.0	2.5	18.3
Lane LOS		A	C
Approach Delay (s)	0.0	2.5	18.3
Approach LOS			C

Intersection Summary			
Average Delay	5.1		
Intersection Capacity Utilization	57.0%	ICU Level of Service	A

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Yield	
Grade	0%			0%	0%	
Volume (veh/h)	99	88	149	84	111	185
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (veh/h)	116	104	175	99	131	218
Pedestrians	10			10	10	
Lane Width (ft)	12.0			12.0	11.0	
Walking Speed (ft/s)	4.0			4.0	4.0	
Percent Blockage	1			1	1	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
vC, conflicting volume			230		638	188
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			87		65	74
cM capacity (veh/h)			1328		377	840

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	220	274	348
Volume Left	0	175	131
Volume Right	104	0	218
cSH	1700	1328	575
Volume to Capacity	0.13	0.13	0.61
Queue Length (ft)	0	11	101
Control Delay (s)	0.0	5.6	20.4
Lane LOS		A	C
Approach Delay (s)	0.0	5.6	20.4
Approach LOS			C

Intersection Summary			
Average Delay	10.3		
Intersection Capacity Utilization	59.2%	ICU Level of Service	A

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	144	64	58	122	64	84
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (veh/h)	169	75	68	144	75	99
Pedestrians	10			10	10	
Lane Width (ft)	12.0			11.0	11.0	
Walking Speed (ft/s)	4.0			4.0	4.0	
Percent Blockage	1			1	1	
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	425	145	184			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	69	92	95			
cM capacity (veh/h)	548	888	1379			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	245	212	174
Volume Left	169	68	0
Volume Right	75	0	99
cSH	622	1379	1700
Volume to Capacity	0.39	0.05	0.10
Queue Length (ft)	47	4	0
Control Delay (s)	14.5	2.8	0.0
Lane LOS	B	A	
Approach Delay (s)	14.5	2.8	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	6.6		
Intersection Capacity Utilization	47.0%	ICU Level of Service	A

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	44	114	196	104	62	50
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (veh/h)	52	134	231	122	73	59
Pedestrians		10	10		10	
Lane Width (ft)		12.0	12.0		11.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		1	1		1	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
vC, conflicting volume	363				549	312
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	96				84	92
cM capacity (veh/h)	1187				467	717

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	186	353	132
Volume Left	52	0	73
Volume Right	0	122	59
cSH	1187	1700	553
Volume to Capacity	0.04	0.21	0.24
Queue Length (ft)	3	0	23
Control Delay (s)	2.6	0.0	13.5
Lane LOS	A		B
Approach Delay (s)	2.6	0.0	13.5
Approach LOS			B

Intersection Summary			
Average Delay	3.4		
Intersection Capacity Utilization	49.5%	ICU Level of Service	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	35	407	18	24	623	15	13	22	9	15	18	24
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (veh/h)	41	479	21	28	733	18	15	26	11	18	21	28
Pedestrians		10			10			10			10	
Lane Width (ft)		12.0			12.0			11.0			11.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		1			1			1			1	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
vC, conflicting volume	761			510			1429	1399	509	1414	1401	762
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	95			97			82	80	98	80	83	93
cM capacity (veh/h)	845			1047			84	128	555	88	128	399

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	541	779	52	67
Volume Left	41	28	15	18
Volume Right	21	18	11	28
cSH	845	1047	128	153
Volume to Capacity	0.05	0.03	0.40	0.44
Queue Length (ft)	4	2	43	49
Control Delay (s)	1.3	0.7	50.9	45.6
Lane LOS	A	A	F	E
Approach Delay (s)	1.3	0.7	50.9	45.6
Approach LOS			F	E

Intersection Summary			
Average Delay	4.8		
Intersection Capacity Utilization	87.0%	ICU Level of Service	D

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	90	120	290	78	58	225
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (veh/h)	106	141	341	92	68	265
Pedestrians	10		10			10
Lane Width (ft)	11.0		12.0			12.0
Walking Speed (ft/s)	4.0		4.0			4.0
Percent Blockage	1		1			1
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	808	407			443	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	67	78			94	
cM capacity (veh/h)	323	634			1109	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	247	433	68	265
Volume Left	106	0	68	0
Volume Right	141	92	0	0
cSH	449	1700	1109	1700
Volume to Capacity	0.55	0.25	0.06	0.16
Queue Length (ft)	81	0	5	0
Control Delay (s)	22.4	0.0	8.5	0.0
Lane LOS	C		A	
Approach Delay (s)	22.4	0.0	1.7	
Approach LOS	C			

Intersection Summary			
Average Delay	6.0		
Intersection Capacity Utilization	52.7%	ICU Level of Service	A

Movement	EBT	EBR	WBL	WBT	NBL	NBR
	→	↘	↙	←	↖	↗
Lane Configurations	↑	↱	↰	↑	↰	↱
Volume (vph)	86	59	64	117	86	117
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10
Ped Button	Yes				Yes	
Pedestrian Timing (s)	16.0				16.0	
Free Right		No				No
Ideal Flow	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120					
Adjusted Volume (vph)	101	69	75	138	101	138
Volume Combined (vph)	101	69	75	138	101	138
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	1.00	0.85	0.95	1.00	0.95	0.85
Saturated Flow (vph)	1900	1615	1805	1900	1805	1615
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.0	1.2	0.0	0.0	0.0	1.2
Pedestrian Frequency (%)	0.28			0.00	0.28	
Protected Option Allowed	Yes			Yes	No	
Reference Time (s)	6.4	6.4	5.0	8.7		11.5
Adj Reference Time (s)	13.1	13.1	9.0	12.7		16.8
Permitted Option Allowed	Yes			Yes	No	
Adj Saturation A (vph)	1900			NA		
Reference Time A (s)	6.4			NA		
Adj Saturation B (vph	NA		0	1900		
Reference Time B (s)	NA		13.0	8.7		
Reference Time (s)	6.4			13.0		
Adj Reference Time (s)	13.1			17.0		
Split Option						
Ref Time Combined (s)	6.4		5.0	8.7	6.7	
Ref Time Seperate (s)	6.4		5.0	8.7	6.7	
Reference Time (s)	6.4		8.7	8.7	6.7	
Adj Reference Time (s)	13.1		12.7	12.7	13.4	

Summary	EB WB	NB	Combined
Protected Option (s)	22.1	NA	
Permitted Option (s)	17.0	NA	
Split Option (s)	25.8	13.4	
Minimum (s)	17.0	13.4	30.4

Right Turns	EBR	NBR
Adj Reference Time (s)	13.1	16.8
Cross Thru Ref Time (s)	0.0	13.1
Oncoming Left Ref Time (s)	9.0	0.0
Combined (s)	22.1	29.9

Intersection Summary			
Intersection Capacity Utilization	25.3%	ICU Level of Service	A

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Volume (vph)	137	124	32	36	109	6	122	200	32	130	328	193
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10	10	10	10	10	10	10
Ped Button		Yes			Yes			Yes			Yes	
Pedestrian Timing (s)		16.0			16.0			16.0			16.0	
Free Right			No			No			No			No
Ideal Flow	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120											
Adjusted Volume (vph)	161	146	38	42	128	7	144	235	38	153	386	227
Volume Combined (vph)	0	345	0	0	178	0	0	416	0	0	766	0
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.95	0.96	0.85	0.95	0.98	0.85	0.95	0.97	0.85	0.95	0.95	0.85
Saturated Flow (vph)	0	1825	0	0	1866	0	0	1842	0	0	1797	0
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.0	0.1	1.2	0.0	0.0	1.2	0.0	0.1	1.2	0.0	0.4	1.2
Pedestrian Frequency (%)		0.28			0.28			0.28			0.28	
Protected Option Allowed		No			No			No			No	
Reference Time (s)			0.0			0.0			0.0			0.0
Adj Reference Time (s)			0.0			0.0			0.0			0.0
Permitted Option Allowed		No			No			No			No	
Adj Saturation A (vph)												
Reference Time A (s)												
Adj Saturation B (vph												
Reference Time B (s)												
Reference Time (s)												
Adj Reference Time (s)												
Split Option												
Ref Time Combined (s)	0.0	22.8		0.0	11.5		0.0	27.2		0.0	51.5	
Ref Time Seperate (s)	10.7	9.6		2.8	8.2		9.5	15.3		10.2	26.2	
Reference Time (s)	22.8	22.8		11.5	11.5		27.2	27.2		51.5	51.5	
Adj Reference Time (s)	26.8	26.8		16.8	16.8		31.2	31.2		55.5	55.5	

Summary	EB WB	NB SB	Combined
Protected Option (s)	NA	NA	
Permitted Option (s)	NA	NA	
Split Option (s)	43.6	86.7	
Minimum (s)	43.6	86.7	130.3

Right Turns	
Adj Reference Time (s)	
Cross Thru Ref Time (s)	
Oncoming Left Ref Time (s)	
Combined (s)	

Intersection Summary			
Intersection Capacity Utilization	108.6%	ICU Level of Service	F

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	111	69	92	284	92	50
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10
Ped Button	Yes				Yes	
Pedestrian Timing (s)	16.0				16.0	
Free Right		No				No
Ideal Flow	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120					
Adjusted Volume (vph)	131	81	108	334	108	59
Volume Combined (vph)	212	0	0	442	167	0
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.94	0.85	0.95	0.99	0.92	0.85
Saturated Flow (vph)	1791	0	0	1877	1741	0
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.5	1.2	0.0	0.0	0.4	1.2
Pedestrian Frequency (%)	0.28			0.00	0.28	
Protected Option Allowed	No			No	No	
Reference Time (s)		0.0				0.0
Adj Reference Time (s)		0.0				0.0
Permitted Option Allowed	No			No	No	
Adj Saturation A (vph)						
Reference Time A (s)						
Adj Saturation B (vph						
Reference Time B (s)						
Reference Time (s)						
Adj Reference Time (s)						
Split Option						
Ref Time Combined (s)	14.7		0.0	28.3	11.9	
Ref Time Seperate (s)	9.2		7.2	21.1	7.9	
Reference Time (s)	14.7		28.3	28.3	11.9	
Adj Reference Time (s)	19.0		32.3	32.3	17.1	

Summary	EB WB	NB	Combined
Protected Option (s)	NA	NA	
Permitted Option (s)	NA	NA	
Split Option (s)	51.3	17.1	
Minimum (s)	51.3	17.1	68.4

Right Turns	
Adj Reference Time (s)	
Cross Thru Ref Time (s)	
Oncoming Left Ref Time (s)	
Combined (s)	

Intersection Summary			
Intersection Capacity Utilization	57.0%	ICU Level of Service	A

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	99	88	149	84	111	185
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10
Ped Button	Yes				Yes	
Pedestrian Timing (s)	16.0				16.0	
Free Right		No				No
Ideal Flow	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120					
Adjusted Volume (vph)	116	104	175	99	131	218
Volume Combined (vph)	220	0	0	274	348	0
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.93	0.85	0.95	0.97	0.89	0.85
Saturated Flow (vph)	1766	0	0	1839	1690	0
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.6	1.2	0.0	0.0	0.8	1.2
Pedestrian Frequency (%)	0.28			0.00	0.28	
Protected Option Allowed	No			No	No	
Reference Time (s)		0.0				0.0
Adj Reference Time (s)		0.0				0.0
Permitted Option Allowed	No			No	No	
Adj Saturation A (vph)						
Reference Time A (s)						
Adj Saturation B (vph						
Reference Time B (s)						
Reference Time (s)						
Adj Reference Time (s)						
Split Option						
Ref Time Combined (s)	15.5		0.0	17.9	25.5	
Ref Time Seperate (s)	8.5		11.7	6.2	10.1	
Reference Time (s)	15.5		17.9	17.9	25.5	
Adj Reference Time (s)	19.7		21.9	21.9	29.5	

Summary	EB WB	NB	Combined
Protected Option (s)	NA	NA	
Permitted Option (s)	NA	NA	
Split Option (s)	41.6	29.5	
Minimum (s)	41.6	29.5	71.1
Right Turns			
Adj Reference Time (s)			
Cross Thru Ref Time (s)			
Oncoming Left Ref Time (s)			
Combined (s)			

Intersection Summary

Intersection Capacity Utilization 59.2% ICU Level of Service A

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	144	64	58	122	64	84
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10
Ped Button	Yes				Yes	
Pedestrian Timing (s)	16.0				16.0	
Free Right		No				No
Ideal Flow	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120					
Adjusted Volume (vph)	169	75	68	144	75	99
Volume Combined (vph)	245	0	0	212	174	0
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.92	0.85	0.95	0.98	0.91	0.85
Saturated Flow (vph)	1750	0	0	1869	1738	0
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.4	1.2	0.0	0.0	0.7	1.2
Pedestrian Frequency (%)	0.28			0.00	0.28	
Protected Option Allowed	No			No	No	
Reference Time (s)		0.0				0.0
Adj Reference Time (s)		0.0				0.0
Permitted Option Allowed	No			No	No	
Adj Saturation A (vph)						
Reference Time A (s)						
Adj Saturation B (vph						
Reference Time B (s)						
Reference Time (s)						
Adj Reference Time (s)						
Split Option						
Ref Time Combined (s)	17.2		0.0	13.6	12.7	
Ref Time Seperate (s)	12.0		4.5	9.1	5.9	
Reference Time (s)	17.2		13.6	13.6	12.7	
Adj Reference Time (s)	21.2		17.6	17.6	17.7	

Summary	EB	NB SB	Combined
Protected Option (s)	NA	NA	
Permitted Option (s)	NA	NA	
Split Option (s)	21.2	35.2	
Minimum (s)	21.2	35.2	56.4

Right Turns	
Adj Reference Time (s)	
Cross Thru Ref Time (s)	
Oncoming Left Ref Time (s)	
Combined (s)	

Intersection Summary			
Intersection Capacity Utilization	47.0%	ICU Level of Service	A

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	44	114	196	104	62	50
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10
Ped Button			Yes		Yes	
Pedestrian Timing (s)			16.0		16.0	
Free Right				No		No
Ideal Flow	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120					
Adjusted Volume (vph)	52	134	231	122	73	59
Volume Combined (vph)	0	186	353	0	132	0
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.95	0.99	0.95	0.85	0.91	0.85
Saturated Flow (vph)	0	1874	1801	0	1724	0
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.0	0.0	0.4	1.2	0.6	1.2
Pedestrian Frequency (%)		0.00	0.28		0.28	
Protected Option Allowed		No	No		No	
Reference Time (s)				0.0		0.0
Adj Reference Time (s)				0.0		0.0
Permitted Option Allowed		Yes	Yes		No	
Adj Saturation A (vph)		261	1801			
Reference Time A (s)		61.7	23.9			
Adj Saturation B (vph	NA	NA	NA			
Reference Time B (s)	NA	NA	NA			
Reference Time (s)		61.7	23.9			
Adj Reference Time (s)		65.7	27.9			
Split Option						
Ref Time Combined (s)	0.0	11.9	23.9		9.7	
Ref Time Seperate (s)	3.4	8.5	15.8		5.6	
Reference Time (s)	11.9	11.9	23.9		9.7	
Adj Reference Time (s)	15.9	15.9	27.9		15.5	

Summary	EB WB	SB	Combined
Protected Option (s)	NA	NA	
Permitted Option (s)	65.7	NA	
Split Option (s)	43.8	15.5	
Minimum (s)	43.8	15.5	59.4

Right Turns	
Adj Reference Time (s)	
Cross Thru Ref Time (s)	
Oncoming Left Ref Time (s)	
Combined (s)	

Intersection Summary			
Intersection Capacity Utilization	49.5%	ICU Level of Service	A

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	186	320	64	78	317	69	64	306	46	74	235	106
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10	10	10	10	10	10	10
Ped Button		No			No			No			No	
Pedestrian Timing (s)		16.0			16.0			16.0			16.0	
Free Right			No			No			No			No
Ideal Flow	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120											
Adjusted Volume (vph)	219	376	75	92	373	81	75	360	54	87	276	125
Volume Combined (vph)	219	452	0	92	454	0	75	414	0	87	401	0
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.95	0.98	0.85	0.95	0.97	0.85	0.95	0.98	0.85	0.95	0.95	0.85
Saturated Flow (vph)	1805	1853	0	1805	1849	0	1805	1863	0	1805	1811	0
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.0	0.2	1.2	0.0	0.2	1.2	0.0	0.2	1.2	0.0	0.4	1.2
Pedestrian Frequency (%)		1.00			1.00			1.00			1.00	
Protected Option Allowed		Yes			Yes			Yes			Yes	
Reference Time (s)	14.5	29.5	0.0	6.1	29.7	0.0	5.0	26.8	0.0	5.8	27.0	0.0
Adj Reference Time (s)	18.5	33.5	0.0	10.1	33.7	0.0	9.0	30.8	0.0	9.8	31.0	0.0
Permitted Option Allowed		No			No			No			No	
Adj Saturation A (vph)												
Reference Time A (s)												
Adj Saturation B (vph												
Reference Time B (s)												
Reference Time (s)												
Adj Reference Time (s)												
Split Option												
Ref Time Combined (s)	14.5	29.5		6.1	29.7		5.0	26.8		5.8	27.0	
Ref Time Seperate (s)	14.5	24.6		6.1	24.4		5.0	23.4		5.8	18.7	
Reference Time (s)	29.5	29.5		29.7	29.7		26.8	26.8		27.0	27.0	
Adj Reference Time (s)	33.5	33.5		33.7	33.7		30.8	30.8		31.0	31.0	

Summary	EB WB	NB SB	Combined
Protected Option (s)	52.2	40.6	
Permitted Option (s)	NA	NA	
Split Option (s)	67.2	61.8	
Minimum (s)	52.2	40.6	92.9

Right Turns	
Adj Reference Time (s)	
Cross Thru Ref Time (s)	
Oncoming Left Ref Time (s)	
Combined (s)	

Intersection Summary			
Intersection Capacity Utilization	77.4%	ICU Level of Service	C

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↱		↰	↱	
Volume (vph)	5	300	43	91	216	146	17	367	125	50	230	34
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10	10	10	10	10	10	10
Ped Button		No			No			No			No	
Pedestrian Timing (s)		16.0			16.0			16.0			16.0	
Free Right			No			No			No			No
Ideal Flow	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120											
Adjusted Volume (vph)	6	353	51	107	254	172	20	432	147	59	271	40
Volume Combined (vph)	6	404	0	107	426	0	20	579	0	59	311	0
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.95	0.98	0.85	0.95	0.94	0.85	0.95	0.96	0.85	0.95	0.98	0.85
Saturated Flow (vph)	1805	1864	0	1805	1785	0	1805	1828	0	1805	1863	0
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.0	0.2	1.2	0.0	0.5	1.2	0.0	0.3	1.2	0.0	0.2	1.2
Pedestrian Frequency (%)		1.00			1.00			1.00			1.00	
Protected Option Allowed		Yes			Yes			Yes			Yes	
Reference Time (s)	0.4	26.1	0.0	7.1	29.1	0.0	1.3	38.3	0.0	3.9	20.2	0.0
Adj Reference Time (s)	8.0	30.1	0.0	11.1	33.1	0.0	8.0	42.3	0.0	8.0	24.2	0.0
Permitted Option Allowed		No			No			Yes			Yes	
Adj Saturation A (vph)								1828			1863	
Reference Time A (s)								38.3			20.2	
Adj Saturation B (vph							NA	NA		NA	NA	
Reference Time B (s)							NA	NA		NA	NA	
Reference Time (s)								38.3			20.2	
Adj Reference Time (s)								42.3			24.2	
Split Option												
Ref Time Combined (s)	0.4	26.1		7.1	29.1		1.3	38.3		3.9	20.2	
Ref Time Seperate (s)	0.4	22.9		7.1	17.6		1.3	28.7		3.9	17.6	
Reference Time (s)	26.1	26.1		29.1	29.1		38.3	38.3		20.2	20.2	
Adj Reference Time (s)	30.1	30.1		33.1	33.1		42.3	42.3		24.2	24.2	

Summary	EB WB	NB SB	Combined
Protected Option (s)	41.2	50.3	
Permitted Option (s)	NA	42.3	
Split Option (s)	63.3	66.5	
Minimum (s)	41.2	42.3	83.6

Right Turns	
Adj Reference Time (s)	
Cross Thru Ref Time (s)	
Oncoming Left Ref Time (s)	
Combined (s)	

Intersection Summary			
Intersection Capacity Utilization	69.6%	ICU Level of Service	B

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Volume (vph)	35	407	18	24	623	15	13	22	9	15	18	24
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10	10	10	10	10	10	10
Ped Button		Yes			Yes			Yes			Yes	
Pedestrian Timing (s)		16.0			16.0			16.0			16.0	
Free Right			No			No			No			No
Ideal Flow	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120											
Adjusted Volume (vph)	41	479	21	28	733	18	15	26	11	18	21	28
Volume Combined (vph)	0	541	0	0	779	0	0	52	0	0	67	0
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.95	0.99	0.85	0.95	0.99	0.85	0.95	0.95	0.85	0.95	0.92	0.85
Saturated Flow (vph)	0	1882	0	0	1890	0	0	1814	0	0	1757	0
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.0	0.0	1.2	0.0	0.0	1.2	0.0	0.3	1.2	0.0	0.5	1.2
Pedestrian Frequency (%)		0.28			0.28			0.28			0.28	
Protected Option Allowed		No			No			No			No	
Reference Time (s)			0.0			0.0			0.0			0.0
Adj Reference Time (s)			0.0			0.0			0.0			0.0
Permitted Option Allowed		Yes			Yes			Yes			Yes	
Adj Saturation A (vph)		592			1002			1354			1226	
Reference Time A (s)		101.4			89.9			3.5			5.4	
Adj Saturation B (vph	NA	NA		NA	NA		0	0		0	0	
Reference Time B (s)	NA	NA		NA	NA		9.0	11.7		9.2	13.1	
Reference Time (s)		101.4			89.9			3.5			5.4	
Adj Reference Time (s)		105.4			93.9			11.4			12.4	
Split Option												
Ref Time Combined (s)	0.0	34.6		0.0	49.5		0.0	3.7		0.0	5.1	
Ref Time Seperate (s)	2.7	30.5		1.9	46.5		1.0	2.0		1.2	2.0	
Reference Time (s)	34.6	34.6		49.5	49.5		3.7	3.7		5.1	5.1	
Adj Reference Time (s)	38.6	38.6		53.5	53.5		11.4	11.4		12.2	12.2	

Summary	EB WB	NB SB	Combined
Protected Option (s)	NA	NA	
Permitted Option (s)	105.4	12.4	
Split Option (s)	92.0	23.6	
Minimum (s)	92.0	12.4	104.4

Right Turns
Adj Reference Time (s)
Cross Thru Ref Time (s)
Oncoming Left Ref Time (s)
Combined (s)

Intersection Summary			
Intersection Capacity Utilization	87.0%	ICU Level of Service	D

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↱		↰	↑	↱
Volume (vph)	74	183	57	239	376	15	21	116	197	19	113	69
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10	10	10	10	10	10	10
Ped Button		No			No			No			No	
Pedestrian Timing (s)		16.0			16.0			16.0			16.0	
Free Right			No			No			No			No
Ideal Flow	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120											
Adjusted Volume (vph)	87	215	67	281	442	18	25	136	232	22	133	81
Volume Combined (vph)	87	282	0	281	460	0	25	368	0	22	133	81
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.95	0.96	0.85	0.95	0.99	0.85	0.95	0.91	0.85	0.95	1.00	0.85
Saturated Flow (vph)	1805	1832	0	1805	1889	0	1805	1721	0	1805	1900	1615
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.0	0.3	1.2	0.0	0.0	1.2	0.0	0.8	1.2	0.0	0.0	1.2
Pedestrian Frequency (%)		1.00			1.00			1.00			1.00	
Protected Option Allowed		Yes			Yes			Yes			Yes	
Reference Time (s)	5.8	18.8	0.0	18.7	29.3	0.0	1.6	26.5	0.0	1.5	8.4	7.3
Adj Reference Time (s)	9.8	22.8	0.0	22.7	33.3	0.0	8.0	30.5	0.0	8.0	20.0	20.0
Permitted Option Allowed		No			No			Yes			Yes	
Adj Saturation A (vph)								1721			1900	
Reference Time A (s)								26.5			8.4	
Adj Saturation B (vph							NA	NA		NA	NA	
Reference Time B (s)							NA	NA		NA	NA	
Reference Time (s)								26.5			8.4	
Adj Reference Time (s)								30.5			20.0	
Split Option												
Ref Time Combined (s)	5.8	18.8		18.7	29.3		1.6	26.5		1.5	8.4	
Ref Time Seperate (s)	5.8	14.4		18.7	28.1		1.6	10.3		1.5	8.4	
Reference Time (s)	18.8	18.8		29.3	29.3		26.5	26.5		8.4	8.4	
Adj Reference Time (s)	22.8	22.8		33.3	33.3		30.5	30.5		20.0	20.0	

Summary	EB WB	NB SB	Combined
Protected Option (s)	45.5	38.5	
Permitted Option (s)	NA	30.5	
Split Option (s)	56.1	50.5	
Minimum (s)	45.5	30.5	75.9

Right Turns	SBR
Adj Reference Time (s)	20.0
Cross Thru Ref Time (s)	33.3
Oncoming Left Ref Time (s)	8.0
Combined (s)	61.3

Intersection Summary			
Intersection Capacity Utilization	63.3%	ICU Level of Service	B

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	90	120	290	78	58	225
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10
Ped Button	Yes		Yes			
Pedestrian Timing (s)	16.0		16.0			
Free Right		No		No		
Ideal Flow	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120					
Adjusted Volume (vph)	106	141	341	92	68	265
Volume Combined (vph)	247	0	433	0	68	265
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.89	0.85	0.97	0.85	0.95	1.00
Saturated Flow (vph)	1700	0	1840	0	1805	1900
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.7	1.2	0.3	1.2	0.0	0.0
Pedestrian Frequency (%)	0.28		0.28			0.00
Protected Option Allowed	No		Yes			Yes
Reference Time (s)		0.0	28.5	0.0	4.5	16.7
Adj Reference Time (s)		0.0	32.5	0.0	8.5	20.7
Permitted Option Allowed	No		No			No
Adj Saturation A (vph)						
Reference Time A (s)						
Adj Saturation B (vph						
Reference Time B (s)						
Reference Time (s)						
Adj Reference Time (s)						
Split Option						
Ref Time Combined (s)	18.1		28.5		4.5	16.7
Ref Time Seperate (s)	8.2		22.5		4.5	16.7
Reference Time (s)	18.1		28.5		16.7	16.7
Adj Reference Time (s)	22.1		32.5		20.7	20.7

Summary	WB	NB SB	Combined
Protected Option (s)	NA	41.0	
Permitted Option (s)	NA	NA	
Split Option (s)	22.1	53.2	
Minimum (s)	22.1	41.0	63.2

Right Turns	
Adj Reference Time (s)	
Cross Thru Ref Time (s)	
Oncoming Left Ref Time (s)	
Combined (s)	

Intersection Summary			
Intersection Capacity Utilization	52.7%	ICU Level of Service	A

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↱		↰	↱	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	0.99		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	0.95		1.00	0.97		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1761	1766		1762	1741		1766	1788		1768	1849	
Flt Permitted	0.45	1.00		0.44	1.00		0.26	1.00		0.24	1.00	
Satd. Flow (perm)	827	1766		824	1741		488	1788		438	1849	
Volume (vph)	28	175	67	145	156	85	28	334	92	53	331	14
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	33	206	79	171	184	100	33	393	108	62	389	16
Lane Group Flow (vph)	33	285	0	171	284	0	33	501	0	62	405	0
Confl. Peds. (#/hr)	10	10	10	10	10	10	10	10	10	10	10	10
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	22.0	17.0		22.0	17.0		22.0	17.0		22.0	17.0	
Effective Green, g (s)	22.0	17.0		22.0	17.0		22.0	17.0		22.0	17.0	
Actuated g/C Ratio	0.37	0.28		0.37	0.28		0.37	0.28		0.37	0.28	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)	381	500		380	493		285	507		271	524	
v/s Ratio Prot	0.01	0.16		c0.04	c0.16		0.01	c0.28		c0.02	0.22	
v/s Ratio Perm	0.02			0.13			0.03			0.06		
v/c Ratio	0.09	0.57		0.45	0.58		0.12	0.99		0.23	0.77	
Uniform Delay, d1	15.2	18.4		17.5	18.4		12.9	21.4		13.8	19.7	
Progression Factor	0.88	0.75		0.67	0.59		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	3.6		3.8	4.8		0.8	37.2		2.0	10.6	
Delay (s)	13.8	17.4		15.6	15.6		13.7	58.6		15.8	30.3	
Level of Service	B	B		B	B		B	E		B	C	
Approach Delay (s)		17.0			15.6			55.8			28.4	
Approach LOS		B			B			E			C	

Intersection Summary			
HCM Average Control Delay	31.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	69.6%	ICU Level of Service	B

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.95		1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1763	1836		1765	1747		1768	1836		1765	1832	
Flt Permitted	0.38	1.00		0.34	1.00		0.24	1.00		0.34	1.00	
Satd. Flow (perm)	710	1836		637	1747		438	1836		637	1832	
Volume (vph)	36	276	22	62	185	91	38	276	22	156	396	38
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	42	325	26	73	218	107	45	325	26	184	466	45
Lane Group Flow (vph)	42	351	0	73	325	0	45	351	0	184	511	0
Confl. Peds. (#/hr)	10	10	10	10	10	10	10	10	10	10	10	10
Confl. Bikes (#/hr)			2			2			2			2
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	22.0	17.0		22.0	17.0		22.0	17.0		22.0	17.0	
Effective Green, g (s)	22.0	17.0		22.0	17.0		22.0	17.0		22.0	17.0	
Actuated g/C Ratio	0.37	0.28		0.37	0.28		0.37	0.28		0.37	0.28	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)	348	520		328	495		271	520		328	519	
v/s Ratio Prot	0.01	c0.19		c0.02	0.19		0.01	0.19		c0.05	c0.28	
v/s Ratio Perm	0.03			0.06			0.05			0.16		
v/c Ratio	0.12	0.68		0.22	0.66		0.17	0.68		0.56	0.98	
Uniform Delay, d1	12.6	19.1		12.9	18.9		22.2	19.1		20.0	21.4	
Progression Factor	1.00	1.00		0.62	0.61		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.7	6.9		1.5	6.5		1.3	6.9		6.8	35.9	
Delay (s)	13.3	25.9		9.5	18.0		23.6	25.9		26.8	57.3	
Level of Service	B	C		A	B		C	C		C	E	
Approach Delay (s)		24.6			16.5			25.7			49.2	
Approach LOS		C			B			C			D	

Intersection Summary			
HCM Average Control Delay	32.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	66.8%	ICU Level of Service	B
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↱		↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	12	12	12
Total Lost time (s)		4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes		1.00		1.00	1.00		1.00	0.97		1.00	1.00	0.96
Flpb, ped/bikes		1.00		0.99	1.00		0.99	1.00		0.99	1.00	1.00
Frt		1.00		1.00	0.99		1.00	0.87		1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1854		1756	1832		1746	1574		1753	1863	1519
Flt Permitted		1.00		0.58	1.00		0.75	1.00		0.64	1.00	1.00
Satd. Flow (perm)		1854		1065	1832		1374	1574		1187	1863	1519
Volume (vph)	0	168	4	80	200	19	17	23	116	46	13	6
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	0	198	5	94	235	22	20	27	136	54	15	7
Lane Group Flow (vph)	0	203	0	94	257	0	20	163	0	54	15	7
Confl. Peds. (#/hr)	10	10	10	10	10	10	10	10	10	10	10	10
Confl. Bikes (#/hr)			2			2			2			2
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8			4		4
Actuated Green, G (s)		17.0		22.0	17.0		22.0	17.0		22.0	17.0	17.0
Effective Green, g (s)		17.0		22.0	17.0		22.0	17.0		22.0	17.0	17.0
Actuated g/C Ratio		0.28		0.37	0.28		0.37	0.28		0.37	0.28	0.28
Clearance Time (s)		4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Grp Cap (vph)		525		448	519		535	446		482	528	430
v/s Ratio Prot		0.11		c0.02	c0.14		0.00	c0.10		c0.01	0.01	
v/s Ratio Perm				0.06			0.01			0.03		0.00
v/c Ratio		0.39		0.21	0.50		0.04	0.37		0.11	0.03	0.02
Uniform Delay, d1		17.3		12.7	17.9		12.2	17.2		12.4	15.5	15.5
Progression Factor		0.72		1.00	1.00		1.00	1.00		0.99	1.00	0.98
Incremental Delay, d2		1.8		1.1	3.4		0.1	2.3		0.5	0.1	0.1
Delay (s)		14.3		13.8	21.3		12.3	19.5		12.8	15.6	15.3
Level of Service		B		B	C		B	B		B	B	B
Approach Delay (s)		14.3			19.3			18.7			13.6	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	17.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	41.9%	ICU Level of Service	A
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
1: Hardee Rd. & Stanley Rd.

8/29/2006

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱	↰	↑	↰	↱
Sign Control	Stop			Stop	Stop	
Volume (veh/h)	40	79	363	4	11	744
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (veh/h)	47	93	427	5	13	875

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2
Volume Total (vph)	47	93	427	5	13	875
Volume Left (vph)	0	0	427	0	13	0
Volume Right (vph)	0	93	0	0	0	875
Hadj (s)	0.0	-0.6	0.2	0.0	0.2	-0.6
Departure Headway (s)	7.4	6.8	8.1	7.9	6.8	6.0
Degree Utilization, x	0.10	0.18	0.96	0.01	0.02	1.46
Capacity (veh/h)	475	516	437	437	518	605
Control Delay (s)	10.0	10.1	60.6	9.8	8.8	231.3
Approach Delay (s)	10.1		60.1		228.0	
Approach LOS	B		F		F	

Intersection Summary			
Delay	157.5		
HCM Level of Service	F		
Intersection Capacity Utilization	68.1%	ICU Level of Service	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Volume (veh/h)	393	174	94	52	101	136	145	475	46	74	294	94
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (veh/h)	462	205	111	61	119	160	171	559	54	87	346	111

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	778	340	784	544
Volume Left (vph)	462	61	171	87
Volume Right (vph)	111	160	54	111
Hadj (s)	0.1	-0.2	0.0	-0.1
Departure Headway (s)	8.7	8.4	8.7	8.6
Degree Utilization, x	1.88	0.80	1.89	1.30
Capacity (veh/h)	419	405	420	427
Control Delay (s)	426.2	37.1	429.3	175.5
Approach Delay (s)	426.2	37.1	429.3	175.5
Approach LOS	F	E	F	F

Intersection Summary			
Delay	317.4		
HCM Level of Service	F		
Intersection Capacity Utilization	148.7%	ICU Level of Service	H

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	124	50	40	168	103	52
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (veh/h)	146	59	47	198	121	61
Pedestrians	10			10	10	
Lane Width (ft)	12.0			12.0	11.0	
Walking Speed (ft/s)	4.0			4.0	4.0	
Percent Blockage	1			1	1	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
vC, conflicting volume			215		487	195
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			97		76	93
cM capacity (veh/h)			1345		512	833

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	205	245	182
Volume Left	0	47	121
Volume Right	59	0	61
cSH	1700	1345	588
Volume to Capacity	0.12	0.03	0.31
Queue Length (ft)	0	3	33
Control Delay (s)	0.0	1.7	13.8
Lane LOS		A	B
Approach Delay (s)	0.0	1.7	13.8
Approach LOS			B

Intersection Summary			
Average Delay	4.7		
Intersection Capacity Utilization	46.6%	ICU Level of Service	A

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Yield	
Grade	0%			0%	0%	
Volume (veh/h)	70	14	58	94	78	52
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (veh/h)	82	16	68	111	92	61
Pedestrians	10			10	10	
Lane Width (ft)	12.0			12.0	11.0	
Walking Speed (ft/s)	4.0			4.0	4.0	
Percent Blockage	1			1	1	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
vC, conflicting volume			109		358	111
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			95		85	93
cM capacity (veh/h)			1470		601	928

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	99	179	153
Volume Left	0	68	92
Volume Right	16	0	61
cSH	1700	1470	700
Volume to Capacity	0.06	0.05	0.22
Queue Length (ft)	0	4	21
Control Delay (s)	0.0	3.1	11.6
Lane LOS		A	B
Approach Delay (s)	0.0	3.1	11.6
Approach LOS			B

Intersection Summary			
Average Delay	5.4		
Intersection Capacity Utilization	33.3%	ICU Level of Service	A

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	26	30	40	34	80	140
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (veh/h)	31	35	47	40	94	165
Pedestrians	10			10	10	
Lane Width (ft)	12.0			11.0	11.0	
Walking Speed (ft/s)	4.0			4.0	4.0	
Percent Blockage	1			1	1	
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	331	196	269			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	95	96	96			
cM capacity (veh/h)	630	831	1284			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	66	87	259
Volume Left	31	47	0
Volume Right	35	0	165
cSH	724	1284	1700
Volume to Capacity	0.09	0.04	0.15
Queue Length (ft)	7	3	0
Control Delay (s)	10.5	4.4	0.0
Lane LOS	B	A	
Approach Delay (s)	10.5	4.4	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	29.3%	ICU Level of Service	A

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	46	1000	470	40	142	70
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (veh/h)	54	1176	553	47	167	82
Pedestrians		10	10		10	
Lane Width (ft)		12.0	12.0		11.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		1	1		1	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
vC, conflicting volume	610				1881	596
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	94				0	83
cM capacity (veh/h)	961				73	495

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	1231	600	249
Volume Left	54	0	167
Volume Right	0	47	82
cSH	961	1700	101
Volume to Capacity	0.06	0.35	2.47
Queue Length (ft)	4	0	567
Control Delay (s)	2.0	0.0	757.1
Lane LOS	A		F
Approach Delay (s)	2.0	0.0	757.1
Approach LOS			F

Intersection Summary			
Average Delay	91.9		
Intersection Capacity Utilization	121.6%	ICU Level of Service	H

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	26	304	4	0	444	13	9	18	22	9	33	35
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (veh/h)	31	358	5	0	522	15	11	21	26	11	39	41
Pedestrians		10			10			10			10	
Lane Width (ft)		12.0			12.0			11.0			11.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		1			1			1			1	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
vC, conflicting volume	548			372			1032	979	380	1008	974	550
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	97			100			93	91	96	94	84	92
cM capacity (veh/h)	1014			1177			162	239	656	187	241	526

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	393	538	58	91
Volume Left	31	0	11	11
Volume Right	5	15	26	41
cSH	1014	1177	298	306
Volume to Capacity	0.03	0.00	0.19	0.30
Queue Length (ft)	2	0	18	30
Control Delay (s)	1.0	0.0	19.9	21.7
Lane LOS	A		C	C
Approach Delay (s)	1.0	0.0	19.9	21.7
Approach LOS			C	C

Intersection Summary			
Average Delay	3.2		
Intersection Capacity Utilization	53.7%	ICU Level of Service	A

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	108	122	281	69	67	324
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (veh/h)	127	144	331	81	79	381
Pedestrians	10		10			10
Lane Width (ft)	11.0		12.0			12.0
Walking Speed (ft/s)	4.0		4.0			4.0
Percent Blockage	1		1			1
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	930	391			422	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	53	78			93	
cM capacity (veh/h)	272	647			1129	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	271	412	79	381
Volume Left	127	0	79	0
Volume Right	144	81	0	0
cSH	392	1700	1129	1700
Volume to Capacity	0.69	0.24	0.07	0.22
Queue Length (ft)	125	0	6	0
Control Delay (s)	32.2	0.0	8.4	0.0
Lane LOS	D		A	
Approach Delay (s)	32.2	0.0	1.4	
Approach LOS	D			

Intersection Summary			
Average Delay	8.2		
Intersection Capacity Utilization	53.3%	ICU Level of Service	A

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱	↰	↑	↰	↱
Volume (vph)	40	79	363	4	11	744
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10
Ped Button	Yes				Yes	
Pedestrian Timing (s)	16.0				16.0	
Free Right		No				No
Ideal Flow	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120					
Adjusted Volume (vph)	47	93	427	5	13	875
Volume Combined (vph)	47	93	427	5	13	875
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	1.00	0.85	0.95	1.00	0.95	0.85
Saturated Flow (vph)	1900	1615	1805	1900	1805	1615
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.0	1.2	0.0	0.0	0.0	1.2
Pedestrian Frequency (%)	0.28			0.00	0.28	
Protected Option Allowed	Yes			Yes	No	
Reference Time (s)	3.0	8.1	28.4	0.3		66.3
Adj Reference Time (s)	11.4	14.4	32.4	8.0		70.3
Permitted Option Allowed	Yes			Yes	No	
Adj Saturation A (vph)	1900			NA		
Reference Time A (s)	3.0			NA		
Adj Saturation B (vph	1900		0	1900		
Reference Time B (s)	3.0		36.4	0.3		
Reference Time (s)	3.0			36.4		
Adj Reference Time (s)	11.4			40.4		
Split Option						
Ref Time Combined (s)	3.0		28.4	0.3	0.9	
Ref Time Seperate (s)	3.0		28.4	0.3	0.9	
Reference Time (s)	3.0		28.4	28.4	0.9	
Adj Reference Time (s)	11.4		32.4	32.4	11.4	

Summary	EB WB	NB	Combined
Protected Option (s)	43.8	NA	
Permitted Option (s)	40.4	NA	
Split Option (s)	43.8	11.4	
Minimum (s)	40.4	11.4	51.8

Right Turns	EBR	NBR
Adj Reference Time (s)	14.4	70.3
Cross Thru Ref Time (s)	0.0	11.4
Oncoming Left Ref Time (s)	32.4	0.0
Combined (s)	46.8	81.7

Intersection Summary			
Intersection Capacity Utilization	68.1%	ICU Level of Service	B

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Volume (vph)	393	174	94	52	101	136	145	475	46	74	294	94
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10	10	10	10	10	10	10
Ped Button		Yes			Yes			Yes			Yes	
Pedestrian Timing (s)		16.0			16.0			16.0			16.0	
Free Right			No			No			No			No
Ideal Flow	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120											
Adjusted Volume (vph)	462	205	111	61	119	160	171	559	54	87	346	111
Volume Combined (vph)	0	778	0	0	340	0	0	784	0	0	544	0
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.95	0.95	0.85	0.95	0.92	0.85	0.95	0.98	0.85	0.95	0.96	0.85
Saturated Flow (vph)	0	1804	0	0	1750	0	0	1860	0	0	1827	0
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.0	0.2	1.2	0.0	0.6	1.2	0.0	0.1	1.2	0.0	0.3	1.2
Pedestrian Frequency (%)		0.28			0.28			0.28			0.28	
Protected Option Allowed		No			No			No			No	
Reference Time (s)			0.0			0.0			0.0			0.0
Adj Reference Time (s)			0.0			0.0			0.0			0.0
Permitted Option Allowed		No			No			No			No	
Adj Saturation A (vph)												
Reference Time A (s)												
Adj Saturation B (vph												
Reference Time B (s)												
Reference Time (s)												
Adj Reference Time (s)												
Split Option												
Ref Time Combined (s)	0.0	51.9		0.0	23.9		0.0	50.6		0.0	35.9	
Ref Time Seperate (s)	30.7	13.8		4.1	8.8		11.3	35.9		5.8	22.9	
Reference Time (s)	51.9	51.9		23.9	23.9		50.6	50.6		35.9	35.9	
Adj Reference Time (s)	55.9	55.9		27.9	27.9		54.6	54.6		39.9	39.9	

Summary	EB WB	NB SB	Combined
Protected Option (s)	NA	NA	
Permitted Option (s)	NA	NA	
Split Option (s)	83.8	94.6	
Minimum (s)	83.8	94.6	178.4

Right Turns	
Adj Reference Time (s)	
Cross Thru Ref Time (s)	
Oncoming Left Ref Time (s)	
Combined (s)	

Intersection Summary			
Intersection Capacity Utilization	148.7%	ICU Level of Service	H

Reference Times and Phasing Options do not represent an optimized timing plan.

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↰	↰↱	
Volume (vph)	124	50	40	168	103	52
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10
Ped Button	Yes				Yes	
Pedestrian Timing (s)	16.0				16.0	
Free Right		No				No
Ideal Flow	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120					
Adjusted Volume (vph)	146	59	47	198	121	61
Volume Combined (vph)	205	0	0	245	182	0
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.96	0.85	0.95	0.99	0.92	0.85
Saturated Flow (vph)	1818	0	0	1882	1744	0
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.4	1.2	0.0	0.0	0.4	1.2
Pedestrian Frequency (%)	0.28			0.00	0.28	
Protected Option Allowed	No			No	No	
Reference Time (s)		0.0				0.0
Adj Reference Time (s)		0.0				0.0
Permitted Option Allowed	Yes			Yes	No	
Adj Saturation A (vph)	1818			410		
Reference Time A (s)	13.9			57.9		
Adj Saturation B (vph	NA		NA	NA		
Reference Time B (s)	NA		NA	NA		
Reference Time (s)	13.9			57.9		
Adj Reference Time (s)	18.5			61.9		
Split Option						
Ref Time Combined (s)	13.9		0.0	15.6	13.0	
Ref Time Seperate (s)	10.0		3.1	12.5	8.8	
Reference Time (s)	13.9		15.6	15.6	13.0	
Adj Reference Time (s)	18.5		19.6	19.6	17.8	

Summary	EB WB	NB	Combined
Protected Option (s)	NA	NA	
Permitted Option (s)	61.9	NA	
Split Option (s)	38.1	17.8	
Minimum (s)	38.1	17.8	55.9

Right Turns	
Adj Reference Time (s)	
Cross Thru Ref Time (s)	
Oncoming Left Ref Time (s)	
Combined (s)	

Intersection Summary			
Intersection Capacity Utilization	46.6%	ICU Level of Service	A

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	70	14	58	94	78	52
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10
Ped Button	Yes				Yes	
Pedestrian Timing (s)	16.0				16.0	
Free Right		No				No
Ideal Flow	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120					
Adjusted Volume (vph)	82	16	68	111	92	61
Volume Combined (vph)	99	0	0	179	153	0
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.98	0.85	0.95	0.98	0.91	0.85
Saturated Flow (vph)	1853	0	0	1864	1732	0
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.2	1.2	0.0	0.0	0.5	1.2
Pedestrian Frequency (%)	0.28			0.00	0.28	
Protected Option Allowed	No			No	No	
Reference Time (s)		0.0				0.0
Adj Reference Time (s)		0.0				0.0
Permitted Option Allowed	Yes			Yes	No	
Adj Saturation A (vph)	1853			NA		
Reference Time A (s)	6.6			NA		
Adj Saturation B (vph	1853		0	0		
Reference Time B (s)	6.6		12.5	19.5		
Reference Time (s)	6.6			19.5		
Adj Reference Time (s)	13.3			23.5		
Split Option						
Ref Time Combined (s)	6.6		0.0	11.5	11.1	
Ref Time Seperate (s)	5.5		4.5	7.0	6.9	
Reference Time (s)	6.6		11.5	11.5	11.1	
Adj Reference Time (s)	13.3		15.5	15.5	16.5	

Summary	EB WB	NB	Combined
Protected Option (s)	NA	NA	
Permitted Option (s)	23.5	NA	
Split Option (s)	28.8	16.5	
Minimum (s)	23.5	16.5	40.0

Right Turns	
Adj Reference Time (s)	
Cross Thru Ref Time (s)	
Oncoming Left Ref Time (s)	
Combined (s)	

Intersection Summary			
Intersection Capacity Utilization	33.3%	ICU Level of Service	A

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	26	30	40	34	80	140
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10
Ped Button	Yes				Yes	
Pedestrian Timing (s)	16.0				16.0	
Free Right		No				No
Ideal Flow	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120					
Adjusted Volume (vph)	31	35	47	40	94	165
Volume Combined (vph)	66	0	0	87	259	0
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.90	0.85	0.95	0.97	0.90	0.85
Saturated Flow (vph)	1707	0	0	1849	1719	0
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.7	1.2	0.0	0.0	0.8	1.2
Pedestrian Frequency (%)	0.28			0.00	0.28	
Protected Option Allowed	No			No	No	
Reference Time (s)		0.0				0.0
Adj Reference Time (s)		0.0				0.0
Permitted Option Allowed	No			Yes	Yes	
Adj Saturation A (vph)				410	1719	
Reference Time A (s)				11.7	18.9	
Adj Saturation B (vph			NA	NA	1719	
Reference Time B (s)			NA	NA	18.9	
Reference Time (s)				11.7	18.9	
Adj Reference Time (s)				15.7	22.9	
Split Option						
Ref Time Combined (s)	5.3		0.0	5.7	18.9	
Ref Time Seperate (s)	2.8		3.1	2.5	7.4	
Reference Time (s)	5.3		5.7	5.7	18.9	
Adj Reference Time (s)	12.3		9.7	9.7	22.9	

Summary	EB	NB SB	Combined
Protected Option (s)	NA	NA	
Permitted Option (s)	NA	22.9	
Split Option (s)	12.3	32.5	
Minimum (s)	12.3	22.9	35.2

Right Turns	
Adj Reference Time (s)	
Cross Thru Ref Time (s)	
Oncoming Left Ref Time (s)	
Combined (s)	

Intersection Summary			
Intersection Capacity Utilization	29.3%	ICU Level of Service	A

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	46	1000	470	40	142	70
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10
Ped Button			Yes		Yes	
Pedestrian Timing (s)			16.0		16.0	
Free Right				No		No
Ideal Flow	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120					
Adjusted Volume (vph)	54	1176	553	47	167	82
Volume Combined (vph)	0	1231	600	0	249	0
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.95	1.00	0.99	0.85	0.92	0.85
Saturated Flow (vph)	0	1896	1878	0	1745	0
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.0	0.0	0.1	1.2	0.4	1.2
Pedestrian Frequency (%)		0.00	0.28		0.28	
Protected Option Allowed		No	No		No	
Reference Time (s)				0.0		0.0
Adj Reference Time (s)				0.0		0.0
Permitted Option Allowed		Yes	Yes		No	
Adj Saturation A (vph)		186	1878			
Reference Time A (s)		757.9	38.4			
Adj Saturation B (vph	NA	NA	NA			
Reference Time B (s)	NA	NA	NA			
Reference Time (s)		757.9	38.4			
Adj Reference Time (s)		761.9	42.4			
Split Option						
Ref Time Combined (s)	0.0	77.9	38.4		17.6	
Ref Time Seperate (s)	3.6	74.3	35.4		11.9	
Reference Time (s)	77.9	77.9	38.4		17.6	
Adj Reference Time (s)	81.9	81.9	42.4		21.6	

Summary	EB WB	SB	Combined
Protected Option (s)	NA	NA	
Permitted Option (s)	761.9	NA	
Split Option (s)	124.3	21.6	
Minimum (s)	124.3	21.6	145.9

Right Turns	
Adj Reference Time (s)	
Cross Thru Ref Time (s)	
Oncoming Left Ref Time (s)	
Combined (s)	

Intersection Summary			
Intersection Capacity Utilization	121.6%	ICU Level of Service	H

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↱		↰	↱	
Volume (vph)	28	175	67	145	156	85	28	334	92	53	331	14
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10	10	10	10	10	10	10
Ped Button		No			No			No			No	
Pedestrian Timing (s)		16.0			16.0			16.0			16.0	
Free Right			No			No			No			No
Ideal Flow	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120											
Adjusted Volume (vph)	33	206	79	171	184	100	33	393	108	62	389	16
Volume Combined (vph)	33	285	0	171	284	0	33	501	0	62	406	0
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.95	0.96	0.85	0.95	0.95	0.85	0.95	0.97	0.85	0.95	0.99	0.85
Saturated Flow (vph)	1805	1821	0	1805	1799	0	1805	1838	0	1805	1888	0
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.0	0.3	1.2	0.0	0.4	1.2	0.0	0.3	1.2	0.0	0.1	1.2
Pedestrian Frequency (%)		1.00			1.00			1.00			1.00	
Protected Option Allowed		Yes			Yes			Yes			Yes	
Reference Time (s)	2.2	19.1	0.0	11.3	19.3	0.0	2.2	33.0	0.0	4.1	25.8	0.0
Adj Reference Time (s)	8.0	23.1	0.0	15.3	23.3	0.0	8.0	37.0	0.0	8.1	29.8	0.0
Permitted Option Allowed		No			No			No			No	
Adj Saturation A (vph)												
Reference Time A (s)												
Adj Saturation B (vph												
Reference Time B (s)												
Reference Time (s)												
Adj Reference Time (s)												
Split Option												
Ref Time Combined (s)	2.2	19.1		11.3	19.3		2.2	33.0		4.1	25.8	
Ref Time Seperate (s)	2.2	13.9		11.3	12.7		2.2	25.9		4.1	24.8	
Reference Time (s)	19.1	19.1		19.3	19.3		33.0	33.0		25.8	25.8	
Adj Reference Time (s)	23.1	23.1		23.3	23.3		37.0	37.0		29.8	29.8	

Summary	EB WB	NB SB	Combined
Protected Option (s)	38.4	45.1	
Permitted Option (s)	NA	NA	
Split Option (s)	46.4	66.8	
Minimum (s)	38.4	45.1	83.6

Right Turns	
Adj Reference Time (s)	
Cross Thru Ref Time (s)	
Oncoming Left Ref Time (s)	
Combined (s)	

Intersection Summary

Intersection Capacity Utilization	69.6%	ICU Level of Service	B

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱		↰	↑↱		↰	↑↱	
Volume (vph)	36	276	22	62	185	91	38	276	22	156	396	38
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10	10	10	10	10	10	10
Ped Button		No			No			No			No	
Pedestrian Timing (s)		16.0			16.0			16.0			16.0	
Free Right			No			No			No			No
Ideal Flow	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120											
Adjusted Volume (vph)	42	325	26	73	218	107	45	325	26	184	466	45
Volume Combined (vph)	42	351	0	73	325	0	45	351	0	184	511	0
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.95	0.99	0.85	0.95	0.95	0.85	0.95	0.99	0.85	0.95	0.99	0.85
Saturated Flow (vph)	1805	1879	0	1805	1806	0	1805	1879	0	1805	1875	0
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.0	0.1	1.2	0.0	0.4	1.2	0.0	0.1	1.2	0.0	0.1	1.2
Pedestrian Frequency (%)		1.00			1.00			1.00			1.00	
Protected Option Allowed		Yes			Yes			Yes			Yes	
Reference Time (s)	2.8	22.5	0.0	4.8	22.0	0.0	3.0	22.5	0.0	12.2	32.8	0.0
Adj Reference Time (s)	8.0	26.5	0.0	8.8	26.0	0.0	8.0	26.5	0.0	16.2	36.8	0.0
Permitted Option Allowed		No			No			No			No	
Adj Saturation A (vph)												
Reference Time A (s)												
Adj Saturation B (vph												
Reference Time B (s)												
Reference Time (s)												
Adj Reference Time (s)												
Split Option												
Ref Time Combined (s)	2.8	22.5		4.8	22.0		3.0	22.5		12.2	32.8	
Ref Time Seperate (s)	2.8	20.8		4.8	14.9		3.0	20.8		12.2	29.9	
Reference Time (s)	22.5	22.5		22.0	22.0		22.5	22.5		32.8	32.8	
Adj Reference Time (s)	26.5	26.5		26.0	26.0		26.5	26.5		36.8	36.8	

Summary	EB WB	NB SB	Combined
Protected Option (s)	35.3	44.8	
Permitted Option (s)	NA	NA	
Split Option (s)	52.5	63.3	
Minimum (s)	35.3	44.8	80.1

Right Turns	
Adj Reference Time (s)	
Cross Thru Ref Time (s)	
Oncoming Left Ref Time (s)	
Combined (s)	

Intersection Summary			
Intersection Capacity Utilization	66.8%	ICU Level of Service	B

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Volume (vph)	26	304	4	0	444	13	9	18	22	9	33	35
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10	10	10	10	10	10	10
Ped Button		Yes			Yes			Yes			Yes	
Pedestrian Timing (s)		16.0			16.0			16.0			16.0	
Free Right			No			No			No			No
Ideal Flow	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120											
Adjusted Volume (vph)	31	358	5	0	522	15	11	21	26	11	39	41
Volume Combined (vph)	0	393	0	0	538	0	0	58	0	0	91	0
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.95	0.99	0.85	0.95	1.00	0.85	0.95	0.92	0.85	0.95	0.93	0.85
Saturated Flow (vph)	0	1889	0	0	1892	0	0	1756	0	0	1760	0
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.0	0.0	1.2	0.0	0.0	1.2	0.0	0.6	1.2	0.0	0.6	1.2
Pedestrian Frequency (%)		0.28			0.28			0.28			0.28	
Protected Option Allowed		No			No			No			No	
Reference Time (s)			0.0			0.0			0.0			0.0
Adj Reference Time (s)			0.0			0.0			0.0			0.0
Permitted Option Allowed		Yes			Yes			Yes			Yes	
Adj Saturation A (vph)		930			1892			1436			1444	
Reference Time A (s)		46.8			34.1			4.5			7.2	
Adj Saturation B (vph	NA	NA		NA	NA		0	0		0	0	
Reference Time B (s)	NA	NA		NA	NA		8.7	12.5		8.7	14.7	
Reference Time (s)		46.8			34.1			4.5			7.2	
Adj Reference Time (s)		50.8			38.1			11.8			13.7	
Split Option												
Ref Time Combined (s)	0.0	25.0		0.0	34.1		0.0	4.5		0.0	6.7	
Ref Time Seperate (s)	2.0	22.6		0.0	33.2		0.7	2.0		0.7	3.2	
Reference Time (s)	25.0	25.0		34.1	34.1		4.5	4.5		6.7	6.7	
Adj Reference Time (s)	29.0	29.0		38.1	38.1		11.8	11.8		13.4	13.4	

Summary	EB WB	NB SB	Combined
Protected Option (s)	NA	NA	
Permitted Option (s)	50.8	13.7	
Split Option (s)	67.1	25.1	
Minimum (s)	50.8	13.7	64.5

Right Turns	
Adj Reference Time (s)	
Cross Thru Ref Time (s)	
Oncoming Left Ref Time (s)	
Combined (s)	

Intersection Summary			
Intersection Capacity Utilization	53.7%	ICU Level of Service	A

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	168	4	80	200	19	17	23	116	46	13	6
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10	10	10	10	10	10	10
Ped Button		No			No			No			No	
Pedestrian Timing (s)		16.0			16.0			16.0			16.0	
Free Right			No			No			No			No
Ideal Flow	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120											
Adjusted Volume (vph)	0	198	5	94	235	22	20	27	136	54	15	7
Volume Combined (vph)	0	202	0	94	258	0	20	164	0	54	15	7
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.95	1.00	0.85	0.95	0.99	0.85	0.95	0.87	0.85	0.95	1.00	0.85
Saturated Flow (vph)	1805	1893	0	1805	1875	0	1805	1662	0	1805	1900	1615
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.0	0.0	1.2	0.0	0.1	1.2	0.0	1.0	1.2	0.0	0.0	1.2
Pedestrian Frequency (%)		1.00			1.00			1.00			1.00	
Protected Option Allowed		Yes			Yes			Yes			Yes	
Reference Time (s)	0.0	12.9	0.0	6.3	16.6	0.0	1.3	12.8	0.0	3.6	1.0	1.8
Adj Reference Time (s)	8.0	20.0	0.0	10.3	20.6	0.0	8.0	20.0	0.0	8.0	20.0	20.0
Permitted Option Allowed		No			No			Yes			Yes	
Adj Saturation A (vph)								1662			1900	
Reference Time A (s)								12.8			1.0	
Adj Saturation B (vph							0	1662		NA	NA	
Reference Time B (s)							9.3	12.8		NA	NA	
Reference Time (s)								12.8			1.0	
Adj Reference Time (s)								20.0			20.0	
Split Option												
Ref Time Combined (s)	0.0	12.9		6.3	16.6		1.3	12.8		3.6	1.0	
Ref Time Seperate (s)	0.0	12.6		6.3	15.2		1.3	3.0		3.6	1.0	
Reference Time (s)	12.9	12.9		16.6	16.6		12.8	12.8		3.6	3.6	
Adj Reference Time (s)	20.0	20.0		20.6	20.6		20.0	20.0		20.0	20.0	

Summary	EB WB	NB SB	Combined
Protected Option (s)	30.3	28.0	
Permitted Option (s)	NA	20.0	
Split Option (s)	40.6	40.0	
Minimum (s)	30.3	20.0	50.3

Right Turns	SBR
Adj Reference Time (s)	20.0
Cross Thru Ref Time (s)	20.6
Oncoming Left Ref Time (s)	8.0
Combined (s)	48.6

Intersection Summary			
Intersection Capacity Utilization	41.9%	ICU Level of Service	A

Reference Times and Phasing Options do not represent an optimized timing plan.

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	108	122	281	69	67	324
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Pedestrians	10	10	10	10	10	10
Ped Button	Yes		Yes			
Pedestrian Timing (s)	16.0		16.0			
Free Right		No		No		
Ideal Flow	1900	1900	1900	1900	1900	1900
Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Refr Cycle Length (s)	120					
Adjusted Volume (vph)	127	144	331	81	79	381
Volume Combined (vph)	271	0	412	0	79	381
Lane Utilization Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Factor (vph)	0.90	0.85	0.97	0.85	0.95	1.00
Saturated Flow (vph)	1708	0	1844	0	1805	1900
Minimum Green (s)	4.0	4.0	4.0	4.0	4.0	4.0
Ped Intf Time (s)	0.7	1.2	0.2	1.2	0.0	0.0
Pedestrian Frequency (%)	0.28		0.28			0.00
Protected Option Allowed	No		Yes			Yes
Reference Time (s)		0.0	27.0	0.0	5.2	24.1
Adj Reference Time (s)		0.0	31.0	0.0	9.2	28.1
Permitted Option Allowed	No		No			No
Adj Saturation A (vph)						
Reference Time A (s)						
Adj Saturation B (vph						
Reference Time B (s)						
Reference Time (s)						
Adj Reference Time (s)						
Split Option						
Ref Time Combined (s)	19.7		27.0		5.2	24.1
Ref Time Seperate (s)	9.6		21.8		5.2	24.1
Reference Time (s)	19.7		27.0		24.1	24.1
Adj Reference Time (s)	23.7		31.0		28.1	28.1

Summary	WB	NB SB	Combined
Protected Option (s)	NA	40.3	
Permitted Option (s)	NA	NA	
Split Option (s)	23.7	59.1	
Minimum (s)	23.7	40.3	64.0

Right Turns	
Adj Reference Time (s)	
Cross Thru Ref Time (s)	
Oncoming Left Ref Time (s)	
Combined (s)	

Intersection Summary			
Intersection Capacity Utilization	53.3%	ICU Level of Service	A

Reference Times and Phasing Options do not represent an optimized timing plan.

G.5 EXISTING SEGMENT ROADWAY ANALYSIS – HQ/ADMINISTRATIVE AREA

Region	Corridor	Existing Conditions
Head Quarter	N New Braunfels	

Location	Direction	ADT	ADT	VPH	DS	LOS
Road S-3 (E)	East	230	455	46	51	A
	West	225				
Road S-6 (W)	East	231	451	45	51	A
	West	220				
Wilson (E)	East	2015	4248	425	53	A
	West	2233				
Wilson (W)	East	2724	4618	462	59	A
	West	1894				
Road S-4 (E)	East	134	273	27	51	A
	West	139				
Stanley (E)	East	1065	1920	192	55	A
	West	855				
Stanley (W)	East	1462	2417	242	60	A
	West	955				
Dickman /Artillery Post (E)	East	472	1049	105	55	A
	West	577				
Dickman /Artillery Post (W)	East	247	556	56	56	A
	West	309				
Graham (E)	East	363	810	81	55	A
	West	447				
Service Street 1 (E)	East	106	161	16	66	A
	West	55				
Service Street 2 (W)	East	57	116	12	51	A
	West	59				
Wheaton Road (E)	East	142	170	17	84	A
	West	28				

Region	Corridor	Existing Conditions
BAMC	George Beach Avenue	

Location	Direction	ADT	ADT	VPH	DS	LOS
George Beach Avenue	Two-way	7881	7881	788	55	A

TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	PZ	Highway	Road S-3 (E)
Agency or Company	MACTEC	From/To	
Date Performed	6/12/2006	Jurisdiction	
Analysis Time Period	DAY	Analysis Year	2003

Input Data

Shoulder width ______ ft
Lane width ______ ft
Lane width ______ ft
Shoulder width ______ ft
Segment length, L_t ______ mi

Show North Arrow

Class I highway ☐ Class II highway ☑
Terrain ☑ Level ☐ Rolling

Two-way hourly volume	46 veh/h
Directional split	51 / 49
Peak-hour factor, PHF	0.88
No-passing zone	0
% Trucks and Buses , P_T	5 %
% Recreational vehicles, P_R	2%
Access points/ mi	8

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	1.7
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	1.0
Heavy-vehicle adjustment factor, f_{HV} f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	0.966
Two-way flow rate[1], v_p (pc/h) v_p=V/ (PHF * f_G * f_{HV})	54
v_p * highest directional split proportion[2] (pc/h)	28

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	mi/h	Base free-flow speed, $BFFS_{FM}$	45.0 mi/h
Observed volume, V_f	veh/h	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	6.0 mi/h
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	34.0 mi/h	Adj. for access points, f_A (Exhibit 20-6)	5.0 mi/h
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	34.0 mi/h

Adj. for no-passing zones, f_{np} (mi/h) (Exhibit 20-11)	0.0
Average travel speed, ATS (mi/h) ATS=FFS-0.00776v_p-f_{np}	33.6

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	1.1
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	1.0
Heavy-vehicle adjustment factor, f_{HV} f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	0.995
Two-way flow rate[1], v_p (pc/h) v_p=V/ (PHF * f_G * f_{HV})	53
v_p * highest directional split proportion[2] (pc/h)	27
Base percent time-spent-following, BPTSF(%) BPTSF=100(1-$e^{-0.000879v_p}$)	4.6
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	0.2
Percent time-spent-following, PTSF(%) PTSF=BPTSF+$f_{d/np}$	4.8

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	A
Volume to capacity ratio v/c v/c=V_p/ 3,200	0.02
Peak 15-min veh-miles of travel,VMT_{15} (veh- mi) VMT_{15}= 0.25L_t(V/PHF)	13
Peak-hour vehicle-miles of travel, VMT_{60} (veh- mi) VMT_{60}=V*L_t	46
Peak 15-min total travel time, TT_{15}(veh-h) TT_{15}= VMT_{15}/ATS	0.4

Notes

1. If v_p >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split v_p>= 1,700 pc/h, terminated anlysis-the LOS is F.

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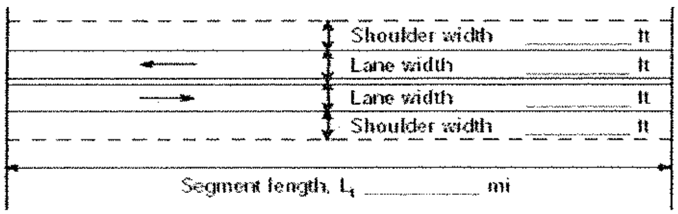
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		*Site Information*	
Analyst	PZ	Highway	Road S-6 (W)
Agency or Company	MACTEC	From/To	
Date Performed	6/12/2006	Jurisdiction	
Analysis Time Period	DAY	Analysis Year	2003

Input Data



Class I highway — Class II highway (checked)

Terrain: Level (checked) — Rolling

Two-way hourly volume	45 veh/h
Directional split	51 / 49
Peak-hour factor, PHF	0.88
No-passing zone	0
% Trucks and Buses , P_T	5 %
% Recreational vehicles, P_R	2%
Access points/ mi	8

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	1.7
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	1.0
Heavy-vehicle adjustment factor, f_{HV} f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	0.966
Two-way flow rate[1], v_p (pc/h) v_p=V/ (PHF * f_G * f_{HV})	53
v_p * highest directional split proportion[2] (pc/h)	27

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
		Base free-flow speed, $BFFS_{FM}$	45.0 mi/h
Field Measured speed, S_{FM}	mi/h	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	6.0 mi/h
Observed volume, V_f	veh/h	Adj. for access points, f_A (Exhibit 20-6)	5.0 mi/h
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	34.0 mi/h	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	34.0 mi/h

Adj. for no-passing zones, f_{np} (mi/h) (Exhibit 20-11)	0.0
Average travel speed, ATS (mi/h) ATS=FFS-0.00776v_p-f_{np}	33.6

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	1.1
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	1.0
Heavy-vehicle adjustment factor, f_{HV} f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	0.995
Two-way flow rate[1], v_p (pc/h) v_p=V/ (PHF * f_G * f_{HV})	51
v_p * highest directional split proportion[2] (pc/h)	26
Base percent time-spent-following, BPTSF(%) BPTSF=100(1-$e^{-0.000879v_p}$)	4.4
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	0.2
Percent time-spent-following, PTSF(%) PTSF=BPTSF+$f_{d/np}$	4.6

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	A
Volume to capacity ratio v/c v/c=V_p/ 3,200	0.02
Peak 15-min veh-miles of travel,VMT_{15} (veh- mi) VMT_{15}= 0.25L_t(V/PHF)	13
Peak-hour vehicle-miles of travel, VMT_{60} (veh- mi) VMT_{60}=V*L_t	45
Peak 15-min total travel time, TT_{15}(veh-h) TT_{15}= VMT_{15}/ATS	0.4

Notes

1. If v_p >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split v_p>= 1,700 pc/h, terminated anlysis-the LOS is F.

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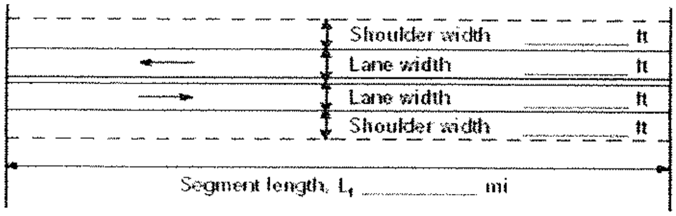
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	PZ	Highway	Wilson (E)
Agency or Company	MACTEC	From/To	
Date Performed	6/12/2006	Jurisdiction	
Analysis Time Period	DAY	Analysis Year	2003

Input Data



Class I highway	Class II highway (checked)
Terrain	Level (checked) / Rolling
Two-way hourly volume	425 veh/h
Directional split	53 / 47
Peak-hour factor, PHF	0.88
No-passing zone	0
% Trucks and Buses , P_T	5 %
% Recreational vehicles, P_R	2%
Access points/ mi	8

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	1.7
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	1.0
Heavy-vehicle adjustment factor, f_{HV} $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.966
Two-way flow rate[1], v_p (pc/h) $v_p=V/(PHF * f_G * f_{HV})$	500
v_p * highest directional split proportion[2] (pc/h)	265

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	mi/h	Base free-flow speed, $BFFS_{FM}$	45.0 mi/h
Observed volume, V_f	veh/h	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	6.0 mi/h
Free-flow speed, FFS $FFS=S_{FM}+0.00776(V_f/f_{HV})$	34.0 mi/h	Adj. for access points, f_A (Exhibit 20-6)	5.0 mi/h
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	34.0 mi/h

Adj. for no-passing zones, f_{np} (mi/h) (Exhibit 20-11)	0.0
Average travel speed, ATS (mi/h) ATS=FFS-0.00776v_p-f_{np}	30.1

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	1.1
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	1.0
Heavy-vehicle adjustment factor, f_{HV} $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.995
Two-way flow rate[1], v_p (pc/h) $v_p=V/(PHF * f_G * f_{HV})$	485
v_p * highest directional split proportion[2] (pc/h)	257
Base percent time-spent-following, BPTSF(%) $BPTSF=100(1-e^{-0.000879v_p})$	34.7
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	0.1
Percent time-spent-following, PTSF(%) PTSF=BPTSF+$f_{d/np}$	34.8

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	A
Volume to capacity ratio v/c $v/c=V_p/3,200$	0.16
Peak 15-min veh-miles of travel,VMT_{15} (veh- mi) $VMT_{15}=0.25L_t(V/PHF)$	121
Peak-hour vehicle-miles of travel, VMT_{60} (veh- mi) $VMT_{60}=V*L_t$	425
Peak 15-min total travel time, TT_{15}(veh-h) $TT_{15}=VMT_{15}/ATS$	4.0

Notes

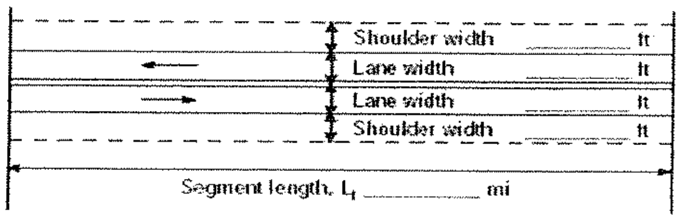
1. If v_p >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split v_p>= 1,700 pc/h, terminated anlysis-the LOS is F.

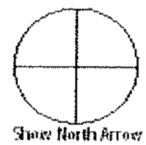
HCS2000™ Version 4.1d

TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	PZ	Highway	Wilson (W)
Agency or Company	MACTEC	From/To	
Date Performed	6/12/2006	Jurisdiction	
Analysis Time Period	DAY	Analysis Year	2003

Input Data





Class I highway	Class II highway
Terrain	Level / Rolling
Two-way hourly volume	462 veh/h
Directional split	59 / 41
Peak-hour factor, PHF	0.88
No-passing zone	0
% Trucks and Buses , P_T	5 %
% Recreational vehicles, P_R	2%
Access points/ mi	8

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	1.7
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	1.0
Heavy-vehicle adjustment factor, f_{HV} f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	0.966
Two-way flow rate[1], v_p (pc/h) v_p=V/ (PHF * f_G * f_{HV})	543
v_p * highest directional split proportion[2] (pc/h)	320

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	mi/h	Base free-flow speed, $BFFS_{FM}$	45.0 mi/h
Observed volume, V_f	veh/h	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	6.0 mi/h
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	37.0 mi/h	Adj. for access points, f_A (Exhibit 20-6)	2.0 mi/h
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	37.0 mi/h

Adj. for no-passing zones, f_{np} (mi/h) (Exhibit 20-11)	0.0
Average travel speed, ATS (mi/h) ATS=FFS-0.00776v_p-f_{np}	32.8

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	1.1
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	1.0
Heavy-vehicle adjustment factor, f_{HV} f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	0.995
Two-way flow rate[1], v_p (pc/h) v_p=V/ (PHF * f_G * f_{HV})	528
v_p * highest directional split proportion[2] (pc/h)	312
Base percent time-spent-following, BPTSF(%) BPTSF=100(1-$e^{-0.000879v_p}$)	37.1
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	0.2
Percent time-spent-following, PTSF(%) PTSF=BPTSF+$f_{d/np}$	37.3

Level of Service and Other Performance Measures

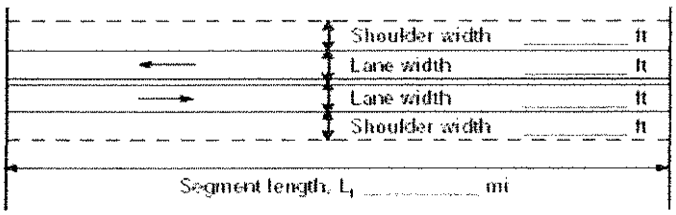
Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	A
Volume to capacity ratio v/c v/c=V_p/ 3,200	0.17
Peak 15-min veh-miles of travel,VMT_{15} (veh- mi) VMT_{15}= 0.25L_t(V/PHF)	131
Peak-hour vehicle-miles of travel, VMT_{60} (veh- mi) VMT_{60}=V*L_t	462
Peak 15-min total travel time, TT_{15}(veh-h) TT_{15}= VMT_{15}/ATS	4.0

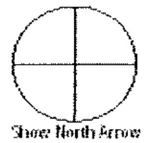
Notes

1. If v_p >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split v_p>= 1,700 pc/h, terminated anlysis-the LOS is F.

TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET			
General Information		***Site Information***	
Analyst	PZ	Highway	Road S-4 (E)
Agency or Company	MACTEC	From/To	
Date Performed	6/12/2006	Jurisdiction	
Analysis Time Period	DAY	Analysis Year	2003

Input Data





Class I highway ☐ Class II highway ☑

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	27 veh/h
Directional split	51 / 49
Peak-hour factor, PHF	0.88
No-passing zone	0
% Trucks and Buses , P_T	5 %
% Recreational vehicles, P_R	2%
Access points/ mi	8

Average Travel Speed	
Grade adjustment factor, f_G (Exhibit 20-7)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	1.7
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	1.0
Heavy-vehicle adjustment factor, f_{HV} f_{HV}=1/ (1+ $P_T(E_T$-1)+$P_R(E_R$-1))	0.966
Two-way flow rate[1], v_p (pc/h) v_p=V/ (PHF * f_G * f_{HV})	32
v_p * highest directional split proportion[2] (pc/h)	16

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
		Base free-flow speed, $BFFS_{FM}$	45.0 mi/h
Field Measured speed, S_{FM}	mi/h	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	6.0 mi/h
Observed volume, V_f	veh/h	Adj. for access points, f_A (Exhibit 20-6)	10.0 mi/h
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	29.0 mi/h	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	29.0 mi/h

Adj. for no-passing zones, f_{np} (mi/h) (Exhibit 20-11)	0.0
Average travel speed, ATS (mi/h) ATS=FFS-0.00776v_p-f_{np}	28.8
Percent Time-Spent-Following	
Grade Adjustment factor, f_G (Exhibit 20-8)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	1.1
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	1.0
Heavy-vehicle adjustment factor, f_{HV} f_{HV}=1/ (1+ $P_T(E_T$-1)+$P_R(E_R$-1))	0.995
Two-way flow rate[1], v_p (pc/h) v_p=V/ (PHF * f_G * f_{HV})	31
v_p * highest directional split proportion[2] (pc/h)	16
Base percent time-spent-following, BPTSF(%) BPTSF=100(1-$e^{-0.000879v_p}$)	2.7
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	0.3
Percent time-spent-following, PTSF(%) PTSF=BPTSF+$f_{d/np}$	2.9
Level of Service and Other Performance Measures	
Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	A
Volume to capacity ratio v/c v/c=V_p/ 3,200	0.01
Peak 15-min veh-miles of travel,VMT_{15} (veh- mi) VMT_{15}= 0.25L_t(V/PHF)	8
Peak-hour vehicle-miles of travel, VMT_{60} (veh- mi) VMT_{60}=V*L_t	27
Peak 15-min total travel time, TT_{15}(veh-h) TT_{15}= VMT_{15}/ATS	0.3

Notes

1. If v_p >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split v_p>= 1,700 pc/h, terminated anlysis-the LOS is F.

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TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	PZ	Highway	Stanley (E)
Agency or Company	MACTEC	From/To	
Date Performed	6/12/2006	Jurisdiction	
Analysis Time Period	DAY	Analysis Year	2003

Input Data

Shoulder width ______ ft
Lane width ______ ft
Lane width ______ ft
Shoulder width ______ ft
Segment length, L_t ______ mi

Show North Arrow

Class I highway ☐ Class II highway ☑

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	192 veh/h
Directional split	55 / 45
Peak-hour factor, PHF	0.88
No-passing zone	0
% Trucks and Buses, P_T	5 %
% Recreational vehicles, P_R	2%
Access points/ mi	8

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	1.7
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	1.0
Heavy-vehicle adjustment factor, f_{HV} $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.966
Two-way flow rate[1], v_p (pc/h) $v_p=V/(PHF * f_G * f_{HV})$	226
v_p * highest directional split proportion[2] (pc/h)	124

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	mi/h	Base free-flow speed, $BFFS_{FM}$	45.0 mi/h
Observed volume, V_f	veh/h	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	6.0 mi/h
Free-flow speed, FFS $FFS=S_{FM}+0.00776(V_f/f_{HV})$	29.0 mi/h	Adj. for access points, f_A (Exhibit 20-6)	10.0 mi/h
		Free-flow speed, FFS $(FSS=BFFS-f_{LS}-f_A)$	29.0 mi/h

Adj. for no-passing zones, f_{np} (mi/h) (Exhibit 20-11)	0.0
Average travel speed, ATS (mi/h) $ATS=FFS-0.00776v_p-f_{np}$	27.2

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	1.1
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	1.0
Heavy-vehicle adjustment factor, f_{HV} $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.995
Two-way flow rate[1], v_p (pc/h) $v_p=V/(PHF * f_G * f_{HV})$	219
v_p * highest directional split proportion[2] (pc/h)	120
Base percent time-spent-following, BPTSF(%) $BPTSF=100(1-e^{-0.000879v_p})$	17.5
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	0.7
Percent time-spent-following, PTSF(%) $PTSF=BPTSF+f_{d/np}$	18.3

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	A
Volume to capacity ratio v/c $v/c=V_p/3{,}200$	0.07
Peak 15-min veh-miles of travel, VMT_{15} (veh- mi) $VMT_{15}=0.25L_t(V/PHF)$	55
Peak-hour vehicle-miles of travel, VMT_{60} (veh- mi) $VMT_{60}=V*L_t$	192
Peak 15-min total travel time, TT_{15}(veh-h) $TT_{15}=VMT_{15}/ATS$	2.0

Notes

1. If v_p >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split v_p >= 1,700 pc/h, terminated anlysis-the LOS is F.

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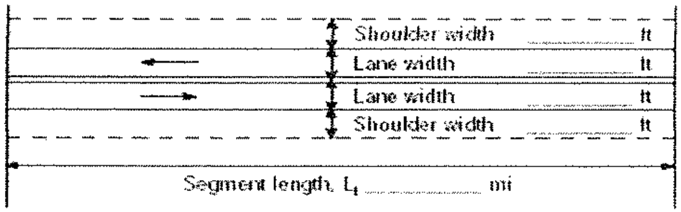
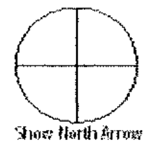
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	PZ	Highway	Stanley (W)
Agency or Company	MACTEC	From/To	
Date Performed	6/12/2006	Jurisdiction	
Analysis Time Period	DAY	Analysis Year	2003

Input Data





Class I highway	
Class II highway	☑
Terrain	Level ☑ / Rolling
Two-way hourly volume	242 veh/h
Directional split	60 / 40
Peak-hour factor, PHF	0.88
No-passing zone	0
% Trucks and Buses , P_T	5 %
% Recreational vehicles, P_R	2%
Access points/ mi	8

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	1.7
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	1.0
Heavy-vehicle adjustment factor, f_{HV} $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.966
Two-way flow rate[1], v_p (pc/h) $v_p=V/(PHF * f_G * f_{HV})$	285
v_p * highest directional split proportion[2] (pc/h)	171

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	mi/h	Base free-flow speed, $BFFS_{FM}$	45.0 mi/h
Observed volume, V_f	veh/h	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	6.0 mi/h
Free-flow speed, FFS $FFS=S_{FM}+0.00776(V_f/f_{HV})$	29.0 mi/h	Adj. for access points, f_A (Exhibit 20-6)	10.0 mi/h
		Free-flow speed, FFS $(FSS=BFFS-f_{LS}-f_A)$	29.0 mi/h

Adj. for no-passing zones, f_{np} (mi/h) (Exhibit 20-11)	0.0
Average travel speed, ATS (mi/h) $ATS=FFS-0.00776v_p-f_{np}$	26.8

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	1.1
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	1.0
Heavy-vehicle adjustment factor, f_{HV} $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.995
Two-way flow rate[1], v_p (pc/h) $v_p=V/(PHF * f_G * f_{HV})$	276
v_p * highest directional split proportion[2] (pc/h)	166
Base percent time-spent-following, BPTSF(%) $BPTSF=100(1-e^{-0.000879v_p})$	21.5
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	1.2
Percent time-spent-following, PTSF(%) $PTSF=BPTSF+f_{d/np}$	22.7

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	A
Volume to capacity ratio v/c $v/c=V_p/3,200$	0.09
Peak 15-min veh-miles of travel, VMT_{15} (veh- mi) $VMT_{15}=0.25L_t(V/PHF)$	69
Peak-hour vehicle-miles of travel, VMT_{60} (veh- mi) $VMT_{60}=V*L_t$	242
Peak 15-min total travel time, TT_{15}(veh-h) $TT_{15}=VMT_{15}/ATS$	2.6

Notes

1. If v_p >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split v_p>= 1,700 pc/h, terminated anlysis-the LOS is F.

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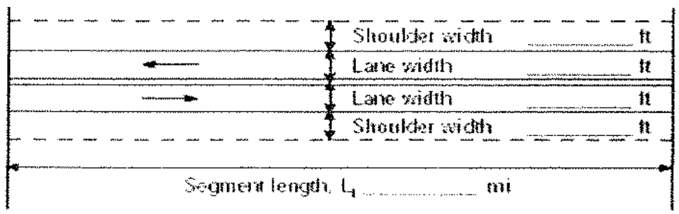
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	PZ	Highway	Dickman /Artillery Post (E)
Agency or Company	MACTEC	From/To	
Date Performed	6/12/2006	Jurisdiction	
Analysis Time Period	DAY	Analysis Year	2003

Input Data



Class I highway ☐ Class II highway ☑

Terrain Level ☑ Rolling ☐

Two-way hourly volume	105 veh/h
Directional split	55 / 45
Peak-hour factor, PHF	0.88
No-passing zone	0
% Trucks and Buses , P_T	5 %
% Recreational vehicles, P_R	2%
Access points/ mi	8

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	1.7
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	1.0
Heavy-vehicle adjustment factor, f_{HV} $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.966
Two-way flow rate[1], v_p (pc/h) $v_p=V/(PHF*f_G*f_{HV})$	123
v_p * highest directional split proportion[2] (pc/h)	68

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	mi/h	Base free-flow speed, $BFFS_{FM}$	45.0 mi/h
Observed volume, V_f	veh/h	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	6.0 mi/h
Free-flow speed, FFS $FFS=S_{FM}+0.00776(V_f/f_{HV})$	29.0 mi/h	Adj. for access points, f_A (Exhibit 20-6)	10.0 mi/h
		Free-flow speed, FFS $(FSS=BFFS-f_{LS}-f_A)$	29.0 mi/h

Adj. for no-passing zones, f_{np} (mi/h) (Exhibit 20-11)	0.0
Average travel speed, ATS (mi/h) $ATS=FFS-0.00776v_p-f_{np}$	28.0

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	1.1
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	1.0
Heavy-vehicle adjustment factor, f_{HV} $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.995
Two-way flow rate[1], v_p (pc/h) $v_p=V/(PHF*f_G*f_{HV})$	120
v_p * highest directional split proportion[2] (pc/h)	66
Base percent time-spent-following, BPTSF(%) $BPTSF=100(1-e^{-0.000879v_p})$	10.0
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	1.0
Percent time-spent-following, PTSF(%) $PTSF=BPTSF+f_{d/np}$	11.0

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	A
Volume to capacity ratio v/c $v/c=V_p/3,200$	0.04
Peak 15-min veh-miles of travel, VMT_{15} (veh- mi) $VMT_{15}=0.25L_t(V/PHF)$	30
Peak-hour vehicle-miles of travel, VMT_{60} (veh- mi) $VMT_{60}=V*L_t$	105
Peak 15-min total travel time, TT_{15}(veh-h) $TT_{15}=VMT_{15}/ATS$	1.1

Notes

1. If v_p >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split v_p >= 1,700 pc/h, terminated anlysis-the LOS is F.

HCS2000™ Version 4.1d

TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	PZ	Highway	Dickman /Artillery Post (W)
Agency or Company	MACTEC	From/To	
Date Performed	6/12/2006	Jurisdiction	
Analysis Time Period	DAY	Analysis Year	2003

Input Data

Shoulder width ____ ft
Lane width ____ ft
Lane width ____ ft
Shoulder width ____ ft
Segment length, L_t ____ mi

Show North Arrow

Class I highway / Class II highway	
Terrain	Level / Rolling
Two-way hourly volume	56 veh/h
Directional split	56 / 44
Peak-hour factor, PHF	0.88
No-passing zone	0
% Trucks and Buses, P_T	5 %
% Recreational vehicles, P_R	2%
Access points/ mi	8

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	1.7
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	1.0
Heavy-vehicle adjustment factor, f_{HV} $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.966
Two-way flow rate¹, v_p (pc/h) $v_p=V/(PHF * f_G * f_{HV})$	66
v_p * highest directional split proportion² (pc/h)	37

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	mi/h	Base free-flow speed, $BFFS_{FM}$	45.0 mi/h
Observed volume, V_f	veh/h	Adj. for lane width and shoulder width³, f_{LS} (Exhibit 20-5)	6.0 mi/h
Free-flow speed, FFS $FFS=S_{FM}+0.00776(V_f/f_{HV})$	29.0 mi/h	Adj. for access points, f_A (Exhibit 20-6)	10.0 mi/h
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	29.0 mi/h

Adj. for no-passing zones, f_{np} (mi/h) (Exhibit 20-11)	0.0
Average travel speed, ATS (mi/h) ATS=FFS-0.00776v_p-f_{np}	28.5

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	1.1
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	1.0
Heavy-vehicle adjustment factor, f_{HV} $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.995
Two-way flow rate¹, v_p (pc/h) $v_p=V/(PHF * f_G * f_{HV})$	64
v_p * highest directional split proportion² (pc/h)	36
Base percent time-spent-following, BPTSF(%) $BPTSF=100(1-e^{-0.000879v_p})$	5.5
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	1.4
Percent time-spent-following, PTSF(%) PTSF=BPTSF+$f_{d/np}$	6.9

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	A
Volume to capacity ratio v/c $v/c=V_p/3,200$	0.02
Peak 15-min veh-miles of travel, VMT_{15} (veh- mi) $VMT_{15}=0.25L_t(V/PHF)$	16
Peak-hour vehicle-miles of travel, VMT_{60} (veh- mi) $VMT_{60}=V*L_t$	56
Peak 15-min total travel time, TT_{15}(veh-h) $TT_{15}=VMT_{15}/ATS$	0.6

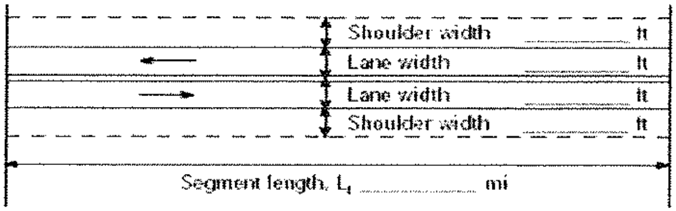
Notes

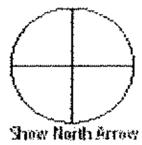
1. If v_p >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split v_p>= 1,700 pc/h, terminated anlysis-the LOS is F.

TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	PZ	Highway	Graham (E)
Agency or Company	MACTEC	From/To	
Date Performed	6/12/2006	Jurisdiction	
Analysis Time Period	DAY	Analysis Year	2003

Input Data





☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	81 veh/h
Directional split	55 / 45
Peak-hour factor, PHF	0.88
No-passing zone	0
% Trucks and Buses , P_T	5 %
% Recreational vehicles, P_R	2%
Access points/ mi	8

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	1.7
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	1.0
Heavy-vehicle adjustment factor, f_{HV} f_{HV}=1/ (1+ $P_T(E_T$-1)+$P_R(E_R$-1))	0.966
Two-way flow rate[1], v_p (pc/h) v_p=V/ (PHF * f_G * f_{HV})	95
v_p * highest directional split proportion[2] (pc/h)	52

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
		Base free-flow speed, $BFFS_{FM}$	45.0 mi/h
Field Measured speed, S_{FM}	mi/h	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	6.0 mi/h
Observed volume, V_f	veh/h	Adj. for access points, f_A (Exhibit 20-6)	10.0 mi/h
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	29.0 mi/h	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	29.0 mi/h

Adj. for no-passing zones, f_{np} (mi/h) (Exhibit 20-11)	0.0
Average travel speed, ATS (mi/h) ATS=FFS-0.00776v_p-f_{np}	28.3

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	1.1
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	1.0
Heavy-vehicle adjustment factor, f_{HV} f_{HV}=1/ (1+ $P_T(E_T$-1)+$P_R(E_R$-1))	0.995
Two-way flow rate[1], v_p (pc/h) v_p=V/ (PHF * f_G * f_{HV})	93
v_p * highest directional split proportion[2] (pc/h)	51
Base percent time-spent-following, BPTSF(%) BPTSF=100(1-$e^{-0.000879v_p}$)	7.8
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	1.1
Percent time-spent-following, PTSF(%) PTSF=BPTSF+$f_{d/np}$	8.9

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	A
Volume to capacity ratio v/c v/c=V_p/ 3,200	0.03
Peak 15-min veh-miles of travel,VMT_{15} (veh- mi) VMT_{15}= 0.25L_t(V/PHF)	23
Peak-hour vehicle-miles of travel, VMT_{60} (veh- mi) VMT_{60}=V*L_t	81
Peak 15-min total travel time, TT_{15}(veh-h) TT_{15}= VMT_{15}/ATS	0.8

Notes

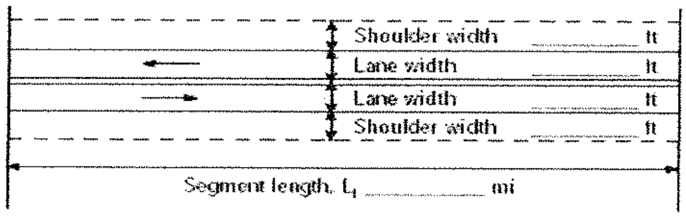
1. If v_p >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split v_p>= 1,700 pc/h, terminated anlysis-the LOS is F.

HCS2000™ Version 4.1d

TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	PZ	Highway	Service Street 1 (E)
Agency or Company	MACTEC	From/To	
Date Performed	6/12/2006	Jurisdiction	
Analysis Time Period	DAY	Analysis Year	2003

Input Data



Class I highway	Class II highway
Terrain	Level / Rolling
Two-way hourly volume	16 veh/h
Directional split	66 / 34
Peak-hour factor, PHF	0.88
No-passing zone	0
% Trucks and Buses , P_T	5 %
% Recreational vehicles, P_R	2%
Access points/ mi	8

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	1.7
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	1.0
Heavy-vehicle adjustment factor, f_{HV} f_{HV}=1/ (1+ $P_T(E_T$-1)+$P_R(E_R$-1))	0.966
Two-way flow rate[1], v_p (pc/h) v_p=V/ (PHF * f_G * f_{HV})	19
v_p * highest directional split proportion[2] (pc/h)	13

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
		Base free-flow speed, $BFFS_{FM}$	45.0 mi/h
Field Measured speed, S_{FM}	mi/h	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	6.0 mi/h
Observed volume, V_f	veh/h		
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	29.0 mi/h	Adj. for access points, f_A (Exhibit 20-6)	10.0 mi/h
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	29.0 mi/h

Adj. for no-passing zones, f_{np} (mi/h) (Exhibit 20-11)	0.0
Average travel speed, ATS (mi/h) ATS=FFS-0.00776v_p-f_{np}	28.9

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	1.1
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	1.0
Heavy-vehicle adjustment factor, f_{HV} f_{HV}=1/ (1+ $P_T(E_T$-1)+$P_R(E_R$-1))	0.995
Two-way flow rate[1], v_p (pc/h) v_p=V/ (PHF * f_G * f_{HV})	18
v_p * highest directional split proportion[2] (pc/h)	12
Base percent time-spent-following, BPTSF(%) BPTSF=100(1-$e^{-0.000879v_p}$)	1.6
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	4.0
Percent time-spent-following, PTSF(%) PTSF=BPTSF+$f_{d/np}$	5.5

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	A
Volume to capacity ratio v/c v/c=V_p/ 3,200	0.01
Peak 15-min veh-miles of travel,VMT_{15} (veh- mi) VMT_{15}= 0.25L_t(V/PHF)	5
Peak-hour vehicle-miles of travel, VMT_{60} (veh- mi) VMT_{60}=V*L_t	16
Peak 15-min total travel time, TT_{15}(veh-h) TT_{15}= VMT_{15}/ATS	0.2

Notes

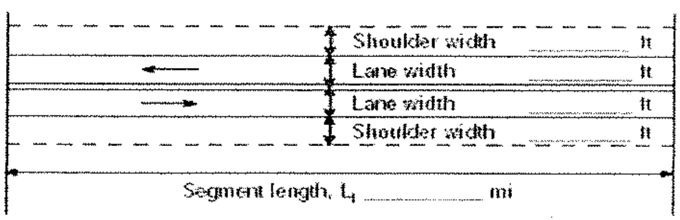
1. If v_p >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split v_p>= 1,700 pc/h, terminated anlysis-the LOS is F.

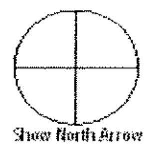
HCS2000™ Version 4.1d

TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	PZ	Highway	Service Street 2 (W)
Agency or Company	MACTEC	From/To	
Date Performed	6/12/2006	Jurisdiction	
Analysis Time Period	DAY	Analysis Year	2003

Input Data





Class I highway / Class II highway	
Terrain	Level / Rolling
Two-way hourly volume	12 veh/h
Directional split	51 / 49
Peak-hour factor, PHF	0.88
No-passing zone	0
% Trucks and Buses , P_T	5 %
% Recreational vehicles, P_R	2%
Access points/ mi	8

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	1.7
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	1.0
Heavy-vehicle adjustment factor, f_{HV} f_{HV}=1/ (1+ $P_T(E_T$-1)+$P_R(E_R$-1))	0.966
Two-way flow rate[1], v_p (pc/h) v_p=V/ (PHF * f_G * f_{HV})	14
v_p * highest directional split proportion[2] (pc/h)	7

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
		Base free-flow speed, $BFFS_{FM}$	45.0 mi/h
Field Measured speed, S_{FM}	mi/h	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	6.0 mi/h
Observed volume, V_f	veh/h	Adj. for access points, f_A (Exhibit 20-6)	10.0 mi/h
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	29.0 mi/h	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	29.0 mi/h

Adj. for no-passing zones, f_{np} (mi/h) (Exhibit 20-11)	0.0
Average travel speed, ATS (mi/h) ATS=FFS-0.00776v_p-f_{np}	28.9

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	1.1
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	1.0
Heavy-vehicle adjustment factor, f_{HV} f_{HV}=1/ (1+ $P_T(E_T$-1)+$P_R(E_R$-1))	0.995
Two-way flow rate[1], v_p (pc/h) v_p=V/ (PHF * f_G * f_{HV})	14
v_p * highest directional split proportion[2] (pc/h)	7
Base percent time-spent-following, BPTSF(%) BPTSF=100(1-$e^{-0.000879v_p}$)	1.2
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	0.3
Percent time-spent-following, PTSF(%) PTSF=BPTSF+$f_{d/np}$	1.5

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	A
Volume to capacity ratio v/c v/c=V_p/ 3,200	0.00
Peak 15-min veh-miles of travel,VMT_{15} (veh- mi) VMT_{15}= 0.25L_t(V/PHF)	3
Peak-hour vehicle-miles of travel, VMT_{60} (veh- mi) VMT_{60}=V*L_t	12
Peak 15-min total travel time, TT_{15}(veh-h) TT_{15}= VMT_{15}/ATS	0.1

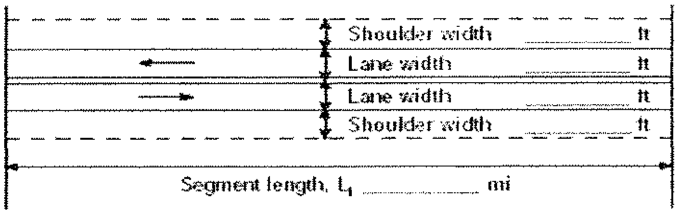
Notes

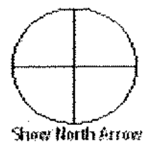
1. If v_p >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split v_p>= 1,700 pc/h, terminated anlysis-the LOS is F.

HCS2000™ Version 4.1d

TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET			
General Information		***Site Information***	
Analyst	PZ	Highway	Wheaton Road (E)
Agency or Company	MACTEC	From/To	
Date Performed	6/12/2006	Jurisdiction	
Analysis Time Period	DAY	Analysis Year	2003

Input Data





Class I highway	Class II highway
Terrain	Level / Rolling
Two-way hourly volume	17 veh/h
Directional split	84 / 16
Peak-hour factor, PHF	0.88
No-passing zone	0
% Trucks and Buses , P_T	5 %
% Recreational vehicles, P_R	2%
Access points/ mi	8

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	1.7
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	1.0
Heavy-vehicle adjustment factor, f_{HV} f_{HV}=1/ (1+ $P_T(E_T$-1)+$P_R(E_R$-1))	0.966
Two-way flow rate[1], v_p (pc/h) v_p=V/ (PHF * f_G * f_{HV})	20
v_p * highest directional split proportion[2] (pc/h)	17

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
		Base free-flow speed, $BFFS_{FM}$	45.0 mi/h
Field Measured speed, S_{FM}	mi/h	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	6.0 mi/h
Observed volume, V_f	veh/h	Adj. for access points, f_A (Exhibit 20-6)	10.0 mi/h
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	29.0 mi/h	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	29.0 mi/h

Adj. for no-passing zones, f_{np} (mi/h) (Exhibit 20-11)	0.0
Average travel speed, ATS (mi/h) ATS=FFS-0.00776v_p-f_{np}	28.8

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	1.1
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	1.0
Heavy-vehicle adjustment factor, f_{HV} f_{HV}=1/ (1+ $P_T(E_T$-1)+$P_R(E_R$-1))	0.995
Two-way flow rate[1], v_p (pc/h) v_p=V/ (PHF * f_G * f_{HV})	19
v_p * highest directional split proportion[2] (pc/h)	16
Base percent time-spent-following, BPTSF(%) BPTSF=100(1-$e^{-0.000879v_p}$)	1.7
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	7.9
Percent time-spent-following, PTSF(%) PTSF=BPTSF+$f_{d/np}$	9.5

Level of Service and Other Performance Measures

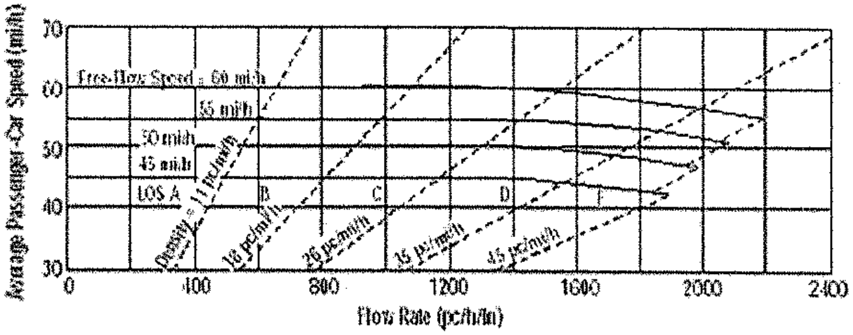
Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	A
Volume to capacity ratio v/c v/c=V_p/ 3,200	0.01
Peak 15-min veh-miles of travel,VMT_{15} (veh- mi) VMT_{15}= 0.25L_t(V/PHF)	5
Peak-hour vehicle-miles of travel, VMT_{60} (veh- mi) VMT_{60}=V*L_t	17
Peak 15-min total travel time, TT_{15}(veh-h) TT_{15}= VMT_{15}/ATS	0.2

Notes

1. If v_p >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split v_p>= 1,700 pc/h, terminated anlysis-the LOS is F.

HCS2000™ Version 4.1d

MULTILANE HIGHWAYS WORKSHEET(Direction 1)



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	PZ
Agency or Company	MACTEC
Date Performed	6/12/2006
Analysis Time Period	DAY

Site Information

Highway/Direction to Travel	George Beach Avenue
From/To	
Jurisdiction	
Analysis Year	2003

Project Description

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	433	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	2
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.972

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearence, LC (ft)	12.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0

Access Points, A (A/mi)	20	f_A (mi/h)	5.0
Median Type, M	Divided	f_M (mi/h)	0.0
FFS (measured)		FFS (mi/h)	45.0
Base Free-Flow Speed, BFFS	50.0		

Operations		Design	
Operational (LOS)		Design (N)	
Flow Rate, v_p (pc/h/ln)	247	Required Number of Lanes, N	
Speed, S (mi/h)	45.0	Flow Rate, v_p (pc/h)	
D (pc/mi/ln)	5.5	Max Service Flow Rate (pc/h/ln)	
LOS	A	Design LOS	

G.6 PROPOSED SEGMENT ROADWAY ANALYSIS – HQ/ADMINISTRATIVE AREA

Region
Head Quarter

Corridor
N New Braunfels

Proposed Conditions

Location	Direction	ADT	ADT	VPH	DS	LOS
Road S-3 (E)	East	736	1456	146	51	A
	West	720				
Road S-6 (W)	East	739	1443	144	51	A
	West	704				
Wilson (E)	East	6448	13594	1359	53	D
	West	7146				
Wilson (W)	East	8717	14778	1478	59	D
	West	6061				
Road S-4 (E)	East	429	874	87	51	A
	West	445				
Stanley (E)	East	3408	6144	614	55	B
	West	2736				
Stanley (W)	East	4678	7734	773	60	B
	West	3056				
Dickman /Artillery Post (E)	East	1510	3357	336	55	A
	West	1846				
Dickman /Artillery Post (W)	East	790	1779	178	56	A
	West	989				
Graham (E)	East	1162	2592	259	55	A
	West	1430				
Service Street 1 (E)	East	339	515	52	66	A
	West	176				
Service Street 2 (W)	East	182	371	37	51	A
	West	189				
Wheaton Road (E)	East	454	544	54	84	A
	West	90				

Region
BAMC

Corridor
George Beach Avenue

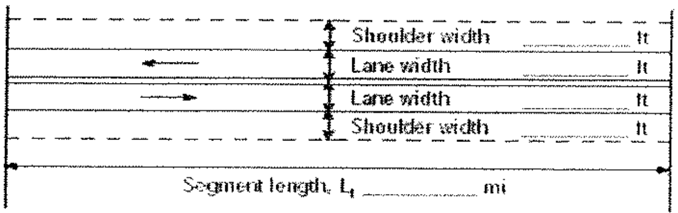
Proposed Conditions

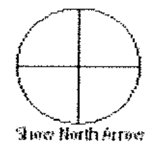
Location	Direction	ADT	ADT	VPH	DS	LOS
George Beach Avenue	Two-way	15762	15762	1576	55	B
		0				

TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	PZ	Highway	Road S-3 (E)
Agency or Company	MACTEC	From/To	
Date Performed	6/28/2006	Jurisdiction	
Analysis Time Period	DAY	Analysis Year	Proposed

Input Data





Class I highway   Class II highway

Terrain   Level   Rolling

Two-way hourly volume	146 veh/h
Directional split	51 / 49
Peak-hour factor, PHF	0.88
No-passing zone	0
% Trucks and Buses , P_T	5 %
% Recreational vehicles, P_R	2%
Access points/ mi	8

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	1.7
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	1.0
Heavy-vehicle adjustment factor, f_{HV} $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.966
Two-way flow rate[1], v_p (pc/h) $v_p=V/(PHF * f_G * f_{HV})$	172
v_p * highest directional split proportion[2] (pc/h)	88

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	mi/h	Base free-flow speed, $BFFS_{FM}$	45.0 mi/h
Observed volume, V_f	veh/h	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	6.0 mi/h
Free-flow speed, FFS $FFS=S_{FM}+0.00776(V_f/f_{HV})$	34.0 mi/h	Adj. for access points, f_A (Exhibit 20-6)	5.0 mi/h
		Free-flow speed, FFS $(FSS=BFFS-f_{LS}-f_A)$	34.0 mi/h

Adj. for no-passing zones, f_{np} (mi/h) (Exhibit 20-11)	0.0
Average travel speed, ATS (mi/h) $ATS=FFS-0.00776v_p-f_{np}$	32.7

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	1.1
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	1.0
Heavy-vehicle adjustment factor, f_{HV} $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.995
Two-way flow rate[1], v_p (pc/h) $v_p=V/(PHF * f_G * f_{HV})$	167
v_p * highest directional split proportion[2] (pc/h)	85
Base percent time-spent-following, BPTSF(%) $BPTSF=100(1-e^{-0.000879v_p})$	13.7
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	0.2
Percent time-spent-following, PTSF(%) $PTSF=BPTSF+f_{d/np}$	13.8

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	A
Volume to capacity ratio v/c $v/c=V_p/3,200$	0.05
Peak 15-min veh-miles of travel, VMT_{15} (veh- mi) $VMT_{15}=0.25L_t(V/PHF)$	41
Peak-hour vehicle-miles of travel, VMT_{60} (veh- mi) $VMT_{60}=V*L_t$	146
Peak 15-min total travel time, TT_{15}(veh-h) $TT_{15}=VMT_{15}/ATS$	1.3

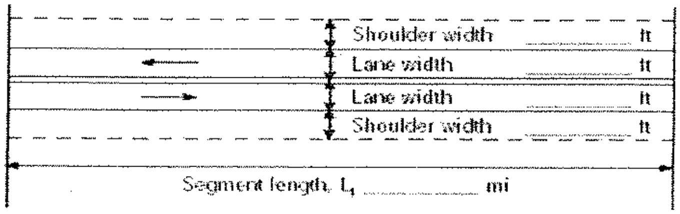
Notes

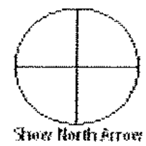
1. If v_p >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split v_p>= 1,700 pc/h, terminated anlysis-the LOS is F.

TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	PZ	Highway	Road S-6 (W)
Agency or Company	MACTEC	From/To	
Date Performed	6/28/2006	Jurisdiction	
Analysis Time Period	DAY	Analysis Year	Proposed

Input Data





Class I highway / Class II highway (checked)	
Terrain: Level (checked) / Rolling	
Two-way hourly volume	144 veh/h
Directional split	51 / 49
Peak-hour factor, PHF	0.88
No-passing zone	0
% Trucks and Buses, P_T	5 %
% Recreational vehicles, P_R	2%
Access points/ mi	8

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	1.7
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	1.0
Heavy-vehicle adjustment factor, f_{HV} $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.966
Two-way flow rate[1], v_p (pc/h) $v_p=V/(PHF * f_G * f_{HV})$	169
v_p * highest directional split proportion[2] (pc/h)	86

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	mi/h	Base free-flow speed, $BFFS_{FM}$	45.0 mi/h
Observed volume, V_f	veh/h	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	6.0 mi/h
Free-flow speed, FFS $FFS=S_{FM}+0.00776(V_f/f_{HV})$	34.0 mi/h	Adj. for access points, f_A (Exhibit 20-6)	5.0 mi/h
		Free-flow speed, FFS $(FSS=BFFS-f_{LS}-f_A)$	34.0 mi/h

Adj. for no-passing zones, f_{np} (mi/h) (Exhibit 20-11)	0.0
Average travel speed, ATS (mi/h) $ATS=FFS-0.00776v_p-f_{np}$	32.7

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	1.1
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	1.0
Heavy-vehicle adjustment factor, f_{HV} $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.995
Two-way flow rate[1], v_p (pc/h) $v_p=V/(PHF * f_G * f_{HV})$	164
v_p * highest directional split proportion[2] (pc/h)	84
Base percent time-spent-following, BPTSF(%) $BPTSF=100(1-e^{-0.000879v_p})$	13.4
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	0.2
Percent time-spent-following, PTSF(%) $PTSF=BPTSF+f_{d/np}$	13.6

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	A
Volume to capacity ratio v/c $v/c=V_p/3,200$	0.05
Peak 15-min veh-miles of travel, VMT_{15} (veh- mi) $VMT_{15}=0.25L_t(V/PHF)$	41
Peak-hour vehicle-miles of travel, VMT_{60} (veh- mi) $VMT_{60}=V*L_t$	144
Peak 15-min total travel time, TT_{15}(veh-h) $TT_{15}=VMT_{15}/ATS$	1.3

Notes

1. If v_p >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split v_p>= 1,700 pc/h, terminated anlysis-the LOS is F.

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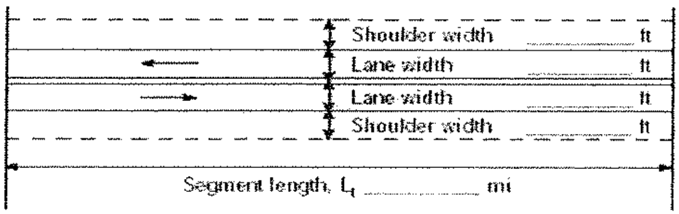
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	PZ	Highway	Wilson (E)
Agency or Company	MACTEC	From/To	
Date Performed	6/28/2006	Jurisdiction	
Analysis Time Period	DAY	Analysis Year	Proposed

Input Data



Class I highway ☐ Class II highway ☑

Terrain Level ☑ Rolling ☐

Two-way hourly volume	1359 veh/h
Directional split	53 / 47
Peak-hour factor, PHF	0.88
No-passing zone	0
% Trucks and Buses , P_T	5 %
% Recreational vehicles, P_R	2%
Access points/ mi	8

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	1.1
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	1.0
Heavy-vehicle adjustment factor, f_{HV} f_{HV}=1/ (1+ $P_T(E_T$-1)+$P_R(E_R$-1))	0.995
Two-way flow rate[1], v_p (pc/h) v_p=V/ (PHF * f_G * f_{HV})	1552
v_p * highest directional split proportion[2] (pc/h)	823

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
		Base free-flow speed, $BFFS_{FM}$	45.0 mi/h
Field Measured speed, S_{FM}	mi/h	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	6.0 mi/h
Observed volume, V_f	veh/h	Adj. for access points, f_A (Exhibit 20-6)	2.0 mi/h
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	37.0 mi/h	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	37.0 mi/h

Adj. for no-passing zones, f_{np} (mi/h) (Exhibit 20-11)	0.0
Average travel speed, ATS (mi/h) ATS=FFS-0.00776v_p-f_{np}	25.0

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	1.0
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	1.0
Heavy-vehicle adjustment factor, f_{HV} f_{HV}=1/ (1+ $P_T(E_T$-1)+$P_R(E_R$-1))	1.000
Two-way flow rate[1], v_p (pc/h) v_p=V/ (PHF * f_G * f_{HV})	1544
v_p * highest directional split proportion[2] (pc/h)	818
Base percent time-spent-following, BPTSF(%) BPTSF=100(1-$e^{-0.000879v_p}$)	74.3
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	0.0
Percent time-spent-following, PTSF(%) PTSF=BPTSF+$f_{d/np}$	74.3

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	D
Volume to capacity ratio v/c v/c=V_p/ 3,200	0.49
Peak 15-min veh-miles of travel,VMT_{15} (veh- mi) VMT_{15}= 0.25L_t(V/PHF)	386
Peak-hour vehicle-miles of travel, VMT_{60} (veh- mi) VMT_{60}=V*L_t	1359
Peak 15-min total travel time, TT_{15}(veh-h) TT_{15}= VMT_{15}/ATS	15.5

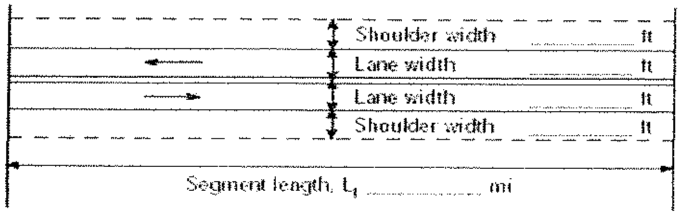
Notes

1. If v_p >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split v_p>= 1,700 pc/h, terminated anlysis-the LOS is F.

TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	PZ	Highway	Wilson (W)
Agency or Company	MACTEC	From/To	
Date Performed	6/28/2006	Jurisdiction	
Analysis Time Period	DAY	Analysis Year	Proposed

Input Data



Class I highway ☐ Class II highway ☑

Terrain Level ☑ Rolling ☐

Two-way hourly volume	1478 veh/h
Directional split	59 / 41
Peak-hour factor, PHF	0.88
No-passing zone	0
% Trucks and Buses, P_T	5 %
% Recreational vehicles, P_R	2%
Access points/ mi	8

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	1.1
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	1.0
Heavy-vehicle adjustment factor, f_{HV} f_{HV}=1/ (1+ $P_T(E_T$-1)+$P_R(E_R$-1))	0.995
Two-way flow rate[1], v_p (pc/h) v_p=V/ (PHF * f_G * f_{HV})	1688
v_p * highest directional split proportion[2] (pc/h)	996

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	mi/h	Base free-flow speed, $BFFS_{FM}$	45.0 mi/h
Observed volume, V_f	veh/h	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	6.0 mi/h
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	37.0 mi/h	Adj. for access points, f_A (Exhibit 20-6)	2.0 mi/h
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	37.0 mi/h

Adj. for no-passing zones, f_{np} (mi/h) (Exhibit 20-11)	0.0
Average travel speed, ATS (mi/h) ATS=FFS-0.00776v_p-f_{np}	23.9

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	1.0
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	1.0
Heavy-vehicle adjustment factor, f_{HV} f_{HV}=1/ (1+ $P_T(E_T$-1)+$P_R(E_R$-1))	1.000
Two-way flow rate[1], v_p (pc/h) v_p=V/ (PHF * f_G * f_{HV})	1680
v_p * highest directional split proportion[2] (pc/h)	991
Base percent time-spent-following, BPTSF(%) BPTSF=100(1-$e^{-0.000879v_p}$)	77.2
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	0.0
Percent time-spent-following, PTSF(%) PTSF=BPTSF+$f_{d/np}$	77.2

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	D
Volume to capacity ratio v/c v/c=V_p/ 3,200	0.53
Peak 15-min veh-miles of travel,VMT_{15} (veh- mi) VMT_{15}= 0.25L_t(V/PHF)	420
Peak-hour vehicle-miles of travel, VMT_{60} (veh- mi) VMT_{60}=V*L_t	1478
Peak 15-min total travel time, TT_{15}(veh-h) TT_{15}= VMT_{15}/ATS	17.6

Notes

1. If v_p >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split v_p>= 1,700 pc/h, terminated anlysis-the LOS is F.

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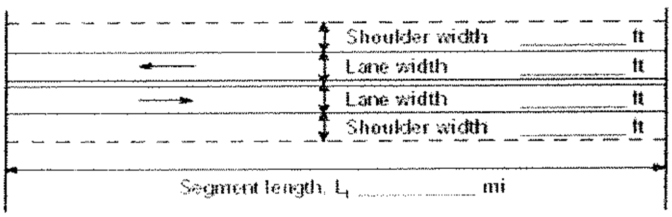
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	PZ	Highway	Road S-4 (E)
Agency or Company	MACTEC	From/To	
Date Performed	6/28/2006	Jurisdiction	
Analysis Time Period	DAY	Analysis Year	Proposed

Input Data



Class I highway ☐ Class II highway ☑

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	87 veh/h
Directional split	51 / 49
Peak-hour factor, PHF	0.88
No-passing zone	0
% Trucks and Buses , P_T	5 %
% Recreational vehicles, P_R	2%
Access points/ mi	8

Average Travel Speed	
Grade adjustment factor, f_G (Exhibit 20-7)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	1.7
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	1.0
Heavy-vehicle adjustment factor, f_{HV} $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.966
Two-way flow rate[1], v_p (pc/h) $v_p=V/(PHF * f_G * f_{HV})$	102
v_p * highest directional split proportion[2] (pc/h)	52

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	mi/h	Base free-flow speed, $BFFS_{FM}$	45.0 mi/h
Observed volume, V_f	veh/h	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	6.0 mi/h
Free-flow speed, FFS $FFS=S_{FM}+0.00776(V_f/f_{HV})$	29.0 mi/h	Adj. for access points, f_A (Exhibit 20-6)	10.0 mi/h
		Free-flow speed, FFS $(FSS=BFFS-f_{LS}-f_A)$	29.0 mi/h

Adj. for no-passing zones, f_{np} (mi/h) (Exhibit 20-11)	0.0
Average travel speed, ATS (mi/h) $ATS=FFS-0.00776v_p-f_{np}$	28.2

Percent Time-Spent-Following	
Grade Adjustment factor, f_G (Exhibit 20-8)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	1.1
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	1.0
Heavy-vehicle adjustment factor, f_{HV} $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.995
Two-way flow rate[1], v_p (pc/h) $v_p=V/(PHF * f_G * f_{HV})$	99
v_p * highest directional split proportion[2] (pc/h)	50
Base percent time-spent-following, BPTSF(%) $BPTSF=100(1-e^{-0.000879v_p})$	8.3
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	0.2
Percent time-spent-following, PTSF(%) $PTSF=BPTSF+f_{d/np}$	8.5

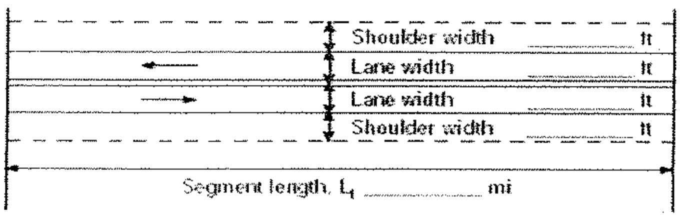
Level of Service and Other Performance Measures	
Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	A
Volume to capacity ratio v/c $v/c=V_p/3{,}200$	0.03
Peak 15-min veh-miles of travel, VMT_{15} (veh- mi) $VMT_{15}=0.25L_t(V/PHF)$	25
Peak-hour vehicle-miles of travel, VMT_{60} (veh- mi) $VMT_{60}=V*L_t$	87
Peak 15-min total travel time, TT_{15}(veh-h) $TT_{15}=VMT_{15}/ATS$	0.9

Notes

1. If v_p >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split v_p>= 1,700 pc/h, terminated anlysis-the LOS is F.

TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET			
General Information		***Site Information***	
Analyst	PZ	Highway	Stanley (E)
Agency or Company	MACTEC	From/To	
Date Performed	6/28/2006	Jurisdiction	
Analysis Time Period	DAY	Analysis Year	Proposed

Input Data



Class I highway ☐ Class II highway ☑

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	614 veh/h
Directional split	55 / 45
Peak-hour factor, PHF	0.88
No-passing zone	0
% Trucks and Buses , P_T	5 %
% Recreational vehicles, P_R	2%
Access points/ mi	8

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	1.2
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	1.0
Heavy-vehicle adjustment factor, f_{HV} $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.990
Two-way flow rate[1], v_p (pc/h) $v_p=V/(PHF * f_G * f_{HV})$	705
v_p * highest directional split proportion[2] (pc/h)	388

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
		Base free-flow speed, $BFFS_{FM}$	45.0 mi/h
Field Measured speed, S_{FM}	mi/h	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	6.0 mi/h
Observed volume, V_f	veh/h	Adj. for access points, f_A (Exhibit 20-6)	10.0 mi/h
Free-flow speed, FFS $FFS=S_{FM}+0.00776(V_f/f_{HV})$	29.0 mi/h	Free-flow speed, FFS $(FSS=BFFS-f_{LS}-f_A)$	29.0 mi/h

Adj. for no-passing zones, f_{np} (mi/h) (Exhibit 20-11)	0.0
Average travel speed, ATS (mi/h) $ATS=FFS-0.00776v_p-f_{np}$	23.5

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	1.1
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	1.0
Heavy-vehicle adjustment factor, f_{HV} $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.995
Two-way flow rate[1], v_p (pc/h) $v_p=V/(PHF * f_G * f_{HV})$	701
v_p * highest directional split proportion[2] (pc/h)	386
Base percent time-spent-following, BPTSF(%) $BPTSF=100(1-e^{-0.000879v_p})$	46.0
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	0.0
Percent time-spent-following, PTSF(%) $PTSF=BPTSF+f_{d/np}$	46.0

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	B
Volume to capacity ratio v/c $v/c=V_p/3{,}200$	0.22
Peak 15-min veh-miles of travel, VMT_{15} (veh- mi) $VMT_{15}=0.25L_t(V/PHF)$	174
Peak-hour vehicle-miles of travel, VMT_{60} (veh- mi) $VMT_{60}=V*L_t$	614
Peak 15-min total travel time, TT_{15}(veh-h) $TT_{15}=VMT_{15}/ATS$	7.4

Notes

1. If v_p >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split v_p>= 1,700 pc/h, terminated anlysis-the LOS is F.

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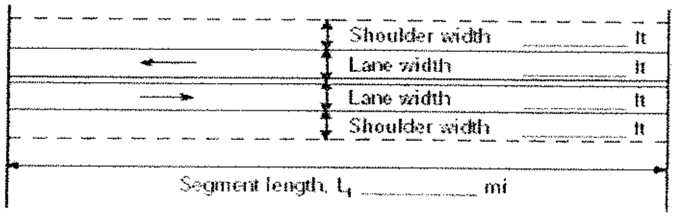
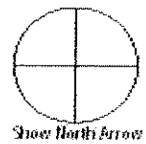
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	PZ	Highway	Stanley (W)
Agency or Company	MACTEC	From/To	
Date Performed	6/28/2006	Jurisdiction	
Analysis Time Period	DAY	Analysis Year	Proposed

Input Data





Class I highway ☐ Class II highway ☑

Terrain	☑ Level ☐ Rolling
Two-way hourly volume	773 veh/h
Directional split	60 / 40
Peak-hour factor, PHF	0.88
No-passing zone	0
% Trucks and Buses , P_T	5 %
% Recreational vehicles, P_R	2%
Access points/ mi	8

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	1.2
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	1.0
Heavy-vehicle adjustment factor, f_{HV} $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.990
Two-way flow rate[1], v_p (pc/h) $v_p=V/(PHF * f_G * f_{HV})$	887
v_p * highest directional split proportion[2] (pc/h)	532

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	mi/h	Base free-flow speed, $BFFS_{FM}$	45.0 mi/h
Observed volume, V_f	veh/h	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	6.0 mi/h
Free-flow speed, FFS $FFS=S_{FM}+0.00776(V_f/f_{HV})$	29.0 mi/h	Adj. for access points, f_A (Exhibit 20-6)	10.0 mi/h
		Free-flow speed, FFS $(FSS=BFFS-f_{LS}-f_A)$	29.0 mi/h

Adj. for no-passing zones, f_{np} (mi/h) (Exhibit 20-11)	0.0
Average travel speed, ATS (mi/h) $ATS=FFS-0.00776v_p-f_{np}$	22.1

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	1.1
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	1.0
Heavy-vehicle adjustment factor, f_{HV} $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.995
Two-way flow rate[1], v_p (pc/h) $v_p=V/(PHF * f_G * f_{HV})$	883
v_p * highest directional split proportion[2] (pc/h)	530
Base percent time-spent-following, BPTSF(%) $BPTSF=100(1-e^{-0.000879v_p})$	54.0
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	0.0
Percent time-spent-following, PTSF(%) $PTSF=BPTSF+f_{d/np}$	54.0

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	B
Volume to capacity ratio v/c $v/c=V_p/3,200$	0.28
Peak 15-min veh-miles of travel, VMT_{15} (veh- mi) $VMT_{15}=0.25L_t(V/PHF)$	220
Peak-hour vehicle-miles of travel, VMT_{60} (veh- mi) $VMT_{60}=V*L_t$	773
Peak 15-min total travel time, TT_{15}(veh-h) $TT_{15}=VMT_{15}/ATS$	9.9

Notes

1. If v_p >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split v_p>= 1,700 pc/h, terminated anlysis-the LOS is F.

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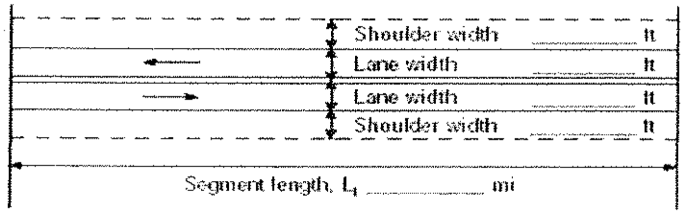
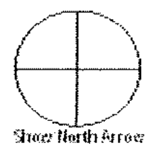
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	PZ	Highway	Dickman /Artillery Post (E)
Agency or Company	MACTEC	From/To	
Date Performed	6/28/2006	Jurisdiction	
Analysis Time Period	DAY	Analysis Year	Proposed

Input Data





Class I highway | Class II highway

Terrain	Level / Rolling
Two-way hourly volume	336 veh/h
Directional split	55 / 45
Peak-hour factor, PHF	0.88
No-passing zone	0
% Trucks and Buses, P_T	5 %
% Recreational vehicles, P_R	2%
Access points/ mi	8

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	1.7
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	1.0
Heavy-vehicle adjustment factor, f_{HV} $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.966
Two-way flow rate[1], v_p (pc/h) $v_p=V/(PHF * f_G * f_{HV})$	395
v_p * highest directional split proportion[2] (pc/h)	217

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
		Base free-flow speed, $BFFS_{FM}$	45.0 mi/h
Field Measured speed, S_{FM}	mi/h	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	6.0 mi/h
Observed volume, V_f	veh/h	Adj. for access points, f_A (Exhibit 20-6)	10.0 mi/h
Free-flow speed, FFS $FFS=S_{FM}+0.00776(V_f/f_{HV})$	29.0 mi/h	Free-flow speed, FFS $(FSS=BFFS-f_{LS}-f_A)$	29.0 mi/h

Adj. for no-passing zones, f_{np} (mi/h) (Exhibit 20-11)	0.0
Average travel speed, ATS (mi/h) $ATS=FFS-0.00776v_p-f_{np}$	25.9

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	1.1
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	1.0
Heavy-vehicle adjustment factor, f_{HV} $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.995
Two-way flow rate[1], v_p (pc/h) $v_p=V/(PHF * f_G * f_{HV})$	384
v_p * highest directional split proportion[2] (pc/h)	211
Base percent time-spent-following, BPTSF(%) $BPTSF=100(1-e^{-0.000879v_p})$	28.6
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	0.3
Percent time-spent-following, PTSF(%) $PTSF=BPTSF+f_{d/np}$	28.9

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	A
Volume to capacity ratio v/c $v/c=V_p/3{,}200$	0.12
Peak 15-min veh-miles of travel, VMT_{15} (veh- mi) $VMT_{15}=0.25L_t(V/PHF)$	95
Peak-hour vehicle-miles of travel, VMT_{60} (veh- mi) $VMT_{60}=V*L_t$	336
Peak 15-min total travel time, TT_{15}(veh-h) $TT_{15}=VMT_{15}/ATS$	3.7

Notes

1. If v_p >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split v_p>= 1,700 pc/h, terminated anlysis-the LOS is F.

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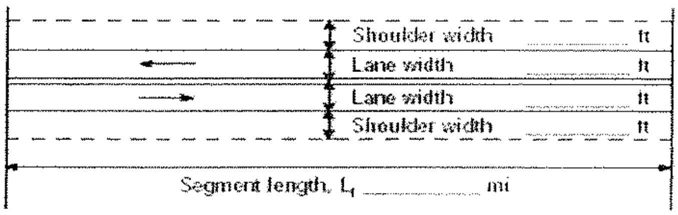
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	PZ	Highway	Dickman /Artillery Post (W)
Agency or Company	MACTEC	From/To	
Date Performed	6/28/2006	Jurisdiction	
Analysis Time Period	DAY	Analysis Year	Proposed

Input Data



Class I highway   Class II highway

Terrain   Level   Rolling

Two-way hourly volume	178 veh/h
Directional split	56 / 44
Peak-hour factor, PHF	0.88
No-passing zone	0
% Trucks and Buses , P_T	5 %
% Recreational vehicles, P_R	2%
Access points/ mi	8

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	1.7
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	1.0
Heavy-vehicle adjustment factor, f_{HV} f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	0.966
Two-way flow rate[1], v_p (pc/h) v_p=V/ (PHF * f_G * f_{HV})	209
v_p * highest directional split proportion[2] (pc/h)	117

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	mi/h	Base free-flow speed, $BFFS_{FM}$	45.0 mi/h
Observed volume, V_f	veh/h	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	6.0 mi/h
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	29.0 mi/h	Adj. for access points, f_A (Exhibit 20-6)	10.0 mi/h
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	29.0 mi/h

Adj. for no-passing zones, f_{np} (mi/h) (Exhibit 20-11)	0.0
Average travel speed, ATS (mi/h) ATS=FFS-0.00776v_p-f_{np}	27.4

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	1.1
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	1.0
Heavy-vehicle adjustment factor, f_{HV} f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	0.995
Two-way flow rate[1], v_p (pc/h) v_p=V/ (PHF * f_G * f_{HV})	203
v_p * highest directional split proportion[2] (pc/h)	114
Base percent time-spent-following, BPTSF(%) BPTSF=100(1-$e^{-0.000879v_p}$)	16.3
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	1.0
Percent time-spent-following, PTSF(%) PTSF=BPTSF+$f_{d/np}$	17.3

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	A
Volume to capacity ratio v/c v/c=V_p/ 3,200	0.07
Peak 15-min veh-miles of travel,VMT_{15} (veh- mi) VMT_{15}= 0.25L_t(V/PHF)	51
Peak-hour vehicle-miles of travel, VMT_{60} (veh- mi) VMT_{60}=V*L_t	178
Peak 15-min total travel time, TT_{15}(veh-h) TT_{15}= VMT_{15}/ATS	1.9

Notes

1. If v_p >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split v_p>= 1,700 pc/h, terminated anlysis-the LOS is F.

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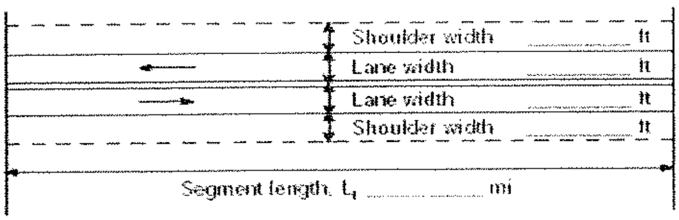
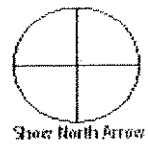
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	PZ	Highway	Graham (E)
Agency or Company	MACTEC	From/To	
Date Performed	6/28/2006	Jurisdiction	
Analysis Time Period	DAY	Analysis Year	Proposed

Input Data





Class I highway	Class II highway ☑
Terrain	Level ☑ / Rolling
Two-way hourly volume	259 veh/h
Directional split	55 / 45
Peak-hour factor, PHF	0.88
No-passing zone	0
% Trucks and Buses , P_T	5 %
% Recreational vehicles, P_R	2%
Access points/ mi	8

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	1.7
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	1.0
Heavy-vehicle adjustment factor, f_{HV} f_{HV}=1/ (1+ $P_T(E_T$-1)+$P_R(E_R$-1))	0.966
Two-way flow rate[1], v_p (pc/h) v_p=V/ (PHF * f_G * f_{HV})	305
v_p * highest directional split proportion[2] (pc/h)	168

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
		Base free-flow speed, $BFFS_{FM}$	45.0 mi/h
Field Measured speed, S_{FM}	mi/h	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	6.0 mi/h
Observed volume, V_f	veh/h	Adj. for access points, f_A (Exhibit 20-6)	10.0 mi/h
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	29.0 mi/h	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	29.0 mi/h

Adj. for no-passing zones, f_{np} (mi/h) (Exhibit 20-11)	0.0
Average travel speed, ATS (mi/h) ATS=FFS-0.00776v_p-f_{np}	26.6

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	1.1
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	1.0
Heavy-vehicle adjustment factor, f_{HV} f_{HV}=1/ (1+ $P_T(E_T$-1)+$P_R(E_R$-1))	0.995
Two-way flow rate[1], v_p (pc/h) v_p=V/ (PHF * f_G * f_{HV})	296
v_p * highest directional split proportion[2] (pc/h)	163
Base percent time-spent-following, BPTSF(%) BPTSF=100(1-$e^{-0.000879v_p}$)	22.9
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	0.5
Percent time-spent-following, PTSF(%) PTSF=BPTSF+$f_{d/np}$	23.4

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	A
Volume to capacity ratio v/c v/c=V_p/ 3,200	0.10
Peak 15-min veh-miles of travel,VMT_{15} (veh- mi) VMT_{15}= 0.25L_t(V/PHF)	74
Peak-hour vehicle-miles of travel, VMT_{60} (veh- mi) VMT_{60}=V*L_t	259
Peak 15-min total travel time, TT_{15}(veh-h) TT_{15}= VMT_{15}/ATS	2.8

Notes

1. If v_p >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split v_p>= 1,700 pc/h, terminated anlysis-the LOS is F.

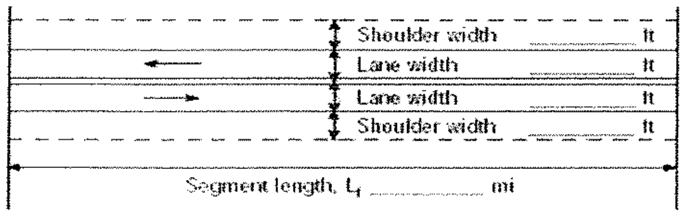
HCS2000[TM]

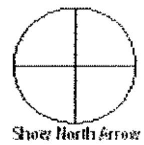
Version 4.1d

TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	PZ	Highway	Service Street 1 (E)
Agency or Company	MACTEC	From/To	
Date Performed	6/28/2006	Jurisdiction	
Analysis Time Period	DAY	Analysis Year	Proposed

Input Data





Class I highway ☐ Class II highway ☑

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	52 veh/h
Directional split	66 / 34
Peak-hour factor, PHF	0.88
No-passing zone	0
% Trucks and Buses , P_T	5 %
% Recreational vehicles, P_R	2%
Access points/ mi	8

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	1.7
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	1.0
Heavy-vehicle adjustment factor, f_{HV} $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.966
Two-way flow rate[1], v_p (pc/h) $v_p=V/(PHF * f_G * f_{HV})$	61
v_p * highest directional split proportion[2] (pc/h)	40

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	mi/h	Base free-flow speed, $BFFS_{FM}$	45.0 mi/h
Observed volume, V_f	veh/h	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	6.0 mi/h
Free-flow speed, FFS $FFS=S_{FM}+0.00776(V_f/f_{HV})$	29.0 mi/h	Adj. for access points, f_A (Exhibit 20-6)	10.0 mi/h
		Free-flow speed, FFS $(FSS=BFFS-f_{LS}-f_A)$	29.0 mi/h

Adj. for no-passing zones, f_{np} (mi/h) (Exhibit 20-11)	0.0
Average travel speed, ATS (mi/h) $ATS=FFS-0.00776v_p-f_{np}$	28.5

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	1.1
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	1.0
Heavy-vehicle adjustment factor, f_{HV} $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.995
Two-way flow rate[1], v_p (pc/h) $v_p=V/(PHF * f_G * f_{HV})$	59
v_p * highest directional split proportion[2] (pc/h)	39
Base percent time-spent-following, BPTSF(%) $BPTSF=100(1-e^{-0.000879v_p})$	5.1
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	3.6
Percent time-spent-following, PTSF(%) $PTSF=BPTSF+f_{d/np}$	8.7

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	A
Volume to capacity ratio v/c $v/c=V_p/3,200$	0.02
Peak 15-min veh-miles of travel, VMT_{15} (veh- mi) $VMT_{15}=0.25L_t(V/PHF)$	15
Peak-hour vehicle-miles of travel, VMT_{60} (veh- mi) $VMT_{60}=V*L_t$	52
Peak 15-min total travel time, TT_{15}(veh-h) $TT_{15}=VMT_{15}/ATS$	0.5

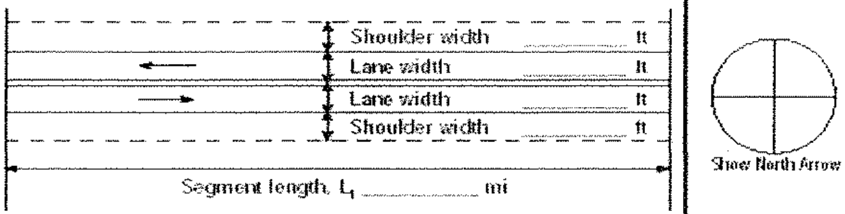
Notes

1. If v_p >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split v_p>= 1,700 pc/h, terminated anlysis-the LOS is F.

TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	PZ	Highway	Service Street 2 (W)
Agency or Company	MACTEC	From/To	
Date Performed	6/28/2006	Jurisdiction	
Analysis Time Period	DAY	Analysis Year	Proposed

Input Data



Class I highway / Class II highway

Terrain	Level / Rolling
Two-way hourly volume	37 veh/h
Directional split	51 / 49
Peak-hour factor, PHF	0.88
No-passing zone	0
% Trucks and Buses , P_T	5 %
% Recreational vehicles, P_R	2%
Access points/ mi	8

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	1.7
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	1.0
Heavy-vehicle adjustment factor, f_{HV} $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.966
Two-way flow rate[1], v_p (pc/h) $v_p=V/(PHF * f_G * f_{HV})$	44
v_p * highest directional split proportion[2] (pc/h)	22

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	mi/h	Base free-flow speed, $BFFS_{FM}$	45.0 mi/h
Observed volume, V_f	veh/h	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	6.0 mi/h
Free-flow speed, FFS $FFS=S_{FM}+0.00776(V_f/f_{HV})$	29.0 mi/h	Adj. for access points, f_A (Exhibit 20-6)	10.0 mi/h
		Free-flow speed, FFS $(FSS=BFFS-f_{LS}-f_A)$	29.0 mi/h

Adj. for no-passing zones, f_{np} (mi/h) (Exhibit 20-11)	0.0
Average travel speed, ATS (mi/h) $ATS=FFS-0.00776v_p-f_{np}$	28.7

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	1.1
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	1.0
Heavy-vehicle adjustment factor, f_{HV} $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.995
Two-way flow rate[1], v_p (pc/h) $v_p=V/(PHF * f_G * f_{HV})$	42
v_p * highest directional split proportion[2] (pc/h)	21
Base percent time-spent-following, BPTSF(%) $BPTSF=100(1-e^{-0.000879v_p})$	3.6
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	0.2
Percent time-spent-following, PTSF(%) $PTSF=BPTSF+f_{d/np}$	3.9

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	A
Volume to capacity ratio v/c $v/c=V_p/3,200$	0.01
Peak 15-min veh-miles of travel, VMT_{15} (veh- mi) $VMT_{15}=0.25L_t(V/PHF)$	11
Peak-hour vehicle-miles of travel, VMT_{60} (veh- mi) $VMT_{60}=V*L_t$	37
Peak 15-min total travel time, TT_{15}(veh-h) $TT_{15}=VMT_{15}/ATS$	0.4

Notes

1. If v_p >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split v_p >= 1,700 pc/h, terminated anlysis-the LOS is F.

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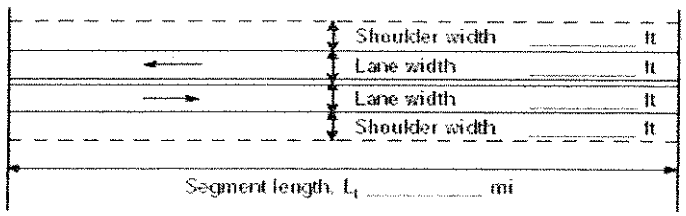
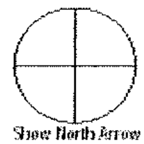
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	PZ	Highway	Wheaton Road (E)
Agency or Company	MACTEC	From/To	
Date Performed	6/28/2006	Jurisdiction	
Analysis Time Period	DAY	Analysis Year	Proposed

Input Data





Class I highway   Class II highway

Terrain	Level / Rolling
Two-way hourly volume	54 veh/h
Directional split	84 / 16
Peak-hour factor, PHF	0.88
No-passing zone	0
% Trucks and Buses , P_T	5 %
% Recreational vehicles, P_R	2%
Access points/ mi	8

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	1.7
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	1.0
Heavy-vehicle adjustment factor, f_{HV} $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.966
Two-way flow rate[1], v_p (pc/h) $v_p=V/(PHF * f_G * f_{HV})$	64
v_p * highest directional split proportion[2] (pc/h)	54

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
		Base free-flow speed, $BFFS_{FM}$	45.0 mi/h
Field Measured speed, S_{FM}	mi/h	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	6.0 mi/h
Observed volume, V_f	veh/h		
Free-flow speed, FFS $FFS=S_{FM}+0.00776(V_f/f_{HV})$	29.0 mi/h	Adj. for access points, f_A (Exhibit 20-6)	10.0 mi/h
		Free-flow speed, FFS $(FSS=BFFS-f_{LS}-f_A)$	29.0 mi/h

Adj. for no-passing zones, f_{np} (mi/h) (Exhibit 20-11)	0.0
Average travel speed, ATS (mi/h) $ATS=FFS-0.00776v_p-f_{np}$	28.5

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	1.00
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	1.1
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	1.0
Heavy-vehicle adjustment factor, f_{HV} $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.995
Two-way flow rate[1], v_p (pc/h) $v_p=V/(PHF * f_G * f_{HV})$	62
v_p * highest directional split proportion[2] (pc/h)	52
Base percent time-spent-following, BPTSF(%) $BPTSF=100(1-e^{-0.000879v_p})$	5.3
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	7.3
Percent time-spent-following, PTSF(%) $PTSF=BPTSF+f_{d/np}$	12.6

Level of Service and Other Performance Measures

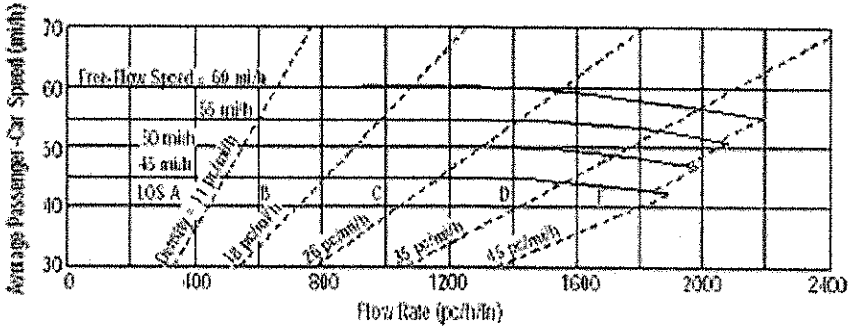
Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	A
Volume to capacity ratio v/c $v/c=V_p/3,200$	0.02
Peak 15-min veh-miles of travel, VMT_{15} (veh- mi) $VMT_{15}=0.25L_t(V/PHF)$	15
Peak-hour vehicle-miles of travel, VMT_{60} (veh- mi) $VMT_{60}=V*L_t$	54
Peak 15-min total travel time, TT_{15}(veh-h) $TT_{15}=VMT_{15}/ATS$	0.5

Notes

1. If v_p >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split v_p>= 1,700 pc/h, terminated anlysis-the LOS is F.

G.7 ROADWAY ANALYSIS – BAMC

MULTILANE HIGHWAYS WORKSHEET(Direction 1)



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	PZ
Agency or Company	MACTEC
Date Performed	6/28/2006
Analysis Time Period	DAY

Site Information

Highway/Direction to Travel	George Beach Avenue
From/To	
Jurisdiction	
Analysis Year	Proposed

Project Description

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	867	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	2
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.972

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearence, LC (ft)	12.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0

Access Points, A (A/mi)	20	f_A (mi/h)	5.0
Median Type, M	Divided	f_M (mi/h)	0.0
FFS (measured)		FFS (mi/h)	45.0
Base Free-Flow Speed, BFFS	50.0		

Operations		**Design**	
Operational (LOS)		Design (N)	
Flow Rate, v_p (pc/h/ln)	495	Required Number of Lanes, N	
Speed, S (mi/h)	45.0	Flow Rate, v_p (pc/h)	
D (pc/mi/ln)	11.0	Max Service Flow Rate (pc/h/ln)	
LOS	A	Design LOS	