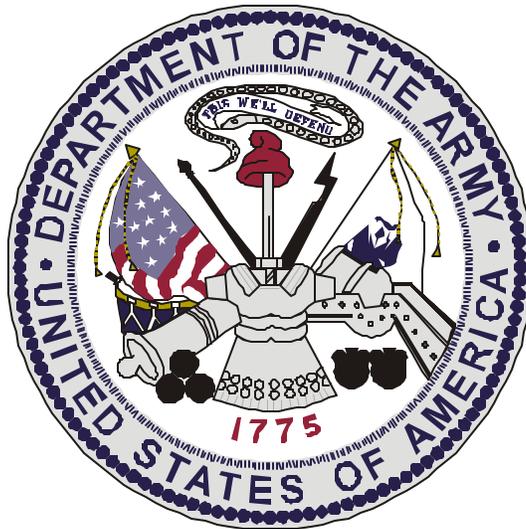


Revised Draft
**Environmental Assessment
for Transformation to Modular Brigades and Construction
of Support Facilities
Fort Hood, Texas**



Prepared for
Environmental Division, Fort Hood, Texas

Prepared by
**Tetra Tech, Inc.
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August 2004

**ENVIRONMENTAL ASSESSMENT
MODULAR BRIGADES AND SUPPORTING FACILITIES
AT FORT HOOD, TEXAS**

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August 2004

ENVIRONMENTAL ASSESSMENT ORGANIZATION

This Environmental Assessment (EA) addresses the proposed action to implement Transformation to Modular Brigades and Constructing Support Facilities at Fort Hood, Texas. As required by Army Regulation 200-2 and the National Environmental Policy Act, the potential environmental and socioeconomic impacts are analyzed.

An ***EXECUTIVE SUMMARY*** briefly describes the proposed action, environmental and socioeconomic consequences, and mitigation measures.

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SECTION 1.0: ***PURPOSE, NEED, AND SCOPE*** summarizes the purpose of and need for the proposed action and describes the scope of the environmental impact analysis process.

SECTION 2.0: ***PROPOSED ACTION AND ALTERNATIVES*** describes the proposed action and alternatives to implementing Brigade Modularity at Fort Hood, Texas.

SECTION 3.0: ***AFFECTED ENVIRONMENT AND CONSEQUENCES*** describes the existing environmental and socio-economic setting at Fort Hood, identifies potential effects of implementing the proposed action, and summarizes the resulting environmental effects

SECTION 4.0: ***REFERENCES*** provides bibliographical information for cited sources.

SECTION 5.0: ***LIST OF PREPARERS*** identifies persons who prepared the document.

SECTION 6.0: ***PERSONS CONSULTED*** provides a listing of persons and agencies consulted during preparation of this EA.

SECTION 7.0: ***DISTRIBUTION LIST*** indicates recipients of this EA.

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Draft
Finding of No Significant Impact

*Transformation to Modular Brigades and
Construction of Support Facilities at Fort Hood, Texas*

Pursuant to the Council on Environmental Quality (CEQ) Regulations (40 CFR Parts 1500-1508) for implementing the procedural provisions of the National Environmental Policy Act (42 U.S.C. 4321 et seq.) and Army regulation (32 CFR 651), III Corps and Fort Hood, Texas, conducted an environmental assessment (EA) of the potential environmental and socioeconomic effects of modularizing brigades and related actions at Fort Hood.

Proposed Action. III Corps and Fort Hood proposes to restructure its forces into modular brigades, construct new facilities, and establish three new ranges for small arms live-fire.

Purpose and Need. The purpose of the proposed action is to restructure III Corps' operational force formations, to construct facilities, and to increase training range capabilities. The proposed action is needed to address changing circumstances confronting the Nation in the 21st century.

Alternatives. III Corps and Fort Hood identifies two alternatives for achieving the purpose and need for action. These are referred to as the "Cantonment Area Alternative" and the "Green Grass Alternative." Each of these alternatives would involve three major aspects: changes in force structure to make brigades modular and to add a fourth heavy brigade combat team unit of action to each division at Fort Hood, facilities and infrastructure improvements (development of new facilities, construction of a tactical vehicle road, and construction of a new Chinook helicopter hangar), and establishment of three new training ranges. The Cantonment Area and Green Grass Alternatives differ only in the location of where new facilities would be sited in order to support changes in force structure.

III Corps and Fort Hood considered alternatives to each aspect of the proposed action. For reasons set forth in the EA, the various alternatives were found not feasible and, therefore, were not evaluated in detail. Consistent with regulations of the Council on Environmental Quality, the EA evaluated in detail the no action alternative.

Factors Considered in Determining That No Environmental Impact Statement Is Required. The EA, which is incorporated by reference into this draft Finding of No Significant Impact (FNSI), examined the potential effects of both the Cantonment and Green Grass proposed alternative actions and the no action alternative on several resources. Implementation of either the Cantonment or Green Grass alternative action would result in a combination of minor and major short-term and long-term adverse and beneficial effects. Short-term and long-term major beneficial effects would be realized by the economy due to the influx of people. Long-term beneficial effects would be realized with more federal aid to the school system. Short-term minor adverse effects would be expected on air quality, hazardous materials/waste, recreation, medical facilities, law enforcement and fire protection, traffic and utilities. Short-term major adverse effects would be expected on the school district as a result of student influx, utilities, and wastewater. Long-term minor adverse effects would be expected on airspace, training land use, air quality due to increased helicopter flight activities, intermittent noise from flight activities at RGAAF, potential cultural sites, and wildlife due to habitat loss. Long-term major impacts would be realized on soil erosion from increased training, and water quality from increased erosion and runoff. There would be no effects as a result of not implementing the proposed action.

1 **Mitigation.** In addition to Best Management Practices (BMPs), specific mitigation actions identified include
2 performing construction and flight training during the daylight hours, installation of noise reduction devices in
3 new facilities near RGAAF, obtaining stormwater permits for run-off during construction, developing a Storm
4 water Prevention Plan, upgrade potable and sewer water systems, obtaining additional land for heavy
5 maneuver training, reduction of cattle grazing areas, and develop a comprehensive Range Management Plan
6 consistent with installation's INRMP that would result in sustainment of the ranges and grazing areas.
7

8 **Conclusion.** Based on the EA, which is herewith incorporated by reference, it has been determined that
9 implementation of the either the Cantonment Area or Green Grass Alternative will have no significant direct,
10 indirect, or cumulative impacts on the quality of the natural or human environment. Because no significant
11 environmental impacts will result from implementation of the proposed action, an environmental impact
12 statement is not required and will not be prepared.
13

14 **Public Comment.** The EA and draft FNSI are available for review and comment for 30 days, beginning on
15 10 August 2004. Copies of the EA and draft FNSI can be obtained by contacting the following local libraries:
16 Killeen Public Library at 205 East Church Avenue, and Copperas Cove Public Library at 501 South Main
17 Street, or contacting the National Environmental Policy Act (NEPA) Coordinator at the Fort Hood Public
18 Works Environmental Division office, (254) 287-6499. Comments may be faxed to the National
19 Environmental Policy Act (NEPA) Coordinator at the Fort Hood Public Works Environmental Division office,
20 (254) 287-6499, mailed to the following address: Fort Hood Environmental Division, ATTN: NEPA
21 Coordinator, Public Works, 77th and Warehouse, Building 4219, Attn: AFZF-PW-ENV, Fort Hood, Texas
22 76544-5057 or e-mailed to Vicki.Bump@us.army.mil no later 10 September 2004.
23

24 Subject to review and consideration of comments submitted by individuals, organizations, or agencies during
25 the comment period, III Corps and Fort Hood intends to issue a final FNSI at the conclusion of the comment
26 period and proceed with the either proposed alternative action.
27

28 This draft FNSI is issued by:
29
30
31

32 **TBD**

(Date)

1 **EXECUTIVE SUMMARY**

2 This environmental assessment (EA) evaluates the proposal of III Corps and Fort Hood, Texas, to
3 enhance the Corps' capabilities by restructuring its forces into modular, brigade-sized units of
4 action, constructing new facilities, and establishing three new small arms live-fire ranges at the
5 installation.

6 In *March* 2002, the Army published a programmatic environmental impact statement (PEIS) for
7 its proposal to conduct a multiyear, phased, and synchronized program of transformation. Over a
8 30-year period, the Army will conduct a series of transformation activities affecting virtually all
9 aspects of Army doctrine, training, leader development, organizations, installations, materiel, and
10 soldiers. This EA evaluates actions at Fort Hood that are part of that transformation process
11 designed to create combat forces that are more responsive, deployable, agile, versatile, lethal,
12 survivable, and sustainable.

13 **PURPOSE AND NEED**

14 The purpose of the proposed action is to restructure III Corps' operational forces formations, to
15 construct facilities, and to increase training range capabilities.

16 The proposed action is needed to address changing circumstances confronting the Nation in the
17 21st century. The Army must adapt to changing world conditions and must improve its
18 capabilities to respond to a variety of circumstances across the full spectrum of military
19 operations. Restructuring of units throughout the Army, including those of III Corps, is needed to
20 create combat forces that are more stand-alone and alike while retaining their broad spectrum
21 capability. The Army needs to create a larger pool of units to fulfill strategic commitments,
22 standardize combat unit designs, make units more adaptable to the range of missions – from
23 peacekeeping to war, move from division-level (larger) to brigade-level (smaller) stand-alone
24 units, make units capable of deploying more rapidly, and improve the Army's ability to tailor
25 units and integrate them among components and with other Services and Nations. Present Army
26 doctrine recognizes the division as the principal deployable unit. To enable commanders' task
27 organization of forces, without resort to deployment of an entire division, the Army needs to
28 standardize its units and increase their number.

29 **PROPOSED ACTION**

30 III Corps and Fort Hood identifies two alternatives for achieving the purpose and need for action.
31 These are referred to as the "Cantonment Area Alternative" and the "Green Grass Alternative."
32 These two alternatives would differ only with respect to the location for development of facilities
33 to support force structure changes.

34 The Cantonment Area Alternative would involve three major aspects, as follows:

- 35 • *Changes in Force Structure.* Modularization of operational forces would redistribute
36 key corps and division resources to the brigade level, producing a more "brigade-
37 centric" Army and, through standardization, provide the Army greater flexibility in
38 meeting operational requirements. To such ends, III Corps proposes to restructure
39 forces at Fort Hood to create a modular Corps headquarters and to restructure forces
40 in both the 4th Infantry Division ("4ID") and 1st Cavalry Division ("1CD") as to
41 create a modular Division headquarters, add a fourth heavy brigade combat team, and

1 create a support brigade headquarters staff, an aviation brigade, and a fires brigade.
2 Personnel to man the modular brigades, equipment, and weapon systems would be
3 reassigned first from existing resources within each division and second from III
4 Corps resources and Army-wide resources. For planning purposes, and as an upper
5 limit, III Corps and Fort Hood estimate that the 4ID and 1CD would each experience
6 net growth of up to 4,000 personnel. The training of modular units would be highly
7 similar to that of existing units. The 4ID's fourth heavy brigade combat team would
8 be manned, equipped, trained, and ready to deploy by June 15, 2005; modularization
9 of 1CD's fourth heavy brigade combat team would begin in Fiscal Year 2006 (i.e.,
10 after September 30, 2005). Dates for modularization of other brigades have not been
11 established.

- 12 • *Facilities and Infrastructure.* Three facilities and infrastructure projects would
13 accompany force structure changes at Fort Hood. (1) In-fill development of the
14 Cantonment Area. III Corps and Fort Hood would maximize use of existing facilities
15 and provide additional facilities. Several elements of III Corps would relocate from
16 the facilities they presently use to other locations within the cantonment area. These
17 relocations would allow facilities in the 4ID area in the eastern portion of the
18 cantonment to be made available principally to the 4ID. Construction would
19 demolition of approximately 33,922 square feet of existing space. In addition to
20 more than 600,000 square feet of impervious surfaces created by the proposed
21 facilities, there would be approximately 1,670,00 square feet (38.2 acres) of
22 additional impervious surfaces for vehicle parking. (2) Tactical Vehicles Road Over
23 U.S. Highway 190. III Corps and Fort Hood proposes to construct a road northward
24 from the Ammunition Supply Point, through the Green Grass Site and over U.S.
25 Highway 190, to join existing roads in the maneuver areas in the western portion of
26 the post. North of the Green Grass Site, access to and use of this proposed road
27 would be limited to military and tactical vehicles. (3) Chinook Hangar. To
28 accommodate Army strategic stationing objectives, Building 7027 at Hood Army
29 Airfield would be demolished and a new, larger hangar built for 12 aircraft and
30 personnel of one CH-47 Chinook helicopter company.
- 31 • *Training Ranges.* Three new small arms live-fire ranges to supplement the post's
32 current inventory of 77 live-fire ranges would be built to develop and hone the skills
33 of squad-designated marksmen, snipers, and machine gunners. All three ranges
34 would be located along the periphery of the post's impact area.

35 The Green Grass Alternative would be identical to the Cantonment Area Alternative with the
36 exception of the location for siting of new facilities to support force structure changes. Under this
37 alternative, III Corps and Fort Hood would construct 220 temporary facilities having 1 million
38 square feet of space for administration, classroom training, maintenance, and billeting functions
39 sufficient in scope to support a brigade-sized organization. Facilities and supporting
40 infrastructure would be located on approximately 300 acres at West Fort Hood on an undeveloped
41 site lying north of the ammunition storage area and west of Clark Road. Construction would
42 create 4,930,796 square feet (113.2 acres) of new impervious surfaces.

43 **ALTERNATIVES**

44 III Corps and Fort Hood considered alternatives to each aspect of the proposed action. The
45 various alternatives were found not feasible and, therefore, are not evaluated in detail in the EA.

1 Consistent with Council on Environmental Quality regulations, the EA does evaluate in detail a
2 no action alternative.

3 ***ENVIRONMENTAL CONSEQUENCES***

4 Environmental consequences would be similar for both the Cantonment and Green Grass
5 Alternatives. Short-term and long-term major beneficial effects would be realized by the
6 economy due to the influx of people. Long-term beneficial effects would be realized with more
7 federal aid to the school system. Short-term minor adverse effects would be expected on air
8 quality, hazardous materials/waste, recreation, medical facilities, law enforcement and fire
9 protection, traffic and utilities. Short-term major adverse effects would be expected on the school
10 district as a result of student influx, utilities, and wastewater. Long-term minor adverse effects
11 would be expected on airspace, training land use, air quality due to increased helicopter flight
12 activities, intermittent noise from flight activities at RGAAF for the Green Grass Alternative,
13 potential cultural sites, vegetation, and wildlife due to habitat loss. Long-term major impacts
14 would be realized on soil erosion from increased training, and surface water and water quality
15 from increased erosion and runoff.
16

17 ***MITIGATION***

18 In addition to Best Management Practices (BMPs), specific mitigation actions identified include
19 performing construction and flight training during the daylight hours, installation of noise
20 reduction devices in new facilities near RGAAF, obtaining storm water permits for run-off during
21 construction, and developing a Storm Water Prevention Plan, upgrade potable and sewer water
22 systems, building of three to four additional elementary schools, reduction of cattle grazing areas,
23 and development of a comprehensive Range Management Plan consistent with installation's
24 INRMP that would result in sustainment of the ranges.

25 ***FINDING OF NO SIGNIFICANT IMPACT***

26 Based on analyses contained in the EA, the proposed action would not result in significant
27 impacts to the natural or human environment. Issuance of a Finding of No Significant Impact
28 would be appropriate; an environmental impact statement need not be prepared.

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1 **SECTION 1.0**

2 **PURPOSE, NEED, AND SCOPE**

3 **1.1 INTRODUCTION**

4 This environmental assessment (EA) evaluates the proposal of III Corps and Fort Hood, Texas, to
5 enhance the Corps' capabilities by restructuring its forces into modular, brigade-sized units of
6 action, providing additional facilities, and establishing three new small arms live-fire ranges. Fort
7 Hood is located in Bell and Coryell Counties of central Texas, 59 miles north of Austin (TAB 3,
8 Figure 1-1).

9 In October 1999, the Secretary of the Army and the Chief of Staff of the Army articulated a
10 vision about people, readiness, and transformation of the Army to meet challenges emerging in
11 the 21st century and the need to be able to respond more rapidly to different types of operations
12 requiring military action. The strategic significance of land forces continues to lie not only in
13 their ability to fight and win the Nation's wars, but also in their providing options to shape the
14 global environment to future benefit of the United States and its allies. Change is needed for the
15 Army to become more strategically responsive and dominant at every point on the spectrum of
16 operations.¹

17 In *March* 2002, the Army published a programmatic environmental impact statement (PEIS) for
18 its proposal to conduct a multiyear, phased, and synchronized program of transformation. Over a
19 30-year period, the Army will conduct a series of transformation activities affecting virtually all
20 aspects of Army doctrine, training, leader development, organizations, installations, materiel, and
21 soldiers. In April 2002, the Army issued a *Record of Decision* reflecting its intent to transform
22 the Army. This EA evaluates actions at Fort Hood that are part of that transformation process
23 designed to create combat forces that are more responsive, deployable, agile, versatile, lethal,
24 survivable, and sustainable. Under the proposed action, III Corps and Fort Hood would

- 25 • Restructure portions of its forces into modular brigades, resulting in the 4th Infantry
26 Division (Mechanized) ("4ID") and 1st Cavalry Division ("1CD") each having a
27 fourth heavy brigade combat team, an aviation brigade, a fires brigade, and a
28 sustainment brigade headquarters.
- 29 • Provide additional facilities and infrastructure for additional units, a tactical vehicles
30 road for access to training areas, and an additional hangar for rotary-wing aircraft.
- 31 • Establish three small arms live-fire ranges for squad-designated marksman, sniper,
32 and machine gunner training.

33 **1.2 PURPOSE AND NEED FOR PROPOSED ACTION**

34 The purpose of the proposed action is to restructure III Corps' operational forces formations, to
35 provide additional facilities, and to increase training range capabilities.

36

¹ See TAB 1 for a glossary of key terms.

1 The proposed action is needed to address the changing circumstances of the 21st century. The
2 Army is legally bound to defend the United States and its territories, support national policies and
3 objectives, and defeat nations responsible for aggression that endangers the peace and security of
4 the United States. To carry out these tasks, the Army must adapt to changing world conditions
5 and must improve its capabilities to respond to a variety of circumstances across the full spectrum
6 of military operations.

7 Recent events have shown that the Army cannot merely be prepared to fight the next war as it
8 fought the last major war. America's foes seek to counter the predominance the Army displayed
9 in Operation Desert Storm in 1991 and in on-going military operations in the Global War on
10 Terrorism. Attacks on the United States underscore the need for planning and training to meet a
11 variety of non-typical scenarios as well as more conventional challenges to the Nation and her
12 interests.

13 Warfighting doctrine continues to evolve. The use of heavy, massed forces that require months to
14 put in place do not optimally respond to opponents that employ means of warfare intended to
15 offset the Army's greater capabilities. Getting into an operational theater in a timely fashion – to
16 shape events or to act predominantly as circumstances dictate – would be enhanced through
17 creation of forces that can be built specifically for major tasks at hand. It is anticipated that future
18 military operations may more frequently require forces capable of conducting joint, multinational,
19 and interagency missions. Planning for and conducting such operations – undertaken with an
20 expeditionary mindset – require more cohesive and combat ready formations that are more agile
21 and easily tailored for a wide array of circumstances.

22 Restructuring of units throughout the Army, including those of III Corps, is needed to create
23 combat forces that are more stand-alone and alike while retaining their broad-spectrum capability.
24 The Army needs to:

- 25 • Create a larger pool of units to fulfill strategic commitments,
- 26 • Standardize combat unit designs,
- 27 • Make units more adaptable to the range of missions – from peacekeeping to war,
- 28 • Move from division-level (larger) to brigade-level (smaller) stand-alone units,
- 29 • Make units capable of deploying more rapidly, and
- 30 • Improve the Army's ability to tailor units and integrate them among components² and
31 with other Services and Nations.

32 Present Army doctrine recognizes the division as the principal deployable unit. The Army's
33 operating forces consist mainly of 10 divisions in the Active Component, 8 divisions in the
34 Reserve Component, and 2 divisions each consisting of Active Component headquarters and
35 Reserve Component maneuver brigades. To enable commanders' task organization of forces,

² Army-wide achievement of modularity would enable commanders in future operations to select from more than 80 brigades and, in appropriate cases, to obtain required, mission-specific capabilities without deploying an entire division.

1 without resort to deployment of an entire division, the Army needs to standardize its units and
2 increase their number.

3 **1.3 SCOPE OF ANALYSIS**

4 This EA has been developed in accordance with the National Environmental Policy Act (NEPA)
5 and implementing regulations issued by the President's Council on Environmental Quality (CEQ)
6 and the Army. Its purpose is to inform decision makers and the public of the likely
7 environmental consequences of the proposed action and alternatives.

8 This EA identifies, documents, and evaluates the effects of restructuring III Corps forces at Fort
9 Hood, providing additional facilities and infrastructure, and enhancing training range capabilities.
10 An interdisciplinary team of environmental scientists, biologists, planners, economists, engineers,
11 archaeologists, historians, and military technicians has analyzed the proposed action and
12 alternatives in light of existing conditions and has identified relevant beneficial and adverse
13 effects associated with the action. The proposed action and alternatives, including a no action
14 alternative, are described in Section 2.0. Conditions existing as of mid-2004, considered to be the
15 "baseline" conditions, are described in Section 3.0, Affected Environment and Consequences.
16 The expected effects of the proposed action, also described in Section 3.0, are presented
17 immediately following the description of baseline conditions for each environmental resource
18 addressed in the EA. Section 3.0 also addresses the potential for cumulative effects, and
19 mitigation measures are identified where appropriate.

20 The proposal to create modular brigades and provide for supporting facilities continues the
21 Army's on-going transformation program. Additional information on transformation may be
22 obtained from the *Programmatic Environmental Impact Statement for Army Transformation*,
23 (March 2002) and the related Record of Decision (April 2002).³

24 This EA evaluates proposed changes in operational force structure and related facilities actions.
25 To the extent the proposed action results in an increase in the total number of military personnel
26 assigned to Fort Hood, related actions might then be reflected in proposals for additional fire
27 stations, daycare facilities, road improvements, and other capabilities ensuring public health and
28 safety and acceptable quality of life standards.⁴ At present, proposals for such related actions
29 have been only generally identified. As planning progresses and specific requirements are
30 identified, additional proposals for specific actions may be put forth. III Corps and Fort Hood
31 will then conduct appropriate environmental impacts analyses in compliance with NEPA.

32 The description of the proposed action presented in this EA is based on III Corps' present
33 understanding of circumstances attending development of Army doctrine and implementation of
34 organizational structure changes. Army doctrine, training, leader development, organizations,
35 installations, materiel, and soldiers are inseparable; changes in one area inevitably affect other
36 areas. Changes and refinements to existing doctrine and the organization of forces are complex.
37 Information presently known concerning the proposed action is adequate to proceed with
38 evaluation of potential environmental effects, with the understanding that at the time of
39 implementation there may be a limited number of minor, "on the ground" adjustments. In the

³ These documents are available at http://notes.tetrattech-ffx.com/army_transformation_PEIS/tcppeis.htm.

⁴ An initial estimate indicates III Corps and Fort Hood would require 87 additional full-time equivalent civilian employees for operational support of a first modular heavy brigade. In light of the post's baseline civilian workforce comprising 4,346 general schedule, wage board, and nonappropriated fund activity personnel, this 2.0 percent I+-incremental change is a routine administrative matter and not specifically included within the scope of this EA.

1 event future requirements would result in impacts beyond those anticipated in this analysis, III
2 Corps and Fort Hood will undertake additional measures, as appropriate, to comply with NEPA.

3 **1.4 AGENCY AND PUBLIC PARTICIPATION**

4 III Corps and Fort Hood invites public participation in the NEPA process. Consideration of the
5 views and information of all interested persons promotes open communication and enables better
6 decision-making. All agencies, organizations, and members of the public having a potential
7 interest in the proposed action, including minority, low-income, disadvantaged, and Native
8 American groups, are urged to participate in the decision-making process.

9 Public participation opportunities with respect to the proposed action and this EA are guided by
10 the provisions of 32 Code of Federal Regulations (CFR) Part 651, *Environmental Analysis of*
11 *Army Actions*. If the EA concludes that the proposed action would not result in significant
12 environmental effects, III Corps and Fort Hood may issue a draft Finding of No Significant
13 Impact (FNSI). III Corps and Fort Hood will then observe a 30-day period during which time
14 agencies and the public may submit comments on the proposed action, the EA, or the draft FNSI.
15 Upon consideration of any comments received from the public or agencies, III Corps and Fort
16 Hood may approve the FNSI and implement the proposed action. If, however, at any time prior
17 to issuance of the final FNSI it is determined that significant effects would be likely, then the
18 Army will issue a Notice of Intent to prepare an environmental impact statement.

19 Throughout this process, the public may obtain information on the status and progress of the
20 proposed action and the EA through the III Corps and Fort Hood Public Affairs Office, phone
21 (254) 287-0106.

22 **1.5 REGULATORY FRAMEWORK**

23 A decision on whether to proceed with the proposed action rests on numerous factors such as
24 mission requirements, schedule, availability of funding, and environmental considerations. In
25 addressing environmental considerations, the III Corps and Fort Hood is guided by several
26 relevant statutes (and their implementing regulations) and Executive Orders that establish
27 standards and provide guidance on environmental and natural resources management and
28 planning. These include, but are not limited to, the Clean Air Act, Clean Water Act, Noise
29 Control Act, Endangered Species Act, National Historic Preservation Act, Archaeological
30 Resources Act, Resource Conservation and Recovery Act, Toxic Substances Control Act,
31 Executive Order 11988 (*Floodplain Management*), Executive Order 11990 (*Protection of*
32 *Wetlands*), Executive Order 12088 (*Federal Compliance with Pollution Control Standards*),
33 Executive Order 12898 (*Federal Actions to Address Environmental Justice in Minority*
34 *Populations and Low-Income Populations*), and Executive Order 13045 (*Protection of Children*
35 *from Environmental Health Risks and Safety Risks*). Where useful to better understanding, key
36 provisions of these statutes and Executive Orders are described in more detail in the text of the
37 EA.

1 **SECTION 2.0**

2 **PROPOSED ACTION AND ALTERNATIVES**

3 **2.1 INTRODUCTION**

4 III Corps and Fort Hood proposes to restructure its forces into modular brigades,⁵ provide
5 additional facilities and infrastructure, and establish three small arms ranges at the installation.

6 Under evolving Army doctrine, a unit of action (UA) possesses a wide range of combat
7 capabilities extending to combined arms, signal, military police/security, chemical, logistics,
8 fires, intelligence, engineer and armed reconnaissance. One or more deployed brigade combat
9 teams serving in the UA role would be augmented by a division-level unit of employment (UEX)
10 or a Corps-level unit of employment (UEY) and one or more standardized support UAs. Support
11 UAs would be manned, equipped, and trained for specialized functions: aviation, fires, strike,
12 sustainment, security, maneuver enhancement, or reconnaissance, surveillance, and target
13 acquisition (RSTA).

14 Fort Hood is home to Headquarters, III Corps and its two Active Component divisions, 4th
15 Infantry Division (Mechanized) (“4th ID”) and 1st Cavalry Division (“1CD”).⁶ III Corps forces at
16 Fort Hood that would be the primary resources for restructuring of forces into modular brigades
17 are listed in TAB 2. Table 2-1 provides general information on III Corps forces at Fort Hood and
18 the post’s resources.

19 **2.2 PROPOSED ACTION**

20 There are two alternatives for III Corps and Fort Hood to meet its purpose and need for the
21 proposed action. The alternatives are identical except for how III Corps and Fort Hood would
22 provide necessary facilities to support proposed force structure changes. The following
23 subsections present the “Cantonment Alternative” and “Green Grass Alternative.”

24 **2.2.1 Cantonment Alternative**

25 **2.2.1.1 Proposed Changes in Force Structure**

26 Modularization of operational forces would redistribute key corps and division resources to the
27 brigade level, producing a more “brigade-centric” Army and, through standardization, provide the
28 Army greater flexibility in meeting operational requirements. To such ends, III Corps proposes to

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⁵ Developing Army doctrine provides for the use of “units of employment” for command and control of operational forces and “units of action” for execution of strategic, operational, and tactical missions. Corps headquarters units of employment are known as “UEY,” and division headquarters units of employment are known as “UEX.” A UEY or UEX may employ one or more brigades as units of action (“UA”). As Army doctrine continues to evolve, brigade-sized units may be variously referred to as brigades, regiments, UAs, or brigade combat teams (BCT). This EA uses “brigades” to identify these units.

⁶ The proposed action presently does not encompass III Corps organizations located at installations other than Fort Hood. These include the 7th Infantry Division (Light), 1st Brigade, 1st Infantry Division (Mechanized), 3d Brigade, 1st Armored Division, 3d Armored Cavalry Regiment, III Corps Artillery (17th Field Artillery Brigade, 75th Field Artillery Brigade, 212th Field Artillery Brigade, and 214th Field Artillery Brigade), 13th Finance Group, and 937th Engineer Group (Combat).

Table 2-1
III Corps General Information

Total personnel of III Corps units at Fort Hood	39,608
Personnel, 1 st Cavalry Division	15,096
Personnel, 4 th Infantry Division (Mechanized)	13,309
Personnel, 13 th Corps Support Command	5,623
Total assigned military personnel (all Services)	41,619
Brigades	17
Battalions	67
Companies	306
Tracked vehicles	2,456
Wheeled vehicles	12,542
Installation size (acres)	214,968
Maneuver training areas (acres)	136,094
Live-fire training ranges	77
Tank trails (miles)	242.8
Buildings (total square feet)	28,173,832

Source: Planning, Analysis, and Integration Office, Garrison Command, July 2004

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restructure forces at Fort Hood to create a modular Corps headquarters and to restructure forces in both the 4ID and 1CD as follows:

3

4

- Create a modular Division headquarters

5

- Add a fourth heavy brigade combat team

6

- Create a support brigade headquarters staff

7

- Create an aviation brigade

8

- Create a fires brigade

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Personnel and Equipment. The Army publishes the Mobilization Table of Organization and Equipment (MTOE) to identify precisely all personnel and equipment of every organization and unit. Restructuring III Corps' organizations to achieve the modular brigades listed above would affect both existing and proposed units. Precision in certain regards (e.g., exact numbers of Soldiers with particular skills, or types of vehicles in units) cannot be known until MTOEs are finalized. The following are factors applicable to the restructuring process as it affects personnel and equipment:

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- Heavy brigades of the 4ID and 1CD presently have three maneuver battalions, each of which consists of three companies of Abrams tanks or Bradley Fighting Vehicles (total: nine companies per brigade). Modular brigades would consist of eight companies in two battalions. Thus, the 4ID and 1CD would experience a net increase in armored or mechanized companies, growing from 27 to 32 companies per division. A modular heavy brigade of mechanized infantry would consist of six battalions: two infantry battalions (mechanized), a brigade troops battalion, an armed reconnaissance

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1 battalion, a fires battalion, and a support battalion. The projected population of each
2 brigade would be 3,644 personnel.⁷ At Fort Hood, assets to create the two additional
3 heavy brigades would be drawn from existing units and from throughout the Army.

- 4 • The support brigade headquarters staff would provide command and control over
5 personnel and resources used to sustain operating forces. When the entire brigade is
6 fleshed out, it would be a principal asset to meet medical, signal, military police, and
7 several combat service support functions. At Fort Hood, assets to create two support
8 brigade headquarters staffs would be drawn from existing units (primarily the two
9 division support commands and the corps support command) and from throughout
10 the Army.

- 11 • A modular aviation brigade would be multi-functional through its variety of 48 AH-
12 64 Apache, 38 UH-60 Black Hawk, and 24 CH-47 Chinook aircraft. The brigade
13 would consist of a headquarters element, two attack battalions, an assault battalion, a
14 general support battalion, and an aviation support battalion. The projected population
15 would be 2,393 personnel. At Fort Hood, assets to create the two aviation brigades
16 could be drawn from existing units (e.g., present division and corps resources) and
17 from throughout the Army.

- 18 • A fires brigade would provide artillery and rocket/missile support to brigade combat
19 teams and other organizations. Primary weapon systems in the fires brigade would
20 be multiple-launch rocket systems, 155 mm and 105 mm cannons (towed), and self-
21 propelled 155 mm artillery (“Paladin”). At Fort Hood, assets to create one or more
22 fires brigades could be drawn from existing division and corps resources and from
23 throughout the Army.

24 **Assignments.** Personnel to man the modular brigades, equipment, and weapon systems would be
25 reassigned first from existing resources within each division and second from III Corps resources
26 and Army-wide resources. Pending finalization of MTOEs, only an estimate may be given for
27 the net changes in personnel and equipment. For planning purposes, and as an upper limit, III
28 Corps and Fort Hood estimate that the 4ID and 1CD would each experience net growth of up to
29 4,000 personnel. The numbers of personnel in Corps-level units would most likely decrease, but
30 the extent of the reductions cannot be known until finalization of revised MTOEs.

31 **Training.** The training of modular units would be highly similar to that of existing units. The
32 majority of training time and effort would continue to be expended to develop and reinforce the
33 skills of individuals in their military occupational specialties and of crew- and small-unit training.
34 Collective training of companies and larger units would also continue; frequency and duration of
35 training events and requisite proficiencies would be as established in Army Training and
36 Readiness Evaluation Program (ARTEP) directives.

37 **Schedule.** The 4ID’s fourth heavy brigade combat team would be manned, equipped, trained,
38 and ready to deploy by June 15, 2005; modularization of 1CD’s fourth heavy brigade combat
39 team would begin in Fiscal Year 2006 (i.e., after September 30, 2005). Dates for modularization
40 of other brigades have not been established.

⁷ Additional refinements in each battalion within the brigade may ultimately result in a slight change in the present projection of 3,644 personnel.

1 2.2.1.2 Proposed Facilities and Infrastructure

2 Under the Cantonment Alternative, many of the facilities and infrastructure requirements to
3 support force structure changes would be fulfilled through use of existing resources within the
4 post's cantonment area. Use of existing adequate facilities and modifications to other would
5 fulfill a large fraction of the requirements for administrative space, housing, maintenance,
6 storage, and other functions. A limited amount of new space would still be needed, however.
7 Facilities projects under this alternative are presented below in terms of proposals that would
8 occur in the cantonment area, construction of a new tactical vehicle road, and construction of a
9 new hangar.

10 **Cantonment Development.** Under the Cantonment Alternative, III Corps and Fort Hood would
11 maximize use of existing facilities and provide additional facilities. Several elements of III Corps
12 would relocate from the facilities they presently use to other locations within the cantonment
13 area. These relocations would allow facilities in the 4ID area in the eastern portion of the
14 cantonment to be made available principally to the 4ID. Specific relocation of units and functions
15 and provision of new facilities would include:

- 16 • *3d Signal Brigade, III Corps.* The motor pool at Bldg 13053 would move to Bldgs
17 4614, 4615, 4616, 4617, and III Corps Tactical Operations Center (a temporary
18 facility). The electronic maintenance shop in Bldg 13053 would be renovated.
- 19 • *13th Finance Group, III Corps.* The brigade headquarters would move from Bldg
20 16007 to a temporary facility in the 3500 Block. Company operations in Bldg 14019
21 would move to two temporary facilities in the 3500 Block. Twenty personnel living
22 in the barracks portion of Bldg 14019 would be relocated to Bldg 36008.
- 23 • *21st Cavalry Brigade (Air Combat), III Corps.* The brigade HQ would move from
24 Bldg 122 to a temporary facility at Hood Army Airfield. Company operations in
25 Bldg 87014 would be relocated to a temporary facility at Hood Army Airfield.
26 Thirty temporary facilities to be located in the 800 Block would replace space for 360
27 personnel now accommodated in Bldgs 87020 and 87022.
- 28 • *Headquarters Company, III Corps.* The 21st Replacement Detachment would move
29 from Bldg 16011 to a temporary facility in the 3500 Block. Company headquarters
30 located in Bldgs 16004, 16006, and 16010 would be relocated to 7 temporary
31 facilities in the 3500 Block. The Headquarters Company motor pool in Bldg 17001
32 would move to a temporary facility and Bldgs 4924 and 4926. Personnel now
33 accommodated in the barracks portions of Bldgs 16004 and 16006 would be
34 relocated to 8 temporary facilities in the 3500 Block.
- 35 • *89th Military Police Brigade, III Corps.* The brigade headquarters in Bldg 87005
36 would move to a temporary facility in the 200 and 300 Blocks. Battalion
37 headquarters in Bldgs 9422, 9423, and 9424 would move to a temporary facilities in
38 the 200 and 300 Blocks. Company operations in Bldgs 9422, 9423, 9424, and 9425
39 would move to 9 temporary facilities in the 200/300 Block. The motor pool in Bldg
40 9529 would move to Bldg 17030. Personnel in the barracks portions of Bldgs 9422,
41 9423, 9424, and 9425 would move to 30 temporary facilities in the 200 and 300
42 Blocks. Unit storage in the 9400 Block would move to a temporary facility in Bldg

- 1 17030. Battalion classrooms in the 9400 Block would move to a temporary facility
 2 in the 200 and 300 Blocks.
- 3 • *13th Corps Support Command, III Corps.* The battalion headquarters in Bldg 16001
 4 would move to a new facility along 72nd Street. Company operations in Bldgs 16002,
 5 16003, and 16009 would move to a new facility along 72nd Street. Motor pool
 6 activities now in Bldgs 15011, 15028, 15060, and 17030 would move to Bldgs 4911,
 7 4912, 4913, 4919, 4920, 4921, 4925, 4927, 4928, 13065, and 40060 and 1 temporary
 8 facility in the 4900 Block. Personnel accommodated in barracks in Bldgs 16003 and
 9 16009 would move to barracks in the 39000 Block.
- 10 • *Vehicle Reception Yard, III Corps.* Yard 27 along Santa Fe Avenue would be
 11 relocated to a new hardstand on Clark Road. Administrative functions in Bldg 4920
 12 would be moved to a temporary facility in the 89000 Block.
- 13 • *4th Infantry Division.* The motor pool in Bldg 13065 would be moved to Bldgs
 14 15011, 15028, and 15060. Selected existing barracks (“hammerheads”) in the 4ID
 15 area would be renovated into battalion headquarters and company headquarters
 16 spaces.

17 The foregoing relocations would enable siting of 287 temporary facilities that would be used
 18 primarily by the 4ID. These would include 12 brigade headquarters, 4 battalion headquarters, 22
 19 company headquarters, 22 company operations supply, 36 administration, 2 classroom, 1
 20 temporary hangar, 6 maintenance shop, 7 unit storage, 35 arms rooms, 2 laundry facility, 2
 21 dayroom, and 136 barracks buildings. Table 2-2 identifies the specific temporary facilities that
 22 would be used to support force structure changes. Placement of these facilities would necessitate
 23 demolition of approximately 33,922 square feet of existing space. In addition to more than
 24 600,000 square feet of impervious surfaces created by the proposed facilities, there would be
 25 approximately 1,670,000 square feet (38.2 acres) of additional impervious surfaces for vehicle
 26 parking.

**Table 2-2
 Proposed Construction**

Location/Building Type	Dimensions (feet)	No. Buildings	Square Feet
800 Block Area			
Barracks	28 x 56	60	94,080
Dayroom	48 x 64	1	3,072
Laundry facility (22 washers/dryers)	36 x 64	1	2,279
Subtotal			99,431
300 Block Area			
Barracks	28 x 56	60	94,080
Dayroom	48 x 64	1	3,072
Laundry facility (22 washers/dryers)	36 x 64	1	2,279
Company headquarters	48 x 64	13	39,936
Company operations supply	36 x 56	13	26,208
Battalion headquarters	48 x 64	4	12,288
Brigade headquarters	48 x 64	8	24,576
Classroom	36 x 64	2	4,608
Arms room (modular)	10 x 20	22	4,400
Subtotal			211,447

27

**Table 2-2
 Proposed Construction (continued)**

Location/Building Type	Dimensions (feet)	No. Buildings	Square Feet
<i>3500 Block Area</i>			
Barracks	28 x 56	16	25,088
Maintenance shop	70 x 150	1	10,500
Unit storage	54 x 120	1	6,480
Administration	36 x 70	2	5,040
Company headquarters	48 x 64	8	24,576
Company operations supply	36 x 56	8	16,128
Arms room (modular)	10 x 20'	8	1,600
Subtotal			89,412
<i>Hood Army Airfield Area</i>			
Hangar (temporary)	70 x 150	1	10,500
Subtotal			10,500
<i>Directorate of Logistics Area</i>			
Maintenance shop	70 x 150	1	10,500
Subtotal			10,500
<i>Landing Zone Phantom Area</i>			
Administration	36 x 70	2	5,040
Unit storage	54 x 120	1	6,480
Subtotal			11,520
<i>9500 Block Area</i>			
Maintenance shop	70 x 150	2	21,000
Unit storage	54 x 120	2	12,960
Administration	36 x 70	4	10,080
Company headquarters	48 x 64	1	3,072
Company operations supply	36 x 56	1	2,016
Brigade headquarters	48 x 64	4	12,288
Arms room (modular)	10 x 20	1	200
Subtotal			61,616
<i>4900 Block Area</i>			
Maintenance shop	70 x 150	2	21,000
Unit storage	54 x 120	2	12,960
Administration	36 x 70	4	10,080
Subtotal			44,040
<i>4400 Block Area</i>			
Administration	36 x 70	24	60,480
Arms room (modular)	10 x 20	4	800
Subtotal			61,280
<i>17000 Block Area</i>			
Unit storage	54 x 120	1	6,480
Subtotal			6,480
Total		287	606,226
<i>Other Construction</i>			
Loading/unloading ramp		1	
Covered storage facility (near 89010)	175 x 200	1	35,000

1 **Tactical Vehicles Road Over U.S. Highway 190.** Operations would require the construction of
2 an additional road west of and parallel to Clark Road to ensure the utility and safety of existing
3 transportation resources on the post. Accordingly, III Corps and Fort Hood proposes to construct
4 a road northward, from the Ammunition Supply Point and over U.S. Highway 190, to join the
5 existing road network in the maneuver areas in the western portion of the post. Access to and use
6 of this proposed road would be limited to military and tactical vehicles. The Figure 2-2 (TAB 3)
7 shows the general alignment of the proposed road segment, which would be approximately 2.5
8 miles in length.

9 **Chinook Hangar.** Consistent with strategic stationing objectives, Headquarters, Department of
10 the Army intends to reassign 12 aircraft and personnel of one CH-47 Chinook helicopter
11 company at Fort Hood. Stationing of the company at Fort Hood, in combination with
12 restructuring of forces to establish an aviation brigade within each division, would require the
13 construction of additional hangar space to store and maintain the aircraft. The proposed hangar
14 would be sited adjacent to the flight line at Hood Army Airfield. Building 7027, located at the
15 southeastern portion of the runway, is an old hangar of insufficient size to house a company of
16 Chinook aircraft. Building 7027 would be removed and a larger facility constructed at the site.
17 The total amount of new built space remains to be determined. Figure 2-3 (TAB 3) identifies
18 Building 7027 site in relation to Hood Army Airfield.

19 2.2.1.3 Proposed Training Ranges

20 III Corps and Fort Hood proposes to establish three new small arms live-fire ranges to
21 supplement the post's current inventory of 77 live-fire ranges (TAB 3, Figure 2-4). These ranges
22 would provide training for squad-designated marksmen, snipers, and machine gunners.
23 Alternative locations for each range were examined for potential use, with consideration given to
24 adequacy of length and width, suitability of firing positions and target locations, availability of
25 adjacent buffer zone areas, topography, cultural sites, and wildlife habitat. Ranges at all potential
26 locations would be oriented so that the beaten zones (where rounds would land) would be in the
27 post's existing impact areas. The following discusses the nine potential sites considered.

28 **Squad-designated Marksman.** This range would have up to 10 firing lanes and provide for 25
29 meter zeroing (sight calibration) and firing at distance of 200 to 500 meters.

- 30 • A site near the present Cowhouse Machine Gun Range in the northern portion
31 Training Area (TA) 89 was found unsuitable for use based on the selection criteria
32 and because it lacked the line of sight requirement.
- 33 • A site at North Fort Hood in the eastern portion of TA 61 was found unsuitable for
34 use based on the selection criteria and because it lacked the line of sight requirement
- 35 • A site at the Ironhorse Scaled Range in the southern portion of TA 93 was found
36 suitable

37 **Sniper Range.** This range, encompassing more than 80 acres, would have 4 lanes and provide for
38 100 meter zeroing and firing at distance of 1,000 to 1,700 meters.

- 39 • A site near the Henson Mountain Multiuse Range in the western portion of TA 62
40 was found unsuitable for use based on the selection criteria and because it lacked the
41 line of sight requirement

- A site near the Owl Creek Assault Course in the southern portion of TA 75 was found unsuitable for use based on the selection criteria and because it lacked the line of sight requirement

- A site near Sugarloaf Multiuse Range in the southeastern portion of TA 93 was found suitable

Multipurpose Machine Gun Range. This range would encompass more than 130 acres and provide for 10 firing lanes.

- A site southwest of Sugarloaf Mountain in the eastern portion TA 92 was found unsuitable for use based on the selection criteria and because it lacked the line of sight requirement

- A site at North Fort Hood in the southeastern portion of TA 61 was found suitable for use.

- A site southeast of Sugarloaf Mountain in the western portion TA 93 was found unsuitable for use based on the selection criteria or because it lacked the line of sight requirement

Based on the identified suitability criteria, six of the potential sites were eliminated from further evaluation for potential use as small arms live-fire training ranges. The three sites found to satisfy the operational requirements screening criteria are examined in detail in this EA. These three suitable sites are shown in Figures 2-5, 2-6, and 2-7 (TAB 3).

2.2.2 *Green Grass Alternative*

2.2.2.1 *Proposed Changes in Force Structure*

Under the Green Grass Alternative, actions with respect to changes in force structure would be identical to those proposed for the Cantonment Alternative, discussed above. That is, III Corps would create a modular Corps headquarters and a modular Division headquarters, add a fourth heavy brigade combat team, and create a support brigade headquarters staff, an aviation brigade, and a fires brigade. Actions with respect to personnel and equipment, assignments, and training would be the same and would adhere to the same schedule.

2.2.2.2 *Proposed Facilities and Infrastructure*

Under the Green Grass Alternative, III Corps and Fort Hood would construct temporary facilities for administration, classroom training, maintenance, and billeting functions sufficient in scope to support a brigade-sized organization. Facilities and infrastructure would be located on approximately 300 acres at West Fort Hood on an undeveloped site (hence, "Green Grass Site") lying north of the ammunition storage area and west of Clark Road. Figure 2-1 (TAB 3) shows the location of the Green Grass Site. Table 2-3 indicates the uses and sizes of the 220 temporary buildings proposed to comprise the brigade-sized complex.

Infrastructure development would extend potable water, electricity, natural gas, and sewer services to the site. Site work would include clearing and grubbing, use of borrow materials, mechanical seeding (Bermuda), finishing with topsoil and planting of beds, and installation of fencing. Two oil/water separators would be installed. Construction would include 2.5 miles of

1 paved roads (24 feet wide), 1,764,000 square feet of hardstand, and 1,999,800 square feet of
 2 parking. Table 2-4 summarizes total proposed impervious surface areas that would be developed
 3 at the Green Grass Site.

4

Table 2-3
Proposed Temporary Facilities

Facility Type	Quantity	Dimensions (feet)	Square Feet
Brigade headquarters	1	172 x 132	22,704
Battalion headquarters	1	48 x 132	6,336
Battalion headquarters	5	64 x 132	42,240
Company headquarters	32	50 x 100	160,000
Administration	1	64 x 132	8,448
Administration	1	72 x 132	9,504
Administration	4	24 x 132	12,672
Administration	1	12 x 66	792
Classroom	6	32 x 132	25,344
Maintenance shop	21	70 x 150	220,500
Unit storage	1	32 x 60	1,920
Unit storage	1	32 x 80	2,560
Unit storage	2	44 x 90	7,920
Unit storage	3	54 x 120	19,440
Barracks (2-story)	131	30 x 54	424,440
Dining facility	1	132 x 228	30,096
Fitness center	2	70 x 150	21,000
Laundromat	2	48 x 66	6,336
Shoppette	1	60 x 115	6,900
Childcare	3	66 x 168	33,264
Totals	220	-	1,062,416

5

Table 2-4
Proposed Creation of Impervious Surface

Construction	Impervious Square Feet	Impervious Acres
Buildings	850,196	19.52
Hardstand	1,764,000	40.50
Parking	1,999,800	45.91
Paved roads	316,800	7.27
Total	4,930,796	113.2

Note: Hardstand surfaces would consist of generally porous base materials. For purposes of evaluation in this EA, hardstand surfaces are considered impervious because, ultimately, they may be paved.

6

7 Under the Green Grass Alternative, actions with respect to construction of a tactical vehicles road
 8 over U.S. Highway 190 and a new Chinook helicopter hangar would be identical to those
 9 proposed for the Cantonment Alternative (discussed above at Section 2.2.1.2).

1 **2.2.2.3 Proposed Training Ranges**

2 Under the Green Grass Alternative, actions with respect to construction of new squad-designated
3 marksman, sniper, and multipurpose machine gun ranges would be identical to those proposed for
4 the Cantonment Alternative (discussed above at Section 2.2.1.3).

5 **2.3 ALTERNATIVES**

6 Alternatives to the proposed action may be framed in three aspects: operating force formations,
7 facilities and infrastructure, and training resources. These are discussed in the following sections.

8 **2.3.1 Operating Forces Formations Alternatives**

9 The Army's *Transformation Campaign Plan*, issued by Headquarters, Department of the Army
10 and evaluated in the *Programmatic Environmental Impact Statement for Army Transformation*,
11 guides all efforts to transform and posture the Army for the 21st century. While the planning
12 process is centrally controlled, numerous organizations and entities throughout the Army
13 iteratively contribute to the overall effort. This ensures that planning is thorough and takes into
14 account all relevant considerations related to doctrine, training, leader development,
15 organizations, installations, materiel, and soldiers.

16 The change in doctrine to accommodate the creation of and reliance on modular brigades is a
17 product of the planning process. Directives issued by Headquarters, Department of the Army to
18 III Corps and Fort Hood have outlined objectives, provided overarching guidance, and imposed
19 certain requirements to ensure consistency across the Army. III Corps and Fort Hood are tasked
20 to restructure certain forces into modular units of specified sizes, weapons systems and other
21 equipment, and capabilities. Deviation from the general precepts and specific requirements of
22 Headquarters, Department of the Army directives would jeopardize the Army's implementation
23 of its transformation program. In this light, alternatives to modular brigades are not available and
24 will not be evaluated in this EA.

25 **2.3.2 Facilities and Infrastructure Alternatives**

26 **Facilities Alternatives.** Appropriate screening criteria for determining a suitable locations for
27 facilities to support force structure changes include the following considerations: adequacy of
28 parcel size, compatibility with adjacent uses, topography and soils (i.e., no steep slopes or soils
29 unsuitable for building footings), access to infrastructure (e.g., water, electricity, natural gas,
30 sewerage, road network), proximity to related functions (i.e., acceptable distance to
31 organizational command and control centers), absence of prohibitive environmental constraints
32 (e.g., critical habitat of protect species, airfield accident potential zones, and consistency with the
33 installation master plan).

34 III Corps and fort Hood have identified two potential alternatives to further facilities development
35 of the cantonment area or a green grass area. That is, facilities of sufficient number and variety
36 could be located along the eastern portion or northern portion of the installation. These two
37 alternative locations were rejected, however, because of widespread critical habitat and unsuitable
38 topography in some areas (steep slopes). Also, siting facilities in the eastern or northern regions
39 would result in moderate to heavy traffic on East Range Road and Hubbard Road. This could
40 lead to undesirable consequences since the primary use of those roads is to transport personnel
41 and equipment to field training. Based on these considerations, these possible alternatives were
42 eliminated and, accordingly, they are not evaluated in detail in this EA.

1 **Tactical Vehicles Road Over U.S. Highway 190 Alternatives.** Clark Road provides the only
2 convenient access between Fort Hood's main cantonment and West Fort Hood. Due to heavy
3 traffic flow through the Clark Road access control points, units do not take full advantage of
4 training areas at West Fort Hood. The installation's Ammunition Supply Point, located at West
5 Fort Hood, receives, stores, and issues all ammunition used at the post. Units picking up
6 ammunition and transporting it northward to primary training areas must use the same road and
7 access control points as vehicular and commercial cargo traffic. Moreover, congestion associated
8 with current use of Clark Road by ammunition and cargo haulers would be compounded by
9 additional traffic traveling in the vicinity of the Green Grass Site, should that alternative be
10 implemented. These circumstances deny the development of meaningful alternatives and,
11 accordingly, only the proposed route is evaluated in detail in this EA.

12 **Chinook Hangar Alternatives.** Hood Army Airfield is fully built out; no open, undeveloped sites
13 are available for placement of a new aircraft hangar. Construction of a new hangar large enough
14 for a Chinook company would require removal of existing facilities. The most suitable candidate
15 for removal is Building 7027. As no other sites are available, only the Building 7027 proposal is
16 evaluated in detail in this EA. The possibility of placing the hangar at RGAAF was considered;
17 however, the RGAAF is predicted to be at maximum flight operations for the next ten years and
18 the Army would suffer with limited availability of flight time.

19 **2.3.3 Live-Fire Training Range Alternatives**

20 Based on the identified suitability criteria, six of the potential sites were eliminated from further
21 evaluation for potential use as small arms live-fire training ranges. The three sites found suitable
22 are examined in detail in this EA.

23 **2.4 NO ACTION ALTERNATIVE**

24 Under the no action alternative, III Corps and Fort Hood would not restructure forces, construct
25 facilities, or establish three new small arms live-fire ranges at the installation. Inclusion of the no
26 action alternative, prescribed in regulations issued by the Council on Environmental Quality,
27 serves as a benchmark against which the potential effects of federal actions can be evaluated.
28 The no action alternative is evaluated in detail in this EA.

1 **SECTION 3.0**

2 **AFFECTED ENVIRONMENT AND CONSEQUENCES**

3 **3.1 LAND AND AIRSPACE USE**

4 **3.1.1 Affected Environment**

5 **3.1.1.1 Regional Setting**

6 **Geographical Setting.** Fort Hood is located in central Texas in Bell and Coryell counties. It lies 58 miles
7 north of Austin, 39 miles southwest of Waco, and its northern boundary is 4 miles south of Gatesville,
8 Texas. State Highway 36, which connects Gatesville and Temple, parallels the eastern edge of
9 Fort Hood. The main entrance to the installation is 4 miles west of Killeen on U.S. Highway 190, which
10 runs along the southern portion of the installation (TAB 3, Figure 1-1).

11 The military installation encompasses 214,968 acres. Fort Hood is comprised of three cantonment areas,
12 two instrumented airfields, and many maneuver and live-fire training areas. The cantonment areas are
13 primarily for urban uses and are designated the Main Cantonment Area, West Fort Hood (often referred
14 to as South Fort Hood), and North Fort Hood. The Main Cantonment Area and Hood Army Airfield
15 (HAAF) are located at the southern edge of the training area and adjacent to Killeen, Texas. West
16 Fort Hood is located south of U.S. Highway 190, near the City of Copperas Cove, Texas, and includes
17 the Robert Gray Army Airfield (RGAAF). North Fort Hood, located near Gatesville, Texas, is the primary
18 site for Army Reserve and National Guard training, equipment service, and storage (USACE, 1999).

19 **Topography and Landforms.** Fort Hood is located within the Texas “Hill and Lake Country,” with
20 topographic features and landforms characterized by valleys, buttes, and mesas. It is near the
21 southeastern edge of the Mid-Continent Plains and Escarpments, and is within the region known as the
22 Lampasas Cutplains. The Edwards Plateau is located west of Fort Hood (USACE, 1992). The basic
23 landscape of Fort Hood has been created by upward displacement and subsequent erosion and
24 weathering (over the past 70 million years) of various limestone, shale, and sandstone rock strata
25 (USACE, 1999; USACE, 1992).

26 **3.1.1.2 Installation Land Use**

27 Land use at Fort Hood is allocated to cantonment areas, maneuver/live-fire training areas, and airfields
28 (Table 3-1). The cantonment areas are urban areas that contain administrative, maintenance, industrial,
29 supply/storage, unaccompanied personnel housing, family housing, community support facilities,
30 medical, outdoor recreation, and open space land uses. Maneuver/live-fire training areas support the
31 maneuver and live-fire training areas that provide locations for combat training activities, which fulfill
32 Fort Hood’s primary purpose. Additionally, a limited amount of cattle grazing is permitted (through 5-
33 year leases) throughout the training areas. The airfields are located adjacent to the cantonment areas and
34 house the fixed-wing/rotary-wing assets and support facilities (USACE, 1999). Various other land uses
35 located on Fort Hood include the Belton Lake Outdoor Recreation Area, and miscellaneous uses such as
36 roadways, and easements.

37 Most of Fort Hood’s land area is used for training and preparedness. Over 88 percent of the land
38 (191,157 acres) is used for maneuver/live-fire training involving combat, combat support, and combat
39 service support elements integrated into formations to conduct multi-echelon, combined arms training

Table 3-1
Fort Hood Land Use Summary

Primary Land Uses	Acreage
Training areas	
Maneuver	138,266
Live-fire	52,891
Cantonment Areas	
Main Cantonment Area (excluding HAAF)	4,862
West Fort Hood (excluding RGAAF)	1,342
North Fort Hood	1,400
Airfields	
HAAF	773
RGAAF	2,142
Belton Lake Recreation Area	862
Miscellaneous uses (roads, easements, etc.)	9,493
Total Acreage	214,968

1

2 to simulate battlefield conditions. Training includes infantry, mechanized infantry, armored units, artillery
3 and air support with helicopters, fixed-wing tactical aircraft, high-speed interceptors, and large bombers
4 (USACE, 1999). The post's training land is divided into two main areas, the Western Maneuver Area and
5 the Eastern Training area. There are 120 individual ranges on Fort Hood.

6 **3.1.1.3 Surrounding Area**

7 Both urban and rural areas surround Fort Hood. Urban areas include the cities of Killeen, Harker Heights,
8 and Copperas Cove near the southern boundary, and the city of Gatesville north of the installation. Urban
9 land uses are primarily residential, business, and industrial. The rural areas surrounding Fort Hood
10 support agricultural land uses of farming and ranching (cattle). Nearby Belton and Stillhouse Hollow
11 reservoirs provide excellent recreational opportunities for surrounding communities and Fort Hood
12 residents.

13 **3.1.1.4 Future Development in the Region**

14 The area immediately south of Fort Hood is undergoing rapid urban growth, thus reducing the amount of
15 available agricultural land. Development and improvement of regional transportation routes has
16 accompanied this growth, especially along the I-35 and US-190 corridors. The road system and adjacent
17 railroad lines have added to the urban opportunities of the region and have shaped the expansion into a
18 crescent-shaped corridor that extends from Copperas Cove on the west to Temple on the east. A new
19 joint use airport, Robert Gray Army Air Field (RGAAF), is scheduled for final development in the area of
20 West Fort Hood in 2005. The Killeen-Temple Metropolitan Transportation Plan predicts the region will
21 grow by 69 percent by the year 2020 (KTUTS, 1999). Community plans are in-work to prepare for this
22 influx including the growth attributed to Fort Hood.

1 **3.1.1.5 Airspace Use**

2 The HAAF is located near the main cantonment area of Fort Hood on 297 ha (773 acres). Military
3 training exercises are conducted at HAAF. HAAF has a control tower and instrument approach
4 procedures. Radar service is provided by the RGAAF radar approach control facility. Two auxiliary
5 airfields, Longhorn and Shorthorn, are located at North Fort Hood to support flight training
6 (USACE, 1992).

7 Helicopters assigned to HAAF include the OH-58 Kiowa, AH-64 Apache, UH-60 Blackhawk, and others
8 (UH1 and CH-47) (USACE, 1992). The number of helicopters at HAAF varies with training requirements
9 and other assignments (USACE, 1999).

10 RGAAF is located in west Fort Hood on 867 ha (2,142 acres). The airfield supports U.S. Air Force
11 (USAF) and commercial aircraft as part of training and operations exercises for rapid deployment of
12 personnel and equipment. A control tower, a radar approach control facility, and instrument approach
13 procedures serve RGAAF. There is an airport traffic area for tower-controlled traffic patterns, an
14 approach control for radar services to and from the airfield, and a control zone for aircraft on instrument
15 arrival and departure routes (USACE, 1999).

16 The Army and FAA produced an EA for the Joint Use of the RGAAF for military and commercial use in
17 2000. (Fort Hood, 2000a). This EA discussed the forecasts of aviation activity from 2000-2020. The
18 RGAAF runway will be 10,000 feet and service large commercial aircraft as well as military cargo
19 aircraft. The EA discusses the military use of RGAAF for troop and equipment transportation and military
20 exercises such as C-5 touch and go training exercises. The airfield will operate under the rules and
21 regulations of the FAA. A FONSI for the new Joint RGAAF was issued April 11, 2000. The reader is
22 referred to this EA for further details.

23 **3.1.2 Consequences**

24 **3.1.2.1 Proposed Action**

25 **3.1.2.1.1 Cantonment Alternative**

26 There would be no effect to land use from the cantonment alternative. There would be no effect to land
27 use from the proposed construction of a new Chinook hangar, or additional small arms live-fire training
28 ranges. Activities from the proposed action would result in increased training activities. However, these
29 activities would take place on land designated for the purpose of military training. Training schedules
30 would be impacted due to proposed increases in small arms range usage.

31 Long-term minor adverse impacts to airspace use would be expected due to increased helicopter training
32 exercises. Impacts to training schedules for aviation units would be expected due to increase in helicopter
33 flights (Personal communication, Eric Harmon, DPTS Range Control, 28 June 2004).

34 **3.1.2.1.2 Green Grass Alternative**

35 There would be no effect to land use from the proposed construction of a tactical vehicle road over U.S.
36 Highway 190, a new Chinook hangar, or additional small arms live-fire training ranges. Activities from
37 the proposed action would result in increased training activities. However, these activities would take
38 place on land designated for the purpose of military training. Training schedules would be impacted due
39 to proposed increases in small arms range usage.

1 A land use change would occur at the proposed Green Grass Site converting approximately 300 acres
2 from training and grazing land uses to administrative, maintenance, industrial, unaccompanied personnel
3 housing, a limited amount of community facilities (i.e. shoppette, day care, fitness center), and associated
4 infrastructure (parking, roads, utilities, etc). Less than 2 tenths of one percent of the total land mass at
5 Fort Hood would be impacted by this potential change in land use, which would be considered an
6 insignificant impact to land use at the installation.

7 No direct impact to the land use of areas surrounding Fort Hood would result from implementation of the
8 proposed action. An indirect impact would be the conversion of undeveloped lands to residential and
9 business land uses that would accommodate additional soldiers and their families. Additional families
10 coming to the region in association with this proposed action could increase the off-post population by
11 approximately 3.5-5.0 percent. However, since the region (Bell and Coryell counties combined) has
12 experienced steady growth in recent years (average of >20 percent between 1990 and 2000) [U.S.
13 Census Bureau 2004], a potential land use change attributable to implementation of the proposed action
14 would be insignificant.

15 Long-term minor adverse impacts to airspace use would be expected due to increased helicopter training
16 exercises. Impacts to training schedules for aviation units would be expected due to increase in helicopter
17 flights (Personal communication, Eric Harmon, DPTS Range Control, 28 June 2004). Impacts to the
18 airspace use have been addressed in the Fort Hood Joint Use of the RGAAF EA. The new Chinook
19 helicopter hangar and flight activity would not be compatible with the flight traffic at RGAAF due to the
20 intensity of planned RGAAF flight operations. No additional impacts to the RGAAF airspace would be
21 expected.

22 3.1.2.2 *No Action Alternative*

23 No effects on surrounding land uses would be expected

24 3.2 **AESTHETICS AND VISUAL RESOURCES**

25 3.2.1 *Affected Environment*

26 The natural environment, in its undisturbed state, is visually attractive. The landforms—flat-topped steep-
27 sided plateaus, ridges and isolated hills, sloping valley sides, floodplains, and stream courses—are varied
28 and visually interesting. Rock outcrops are visible at the tops of some of the steeper slopes and add
29 visual interest. Vegetation is visually varied with dense shrub forest, areas of scattered trees and brush,
30 and areas with low grassy or forb ground cover. Trees are a mix of coniferous and deciduous species.
31 Moving or standing water along stream channels or in the form of constructed ponds and small lakes is
32 frequent and also adds visual interest (USACE, 1999).

33 The training areas occupy the bulk of the installation. They are primarily natural but include isolated
34 facilities and equipment used for range operations. Cattle grazing occurs throughout the installation,
35 primarily in the open grassy areas. Some portions of the range are marred by vehicle tracks and ruts
36 from field training activities (USACE, 1992).

37 The Main Cantonment Area is built on gently rolling terraces (USACE, 1999). Buildings vary in size and
38 style, reflecting continuous development from the 1940s to the present with most structures being one or
39 two stories in height. The buildings in the Main Cantonment Area are separated by large, open, grassy
40 areas used for recreation and as parade grounds and by parking and undeveloped areas. Several family
41 housing areas are interspersed throughout the Main Cantonment Area. The older housing areas have

1 more established landscaping (USACE, 1992). The community of Killeen is immediately adjacent to the
2 installation and not far from the Main Cantonment Area.

3 The visual appearance of the Main Cantonment Area relates directly to its functions and date of
4 construction. The Main Cantonment Area is characterized by large, open spaces with little landscaping
5 outside of the family housing areas. The headquarters buildings are sited to maximize the impact of large
6 monumental forms in the middle of an open space. Because of low building density, Fort Hood is
7 automobile-oriented. Most buildings have small to large parking areas beside them, which generally lack
8 landscaping and shade (USACE, 1992).

9 North Fort Hood, at the opposite side of the installation from the Main Cantonment Area, is smaller in
10 scale but generally similar in appearance. It has large, open areas used for tents during reserve training in
11 the summer. A third major built-up area of the installation is West Fort Hood, located southwest of the
12 Main Cantonment Area. This is built around RGAAF and various research and testing facilities. It is
13 visually separated from the main post by the surrounding landscape. West Fort Hood is focused on
14 RGAAF with its extensive open spaces and large industrial buildings. Its lack of landscaping contributes
15 to a relatively barren visual character (USACE, 1999).

16 The Belton Lake Outdoor Recreation Area is operated by Fort Hood. The area's varied topography,
17 mature vegetation, vista points, lakeside beaches, and amenities contrast with the more organized and
18 developed areas on the installation. The well-maintained roads and facilities are generally smaller in scale
19 than in the Main Cantonment Area (USACE, 1992). A visually intrusive condition has been caused by a
20 lack of designated parking and the resulting degradation of the natural environment as visitors
21 consequently drive and park off the road (USACE, 1999).

22 There are no scenic highways or visually sensitive, federally protected areas that have views to
23 Fort Hood. Mother Neff State Park, northeast of the installation, has no line-of-sight to the Main
24 Cantonment Area. Vista points in Belton Lake Recreation Area have views to Killeen and the installation.
25 Stillhouse Hollow Lake, south of Killeen, has no views to any portion of Fort Hood where new
26 construction would occur (USACE, 1992).

27 **3.2.2 Consequences**

28 **3.2.2.1 Proposed Action**

29 **3.2.2.1.1 Cantonment Alternative**

30 No effects would be expected since there are no known scenic highways or scenic views in the
31 cantonment site area or nearby vicinity. New structures would comply to the standards of existing
32 cantonment in-fill guidance.

33 **3.2.2.1.2 Green Grass Alternative**

34 No effects would be expected since there are no known scenic highways or scenic views in the
35 proposed site area or nearby vicinity. There would be changes to the viewshed from some parts of
36 Copperas Cove, and other West Fort Hood facilities. However, the proposed Green Grass Site is located
37 at a considerable distance from these areas, and it would be consistent with the existing appearance of
38 Fort Hood facilities.

1 **3.2.2.2 No Action Alternative**

2 No effects would be expected by not implementing the no action or other alternatives.

3 **3.3 SOILS AND GEOLOGY**

4 **3.3.1 Affected Environment**

5 **3.3.1.1 Soils/Mineral Resources**

6 Soil types within the proposed project area were determined using the U.S. Department of Agriculture
 7 (USDA), Natural Resources Conservation Service (NRCS) [formerly the Soil Conservation Service
 8 (SCS)] Bell County and Coryell County Soil Surveys (1977 and 1985, respectively). Table 3-2 identifies
 9 and gives a brief description of the soils in affected areas.

10 **Table 3-2**
 11 **Project Area Soil Information**

Map Symbol	Mapping Unit	Description
AIC	Altoga silty clay	Deep, gently sloping to strongly sloping, clayey soils on foot slopes below limestone hills and ridges. The soil is well drained, with moderate permeability, and medium runoff. The soil is well suited as pasture.
Bo	Bosque clay loam	Deep, nearly level soil on flood plains along major streams. The soil is well drained, with moderate permeability and slow runoff. It is well suited as pasture.
BRE	Brackett association	Gently sloping to strongly sloping and rolling, calcareous, loamy soils. Soils forming in loamy material underlain by soft limestone. Well drained, moderately slow permeability, rapid runoff.
BtC2	Brackett-Topsey Association	Deep loamy soils on undulating uplands. The soil is well drained, with moderately slow permeability, and medium runoff. The erosion hazard is moderate for Brackett soils and severe for Topsey soils. This association is moderately suited for pasture.
CoB2	Cisco fine sandy loam	Deep, gently sloping soil on convex slopes of uplands. The soil is well drained, with moderate permeability and medium runoff. It is moderately suited as pasture.
DPB	Denton association	Deep or moderately deep, occurring mostly on Fort Hood Military Reservation. Soil areas are in saddles between hills and on foot slopes. Underlain by limestone and interbedded marl. Well drained, slow permeability, medium to rapid runoff.
DrC	Doss-Real complex	Shallow, loamy, soils on side slopes that have a benched appearance because of horizontal limestone outcrops. They are well drained, with moderately slow permeability, and medium to rapid runoff. Erosion potential is moderate. The soils are poorly suited as pasture.
EvB	Evant silty clay	Shallow, gently sloping soil on plane to convex uplands. It is well drained, with slow permeability and slow runoff. Soil is poorly suited as pasture.

12

Table 3-2
Project Area Soil Information (continued)

Map Symbol	Mapping Unit	Description
Fr	Frio silty clay	Deep, nearly level, clayey soil on flood plains of major streams. Flooded every 3 to 10 years for a duration of less than one day. The soil is well drained, with slow permeability, and slow runoff. It is poorly suited as pasture.
KrB	Krum silty clay	Deep, nearly level to gently sloping and undulating calcareous soils. Mostly on the foot slopes of the higher limestone hills and in narrow valleys that are drainage ways from the hill country. Most occur on Fort Hood Military Reservation. Well suited to crops. Well drained, moderately slow permeability, slow to rapid runoff.
LeB	Lewisville clay loam	Deep, gently sloping soil on major stream terraces. The soil is well drained, with moderate permeability, and medium runoff. It is well suited as pasture.
MuB	Minwells-Urban land complex	Deep and gently sloping soils on terraces of the Leon River. The soil is well drained, with slow permeability and medium runoff.
NuC	Nuff very stony silty clay loam	Deep, gently sloping to sloping soil on the sides of low ridges and stream divides. The soil is well drained, with slow permeability, and medium runoff. Not suited as pasture.
ReF	Real-Rock outcrop complex	Shallow, moderately steep to steep soils with areas of rock outcrop on side slopes of uplands, located on hill slopes or bluffs overlooking rivers and streams. Real soil is well drained, with moderate permeability and very rapid runoff. The complex is not suited for pasture.
SaB	San Saba clay	Moderately deep, nearly level to gently sloping, calcareous, clayey soils in low areas on limestone uplands. The soil is moderately well drained, with very slow to rapid permeability (depending on soil moisture), and slow to medium runoff. Well suited as pasture.
SIB	Slidell silty clay	Deep, gently sloping soil in valley fill areas along drainage ways. The soil is well drained, with very slow permeability, and slow to medium runoff. Well suited as pasture.
TpC	Topsey-Pidcoke association	Deep and shallow loamy soils on undulating uplands. Topsey soil is well drained, with moderately slow permeability and medium runoff. Pidcoke is well drained, with moderately slow permeability and medium runoff. The association is poorly to moderately suited for pasture.

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In 2002, the NRCS assessed soil erosion at Fort Hood as part of the Land Condition and Trend Analysis Program. They concluded that soil erosion was highest, and at an unacceptable rate, in the Western Maneuver Area, the result of drought conditions, military training and continuous grazing without deferment on the soil and vegetation. In the Eastern Training Area 42 percent of the sites monitored exhibited soil erosion rates that exceeded acceptable soil loss rates. West Fort Hood was found to have the lowest erosion rates, where no sites were found to have soil losses that exceeded acceptable limits. The NRCS recommended scheduled deferments from grazing and military activities in the Western Maneuver Area, rest-rotation grazing in the Eastern Training Area, and had no recommendations concerning West Fort Hood (NRCS, 2002).

1 **Mineral Resources.** No mining or quarrying occurs in the cantonment area or on Fort Hood.

2 **3.3.1.2 Geology/Seismicity**

3 The strata underlying Fort Hood, with the exception of the recent alluvium and river terrace deposits, are
4 consolidated sedimentary rocks of Cretaceous age and belong to the Comanche Series. The erosion of
5 these Cretaceous rocks over the past 70 million years and the deposition of unconsolidated materials
6 along the major streams have produced the present landscape of Fort Hood (USACE 1987). The major
7 strata beneath Fort Hood are the Glen Rose formation, Paluxy Sand, Walnut Clay, Comanche Peak
8 formation, Edwards Limestone-Kiamichi Clay complex, Denton Clay-Fort Worth Limestone, and Duck
9 Creek Limestone complex. The major floodplains are filled with alluvium and river terrace deposits
10 (USACE 1987).

11 The Balcones Fault Zone passes immediately east of the installation, trending north/southwest. The land
12 to the northwest of this zone (*i.e.* the land that Fort Hood currently occupies) has, over geologic time,
13 elevated as much as 500 feet. Subsequent erosion of this elevated land is what created the relatively
14 irregular, steeply sloping terrain on the installation (USACE 1987).

15 **Seismic Activity.** Earthquakes do occur in Texas and in neighboring regions although they have not
16 historically been a major danger to Texans. In Texas the regions at greatest risk are in West Texas,
17 where earthquakes of magnitude about 6 occurred in 1931 and 1995, and in the Panhandle, where at least
18 six earthquakes with magnitude above 4 have occurred since 1900. There is no specific threat of
19 earthquake in the vicinity of Fort Hood, however, the hazard level is not zero anywhere in Texas, and
20 small earthquakes are possible almost anywhere (University of Texas 2002).

21 **3.3.1.3 Prime Farmland**

22 Prime farmland soils are protected under the Farmland Protection Policy Act (FPPA) of 1981. The intent
23 of the act is to minimize the extent to which federal programs contribute to the unnecessary or
24 irreversible conversion of farmland soils to nonagricultural uses. The act also ensures that federal
25 programs are administered in a manner that, to the extent practicable, will be compatible with private,
26 state, and local government programs and policies to protect farmland. The NRCS is responsible for
27 overseeing compliance with the FPPA and has developed rules and regulations for implementation of the
28 act (see 7 CFR Part 658; revised January 1, 1998).

29 The proposed action activities do not occur in areas designated as farmland. Therefore, a Farmland
30 Conversion Impact Rating (Form AD-1006) of the project area is not needed and no further action is
31 required under the FPPA.

32 **.3.2 Consequences**

33 **3.3.2.1 Proposed Action**

34 **3.3.2.1.1 Cantonment Alternative**

35 Long-term and short term minor adverse effects would be expected from the cantonment alternative.
36 The proposed cantonment area and small arms ranges would involve standard construction activities,
37

1 which would disturb approximately 113 acres in the cantonment area; =10 acres at Marksman Range;
2 =40 acres at Sniper Range; =65 acres at Machine Gun Range)¹. Other sites associated with this
3 alternative would involve locations that are already disturbed, or have existing facilities. Short-term minor
4 adverse effects to soils would be associated with increased potential for erosion and sedimentation due to
5 excavation, grading, removal of vegetation, and exposure of soil, during construction. These effects
6 would be minimized by the use of appropriate Best Management Practices (BMPs) for controlling runoff,
7 erosion, and sedimentation. Mitigation measures are discussed in Section 3.15. There would be no long-
8 term effects to soils at the small arms training sites; however, a minor adverse effect would be associated
9 with conversion of approximately 113 acres of native soil to impervious surfaces in the cantonment area.

10 Erosion potential for each soil impacted would be determined prior to construction, and appropriate
11 erosion control designs would be incorporated into the construction plans. In accordance with the Clean
12 Water Act, a Storm Water Pollution Prevention Plan would be prepared prior to the start of construction.

13 Implementation of the proposed action would increase training associated with heavy brigade maneuvers
14 by up to 20 percent. This could exacerbate erosional issues already existing in training areas, resulting in
15 long-term major adverse impacts. Measures to mitigate these impacts would need to be identified and put
16 into practice. Soil erosion management would be consistent with Fort Hood's Integrated Natural
17 Resources Management Plan (INRMP), and a comprehensive Range Management Plan would be
18 developed for all training areas.

19 **3.3.2.1.2 Green Grass Alternative**

20 Long-term and short term minor adverse effects would be expected from the Green Grass action. The
21 proposed Green Grass Site and small arms ranges would involve standard construction activities, which
22 would disturb approximately 415 acres of soils at Fort Hood (=300 acres at Green Grass Site; =10 acres
23 at Marksman Range; =40 acres at Sniper Range; =65 acres at Machine Gun Range)². Other sites
24 associated with this proposed action would involve locations that are already disturbed, or have existing
25 facilities. Short-term minor adverse effects to soils would be associated with increased potential for
26 erosion and sedimentation due to excavation, grading, removal of vegetation, and exposure of soil, during
27 construction. These effects would be minimized by the use of appropriate Best Management Practices
28 (BMPs) for controlling runoff, erosion, and sedimentation. Mitigation measures are discussed in Section
29 3.15. There would be no long-term effects to soils at the small arms training sites; however, a minor
30 adverse effect would be associated with conversion of approximately 113 acres of native soil to
31 impervious surfaces at the Green Grass Site.

32 Erosion potential for each soil impacted would be determined prior to construction, and appropriate
33 erosion control designs would be incorporated into the construction plans. In accordance with the Clean
34 Water Act, a Storm Water Pollution Prevention Plan would be prepared prior to the start of construction.

35 Implementation of the proposed action would increase training associated with heavy brigade maneuvers
36 by up to 20 percent. This could exacerbate erosional issues already existing in training areas, resulting in
37 long-term major adverse impacts. Measures to mitigate these impacts would need to be identified and put
38 into practice. Soil erosion management would be consistent with Fort Hood's Integrated Natural

¹ Actual ground disturbing activity necessary to construct Sniper Range and Machine Gun Range is far less than total range size. Range sites are placed in areas with topography suitable for the training - requiring only minimal ground recontouring.

² Actual ground disturbing activity necessary to construct Sniper Range and Machine Gun Range is far less than total range size. Range sites are placed in areas with topography suitable for the training - requiring only minimal ground recontouring.

1 Resources Management Plan (INRMP), and a comprehensive Range Management Plan would be
2 developed for all training areas.

3 3.3.2.2 *No Action Alternative*

4 No effects would be expected from not implementing the proposed or alternative actions.

5 3.4 **WATER RESOURCES**

6 3.4.1 *Affected Environment*

7 3.4.1.1 *Groundwater*

8 The primary stratigraphic units that occur in the Fort Hood area are pre-Cretaceous rocks, the Travis
9 Peak formation, the Glen Rose formation, the Paluxy formation, and the Walnut formation. The Walnut
10 formation occurs at the surface of the area, while the Paluxy and Glen Rose formations are exposed only
11 along the channels of the Leon River and its tributaries (USACE, 1999). Potentially sensitive
12 groundwater areas of the Fort Hood Region are the outcrop areas of the Paluxy formation and recent
13 alluvial materials within and adjacent to Cowhouse Creek, Henson Creek, and the Leon River, as well as
14 the Karst or cave systems found throughout the installation. The aquifers recharged by these areas are
15 relatively shallow, and could be affected by hazardous material spills and seepage, however the primary
16 use of these waters is livestock watering (USACE, 1999). USA CHPPM conducted a Geohydrologic
17 Study in April 2001 on the range areas of Fort Hood. Groundwater, surface water and sediment were
18 analyzed for metal concentrations and perchlorate. CHPPM results indicated that activities conducted in
19 the impact area do not adversely affect stream water quality or ecology (CHPPM, 2001).

20 3.4.1.2 *Surface Water*

21 Fort Hood is situated in the Brazos River Basin. The surface configuration of the land is generally the
22 result of the dissection of numerous small to moderate sized streams, which flow in a southeasterly
23 direction. Fort Hood has 200 impoundments and 35 springs. Water resources include 202 surface-ha
24 (500 acres) of lakes and ponds, 88 km (55 miles) of rivers and permanent streams, and 218 km (136
25 miles) of shoreline of Belton reservoir. The Leon River, Owl Creek, and Cowhouse Creek flow into
26 Belton Lake, while Reese Creek flows into the Lampasas River. Nolan Creek, on Fort Hood, flows into
27 the Leon River below Belton Dam. Cowhouse Creek is the major drainage on the military reservation.
28 Belton Lake is owned and operated by the USACE for flood control, water supply, and recreation. The
29 Cowhouse Creek arm of the reservoir is bounded by the installation and is particularly sensitive to
30 sedimentation impacts.

31 Waters of the United States (U.S.) that could be directly or indirectly affected by implementation of the
32 proposed action are Clear Creek (a tributary of Cowhouse Creek near the Green Grass Site), Cowhouse
33 Creek and the Leon River (near proposed small arms training ranges). Two small recreational
34 impoundments (fishing) are located within the vicinity of the proposed Green Grass Site, which are
35 hydrologically connected to Clear Creek.

36

1 **3.4.1.3 Wetlands**

2 Wetlands, which are other surface waters falling under the jurisdiction of the USACE, are not found
3 within the proposed project areas.

4 **3.4.1.4 Water Quality**

5 The TCEQ has divided the Middle Brazos River basin into 16 classified segments. The proposed small
6 arms ranges would be located near two possible segments. One choice is segment 1221_06 (Leon River
7 downstream of Gatesville) with designated uses of aquatic life, contact recreation, general, fish
8 consumption, and public water supply. The other choice is segment 1220A (Cowhouse Creek) with
9 designated uses of aquatic life, contact recreation, and fish consumption. Both of these segments either
10 fully support their designated uses, or have not been assessed. Neither segment is listed on the TCEQ
11 2004 303d draft list of impaired waters. The proposed Green Grass Site is located near Clear Creek,
12 which is itself not classified by the state, but which is a tributary to Cowhouse Creek.

13 **3.4.1.5 Floodplains**

14 Executive Order (E.O.) 11988, "Floodplain Management", was enacted May 24, 1977, in order to set
15 guidelines to avoid the long and short-term adverse impacts associated with the occupancy and
16 modification of floodplains and to avoid direct or indirect support of floodplain development wherever
17 there is a practicable alternative. Flood Insurance Rate Maps (FIRM) for Bell and Coryell Counties,
18 (Community Panel Numbers 480706 0125 B, 4807680370 B, 4807060080 B, 4807680215 B, and
19 4807680325 B) were analyzed for proposed construction areas to evaluate any impact to floodplains from
20 the proposed construction. The locations under consideration for proposed construction all fall within
21 FIRM map Zone C, which are areas determined to be outside of the 100-year floodplain.

22 **3.4.2 Consequences**

23 **3.4.2.1 Proposed Action**

24 **3.4.2.1.1 Cantonment Alternative**

25 **Ground Water.** No impact to ground water is anticipated from implementation of the cantonment
26 alternative. Ground water monitoring wells are located in the impact area, upstream of Cowhouse Creek.
27 Fort Hood impact area activities not adversely impact the Cowhouse Creek ecology as indicated in the
28 CHPPM report (CHPPM, 2001). This monitoring program would continue for the training ranges, and
29 any groundwater contamination that might result from increased training activities would be easily
30 detected.

31 **Surface Waters and Water Quality.** Long-term minor adverse effects would be expected from the
32 Cantonment Alternative. The Blackland Research and Extension Center Water Science Laboratory in
33 Temple monitors sediment and other water quality parameters at fourteen locations on the Fort Hood
34 Military Reservation. Soil erosion from the installation has resulted in decreased water quality and
35 substantial sedimentation in portions of Belton Lake as well as the smaller water bodies on the installation
36 (USACE, 1999). Soil erosion management actions carried out in accordance with the Fort Hood INRMP,
37 would control the sedimentation loads associated with the proposed action.

1 Storm water flows are important to management of surface water. The flows can introduce sediments
2 and other contaminants into lakes, rivers, and streams that may be exacerbated by high proportions of
3 impervious surfaces associated with buildings, roads, and parking lots. Surface waters within the Fort
4 Hood training ranges are not controlled by a man-made drainage system, and the construction of several
5 new small arms ranges would not warrant the addition of such a system. Hardening of surfaces through
6 construction of buildings and parking areas may slightly increase storm flows through the downstream
7 reach of Clear Creek. Adherence to proper storm water management engineering practices; applicable
8 regulations, codes, and permit requirements; and low-impact development techniques would reduce
9 storm water runoff-related impacts to a level of insignificance.

10 The Texas Commission on Environmental Quality (TCEQ) issues permits for Water Quality Certification
11 for construction activities, as required by Section 401 of the Clean Water Act (CWA). The U.S. Army
12 Corps of Engineers (USACE) regulates the placement of dredge or fill materials into the waters of the
13 U.S. under Section 404 of the CWA. Any construction plans associated with the proposed action would
14 be assessed by the USACE to determine what actions would be necessary (if any) to obtain appropriate
15 CWA permits. Construction associated with the proposed action would require the development of a
16 Storm Water Pollution Prevention Plan to meet requirements of the Texas Pollutant Discharge Elimination
17 System (TPDES) program which would require development of a Storm Water Pollution Prevention Plan
18 (SWPPP) since more than 1 acre of land would be disturbed. Erosion and sedimentation controls would
19 be required and would be in place during construction to reduce and control siltation or erosion impacts
20 to areas outside of the construction site. The use of BMPs such as silt fencing and sediment traps, the
21 application of water sprays, and the revegetation of disturbed areas would also reduce potential impacts.
22 Implementation of sediment and erosion controls during construction activities would maintain water
23 runoff quality at levels comparable to existing conditions and would limit potential impacts to soils
24 resulting from future development.

25 **Floodplains.** There would be no impact to floodplains or floodplain management from implementation of
26 the proposed action.

27 **3.4.2.1.2 Green Grass Alternative**

28 **Ground Water, Surface Waters, and Water Quality.** The same impacts would be expected for the
29 Green Grass Alternative as the Cantonment Alternative.

30 **Floodplains.** There would be no impact to floodplains or floodplain management from implementation of
31 the proposed action.

32 **3.4.2.2 No Action Alternative**

33 There would be no impacts to groundwater, surface water, water quality or floodplains under the No
34 Action Alternative.

1 3.5 **BIOLOGICAL RESOURCES**

2 3.5.1 **Affected Environment**

3 3.5.1.1 **Vegetation**

4 The combination of soils, topography, climate, and human activities has produced a diverse mix of
5 vegetation communities or habitats within the installation. Fort Hood is in the southernmost extension of
6 the Cross Timbers and Prairies region and the northwestern reaches of the Edwards Plateau ecological
7 region. Woodlands in the area are closely representative of Edwards Plateau vegetative associations.
8 Three types of forest and shrub communities are found on Fort Hood including coniferous, deciduous,
9 and mixed forests and shrub communities. The coniferous woodlands on the installation are dominated
10 by Ashe juniper (*Juniperus ashei*), the only coniferous species on the installation. Deciduous forests and
11 shrubs are generally found in lowlands and protected slopes and are relatively uncommon on the
12 installation (USACE Fort Worth District, 2000). The grasslands, which comprised much of the area
13 historically, are representative primarily of the mid-grass associations of the Cross Timbers and Prairies
14 areas, with inclusions of the tall-grass associations of the Blackland Prairie. Frequent range fires
15 throughout the grasslands confine the woody vegetation to the riparian areas and the rocky slopes and
16 hills. As a result of human activities, including cattle grazing, reduction and suppression of fires, and
17 training activities, the current vegetation structure and mix of species differ from those expected for
18 these vegetation communities (NRCS, 1998). An inventory of plant species found on the installation is
19 included as an appendix to this document, labeled Tab 4.

20 3.5.1.2 **Fish and Wildlife**

21 The various habitat types in the area provide for wildlife communities characteristic of the Edwards
22 Plateau, Blackland Prairie, and the Cross Timbers and Prairies areas. Terrestrial wildlife habitats closely
23 follow the vegetation communities described above, but also follow clines from upland down to riparian
24 habitats.

25 Deciduous woodland in riparian areas contains the greatest densities of passerine birds, followed by
26 juniper woodland and mixed woodland. The least dense bird populations are found in the grassland
27 habitat. The most widespread and abundant passerine species located on the area is the cardinal
28 (*Cardinalis cardinalis*), which thrives in disturbed areas. Other common species are the mourning dove
29 (*Zenaidura macroura*), Carolina chickadee (*Parus carolinensis*), mockingbird (*Mimus polyglottos*), and
30 turkey vulture (*Cathartes aura*). Common mammal species in the area are the raccoon (*Procyon lotor*),
31 white-tailed deer (*Odocoileus virginianus*), and black-tailed jackrabbit (*Lepus californicus*). Common
32 small mammals include the deer mouse (*Peromyscus maniculatus*), hispid cotton rat (*Sigmodon hispidus*),
33 and eastern wood rat (*Neotoma floridana*). Reptiles and amphibians at Fort Hood are representative of
34 the eastern, western, and southern U.S. communities. Eastern species present on the installation include
35 Blanchard's cricket frog (*Acris crepitans blanchardi*), gray treefrog (*Hyla versicolor*), and bullfrog
36 (*Rana catesbeiana*). Western species include the Texas greater earless lizard (*Cophosaurus texanus*),
37 collared lizard (*Crotaphytus collaris*), western diamondback rattlesnake (*Crotalus atrox*), and the western
38 narrow-mouthed toad (*Gastrophryne olivacea*). Southern species include the Texas spiny lizard
39 (*Sceloporus olivaceus*), short-lined skink (*Eumeces tetragrammus brevilineatus*), Rio Grande leopard frog
40 (*Rana berlandieri*), and Texas patchnose snake (*Salvadora grahamiae lineata*). Thirty-two species of
41 fishes have been documented from the lakes, ponds, and streams on the installation. The common
42 species are the red shiner (*Cyprinella lutrensis*), the blacktailed shiner (*Notropis venustus*), and the

1 bullhead minnow (*Pimephales vigilax*), with the remaining species being members of the minnow
 2 (Cyprinidae) or sunfish (Centrarchidae) families (USACE, 1999).

3 Wild game populations appear stable although some species number less than the expected carrying
 4 capacity. The white-tailed deer is the most important big-game mammal in Texas, and is managed as a
 5 recreational resource. The ideal carrying capacity of white-tailed deer for Fort Hood's habitat is
 6 estimated at one deer per 50 acres, but surveys indicate that the density is approximately one deer per
 7 81 acres. Wild turkey appear to be gradually increasing in abundance although the observed gain may be
 8 biased by improved survey techniques (USACE, 1999).

9 **3.5.1.3 Threatened and Endangered Species**

10 The Endangered Species Act (ESA) [16 U.S.C. 1532 et. seq.] of 1973, as amended, was enacted to
 11 provide a program for the preservation of endangered and threatened species and to provide protection
 12 for the ecosystems upon which these species depend for their survival. All federal agencies are required
 13 to implement protection programs for designated species and to use their authorities to further the
 14 purposes of the act. The presence of federally listed endangered species on Fort Hood is a significant
 15 natural resource management challenge for the Army and Fort Hood. In accordance with Army
 16 Regulation (AR) 200-3 Fort Hood has prepared an Endangered Species Management Plan (ESMP) [Fort
 17 Hood 2001] which provides comprehensive guidelines for maintaining and enhancing populations and
 18 habitats of federally listed and candidate species on Fort Hood while maintaining mission readiness
 19 consistent with Army and Federal environmental regulations. A listing of threatened, endangered, or
 20 other species of concern at Fort Hood is provided in Table 3-3.

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Table 3-3
Protected, Candidate, and Species of Concern and Their Occurrence on Fort Hood

Common Name	Scientific Name	Federal Status	Status on Fort Hood ¹ *
FEDERALLY LISTED SPECIES			
Whooping crane	<i>Grus americana</i>	E	B
Bald eagle	<i>Haliaeetus leucocephalus</i>	T	A
Black-capped vireo	<i>Vireo atricapilla</i>	E	A
Golden-cheeked warbler	<i>Dendroica chrysoparia</i>	E	A
CANDIDATE SPECIES			
Salado Springs salamander	<i>Eurycea chisholmensis</i>	C	C
SPECIES OF CONCERN			
Texabama croton	<i>Croton alabamensis</i>	N/A	A
Salamander (new species)	Plethodon	N/A	A
Cave-associated species	Multiple species	N/A	A

Legend: Federal status: E=endangered, T=threatened, C=candidate, N/A=Not Applicable.

¹ Status refers to population status on Fort Hood according to these definitions:

A = Population established on Fort Hood. Recent information documents an established breeding population (even if small) or regular occurrence, on the installation. This includes those species for which research and management is ongoing and several endemic cave invertebrates.

B = Recently recorded on Fort Hood, but there is no evidence of an established population. This includes species considered to be transient, accidental, or migratory (e.g., some migrating birds may use the installation as a stopover site during migration to and from their wintering grounds). For some species in this category, further inventory may reveal breeding populations.

C = Not known to occur on or near Fort Hood, but there is some possibility of occurrence.

* Updated from the ESMP (2001)

1 Three federally listed species found on or near Fort Hood are the bald eagle, which is a winter resident on
2 Belton Reservoir, the golden-cheeked warbler, which was federally listed as endangered in
3 December 1990 and nests on Fort Hood during March through June, and the black-capped vireo, which
4 was listed as endangered in November 1987 and nests on Fort Hood from March through July each year.
5 Whooping cranes are rare migrants through the Fort Hood area. Five observations of whooping cranes
6 on the installation were documented in December 1986. They may fly over the installation during spring
7 and fall migration and may stop on Belton Lake (USFWS, 2000).

8 The *golden-cheeked warbler* nests in mixed oak-juniper woodland, preferring older stands with tall, old
9 (approximately 40 years old) trees and closed canopies (USFWS, 1992). Golden-cheeked warblers nest
10 in suitable habitat throughout the installation. The Fort Hood *Endangered Species Management Plan*
11 (ESMP) designates 14,879 ha (36,766 acres) of golden-cheeked warbler habitat in the Eastern Training
12 Area as core habitat for the species, and activities in the core habitat area are limited to minimize impacts
13 to the species (USACE, 2000). Based on recent monitoring efforts, the golden-cheeked warbler
14 population size on Fort Hood increased significantly over the past 10 years (Anders, 2001). Threats to
15 the species include habitat destruction by urban development, brush clearing, oak wilt, range wildfires,
16 and nest parasitism from brown-headed cowbirds (*Molothrus ater*). Installation guidelines restrict brush
17 removal within 100 meters (328 feet) of endangered species habitat (USACE, 2000). Oak wilt has been
18 observed on the installation and its impacts are unknown, but studies are underway to assess the extent
19 and the impacts of this disease.

20 *Black-capped vireos* nest in an early-successional deciduous scrub community. This habitat is generated
21 as the result of various disturbances, including wildfire or mechanical removal of woody top growth.
22 Good nesting habitat for black-capped vireos includes a wide diversity of hardwoods in a patchy, low-
23 growing configuration with open, grassy spaces between patches of woody vegetation. Managing
24 habitat for black-capped vireos requires active management, as habitat will decrease in quality as it ages,
25 until it is no longer used. Black-capped vireos are found nesting in suitable habitat throughout the
26 installation. The Fort Hood ESMP designates 4,184 ha (10,340 acres) of black-capped vireo habitat in
27 the Eastern Training Area as core habitat for the species. Activities in the core habitat are limited in order
28 to minimize the risk of impacts to the species (USACE, 2000). Throughout the range of the species, the
29 black-capped vireo is threatened by cowbird parasitism, and by habitat loss from browsing animals
30 (goats, deer, and exotics), fire suppression, and urban development. Wildfire suppression threatens the
31 black-capped vireo because it utilizes the relatively young mixed shrub communities that replace the
32 older, single-species juniper stands after a wild fire (USFWS, 1991).

33 The *bald eagle* winters regularly on Belton Lake and the shoreline along the eastern boundary of
34 Fort Hood. Wintering populations vary from two to as many as seven, including adults, sub-adults, and
35 juveniles. Eagles arrive during mid- to late-October, and depart generally around the end of March.
36 Historically, threats to bald eagles included hunting, habitat destruction, and widespread pesticide use.
37 Laws preventing hunting of the species and outlawing the use of certain pesticides have resulted in a
38 significant comeback by this species, and a proposal to remove it from the threatened species list. The
39 only substantial threat to this species on the installation is the aerial support for training activities.
40 However, activities near roost sites are heavily restricted when bald eagles are known to be in the area
41 (USACE, 2000; USFWS, 2000).

1 **3.5.2 Consequences**

2 **3.5.2.1 Proposed Action**

3 **3.5.2.1.1 Cantonment Alternative**

4 **Vegetation.** There would be both short- and long-term minor adverse impacts from construction
5 associated with the Cantonment Alternative action. Construction of the small arms ranges would require
6 temporary removal of vegetation, but only in those areas where ground contours are modified to
7 accommodate addition of berms, or leveling for line of sight purposes. Small arms ranges are typically
8 located on sites that are topographically suited to the purpose of the range, so that a minimum of ground
9 disturbing activities are required for creation of the range. Once constructed, those areas that must be
10 disturbed would be seeded with native grasses.

11 Only small patches of vegetation would be permanently removed to accommodate the placement of
12 targets within any of the proposed small arms ranges. There would be long-term major adverse effects to
13 grasslands within the western maneuver area from the increased training (up to 20 percent over current
14 levels). However, implementation of management measures consistent with the Fort Hood INRMP and
15 the development of a Range Management Plan would prevent further degradation of the grasslands.

16 **Wildlife.** No impacts would be expected as wildlife population in the cantonment is sparse.

17 **Threatened and Endangered Species.** There would be no impact to threatened, endangered, or other
18 species of concern by implementation of the proposed action. All known habitats for sensitive species
19 would be avoided. All activities undertaken as a result of the proposed action would be consistent with
20 terms and conditions outlined in the Fort Hood Endangered Species Management Plan.

21 **3.5.2.1.2 Green Grass Alternative**

22 **Vegetation.** There would be both short- and long-term minor adverse impacts from construction
23 associated with the Green Grass Alternative action. More native prairie grasses would be impacted under
24 the Green Grass Alternative. Long-term, insignificant impacts from construction activities would include
25 the direct loss of approximately 300 acres of native prairie grasses at the proposed Green Grass Site.

26 **Wildlife.** Long-term minor impacts to fish and wildlife from construction activities would include the
27 direct loss of approximately 300 acres of habitat at the Green Grass Site. Impacts would result from the
28 displacement of wildlife due to disturbance from ground clearing operations and construction of new
29 facilities. Similar habitat would remain in the area; therefore, implementation of the proposed action
30 would not significantly affect wildlife communities on a regional basis. Wildlife species have adapted to
31 the live-fire, maneuver, and other training activities conducted on the ranges, and are not expected to
32 react adversely to additional training area occupation, however, any loss of vegetation, or other resources
33 related to increased stress on the ecosystem would have long-term adverse effects on wildlife.
34 Implementation of management measures consistent with the Fort Hood INRMP would minimize any
35 such impacts.

36

1 **3.5.2.2 No Action Alternative**

2 Under the No Action Alternative there would be no impact to vegetation, wildlife, or threatened and
3 endangered species.

4 **3.6 CULTURAL RESOURCES**

5 **3.6.1 Affected Environment**

6 **3.6.1.1 Historic Context**

7 The Fort Hood region has been inhabited since about 12,000 years ago when groups hunted large game
8 and collected the plant resources of the region at the end of the last Ice Age. As the climate gradually
9 warmed, small bands of people used a wider range of plant foods. Burned rock deposits provide
10 archaeological evidence of specialized food processing techniques. Later, hunting activities increased and
11 the bow and arrow came into use. Pottery appeared and regional trade networks were established in the
12 area (U.S. Army, 1995).

13 Europeans reported encountering Tonkawa Indians in central Texas in the late 1600s (U.S. Army, 1995).
14 Little else is known about the Tonkawa people who may have been displaced by tribes from the plains
15 who had adopted the horse. Wild horse herds are likely to have attracted both Anglo-Americans and
16 Comanches to the area. The Wichita Indians, who had a large village at Waco by the early 1800s, hunted
17 in the hill country around Fort Hood, along with the Comanche people. In the early 1800s, Phillip Nolan
18 operated in the area rounding up horses for resale in Louisiana.

19 The Brazos River area (including Bell and Coryell counties) was colonized in the 1830s by Sterling
20 Robertson and was known as “Robertson’s Colony” (U.S. Army, 1995). After Texas became part of the
21 U.S. in 1846, the U.S. Army built Fort Gates on the Leon River. The following year, Bell County was
22 organized and the region grew as ranchers grazed cattle and hogs on the open rangeland. In the 1880s,
23 railroad access to the area increased settlement along the railroad route and provided access to regional
24 markets for cash crops such as cotton. Cotton increased in importance through World War I and lasted
25 until the economic decline of the 1920s.

26 In 1942, Camp Hood was established as a tank destroyer center with 5,630 buildings and 35 firing
27 ranges. Camp Hood was renamed Fort Hood when it became a permanent installation in 1951 (U.S.
28 Army, 1995). Since its establishment, Fort Hood has been used as a training location for U.S. Army
29 armored units.

30 **3.6.1.2 Archeological Resources**

31 Prehistoric sites at Fort Hood (a total of 1,103) range in age from 12,000 years old to less than 150 years
32 old and include flaked rock scatters, campsites, burned rock features, rock quarries, caves and
33 rockshelters, and rock art. According to the Fort Hood archeological database, 174 of these are eligible
34 for the National Register of Historic Places (NRHP), and 252 are potentially eligible. Historic
35 archeological sites (totaling 1,124) include the remains of farms, homes, churches, and cemeteries
36 reflecting Euroamerican occupation of the area. There are 27 eligible resources and 89 potentially eligible
37 resources.

1 **3.6.1.3 Architectural Resources**

2 Historic architectural resources at Fort Hood include buildings that predate Army ownership of the
3 property and more than 600 (primarily temporary buildings) constructed during the World War II era
4 many of which have been demolished in recent years. None of the Fort Hood buildings are presently
5 listed on the NRHP (NPS, 2000). A building survey is underway to identify if any of the 5,000 plus
6 buildings are potentially eligible for the NRHP or meet criteria for nomination as a district.

7 **3.6.1.4 Traditional Cultural Resources**

8 At Fort Hood, one traditional cultural place has been evaluated as eligible for the NRHP and its access is
9 covered under a Memorandum of Understanding (U.S. Army, 1999a). Fort Hood maintains an informal
10 agreement with the Tonkawa and Comanche tribes regarding the treatment of human remains under the
11 *Native American Graves Protection and Repatriation Act* (NAGPRA) (U.S. Army, 1999a).

12 **3.6.2 Consequences**

13 Cultural resources are subject to review under both federal and state laws and regulations. Section 106 of
14 the National Historic Preservation Act (NHPA) of 1966 empowers the State Historic Preservation Officer
15 (SHPO) to comment on federally initiated, licensed, or permitted projects affecting cultural sites listed or
16 eligible for listing on the NRHP. Impacts to cultural resources determined to be eligible or potentially
17 eligible for the NRHP must be considered by federal agencies during the course of their undertakings.
18 Impacts are assessed by identifying the types and locations of a proposed activity and determining the
19 location of cultural resources that could be affected.

20 **3.6.2.1 Proposed Action**

21 **3.6.2.1.1 Cantonment Alternative**

22 Historic and prehistoric sites (that are potentially eligible for inclusion on the NRHP) would not be
23 affected by implementation of the Cantonment Alternative, however, the exact number is not known at
24 this time. All proposed sites for range modifications would be required final assessment for impacts to
25 potential cultural sites that may be eligible for NRHP. The Cultural Resources Management Team at Fort
26 Hood is currently compiling data regarding sites that would be impacted by implementation of the
27 proposed action. Once exact construction sites have been selected, those resources which would be
28 affected would be subject to intensive investigations to determine their eligibility. Fort Hood would carry
29 out Section 106 consultation with the State Historic Preservation Officer (SHPO), as required by the
30 National Historic Preservation Act, and all resulting mitigation actions would be carried out.

31 **3.6.2.1.2 Green Grass Alternative**

32 The same impacts would be expected as for the Cantonment Alternative.

33 **3.6.2.2 No Action Alternative**

34 Under the No Action alternative, there would be no impacts to cultural resources at Fort Hood.

1 **3.7 NOISE**

2 **3.7.1 Affected Environment**

3 **3.7.1.1 Natural Noise Environment**

4 The Noise Control Act of 1972 (Public Law 92-574) directs federal agencies to comply with applicable
5 federal, state, interstate, and local noise control regulations. Sound quality criteria promulgated by EPA,
6 the U.S. Department of Housing and Urban Development (HUD), and the DoD have identified noise levels
7 to protect public health and welfare with an adequate margin of safety. These levels are considered
8 acceptable guidelines for assessing noise conditions in an environmental setting. Noise levels below 65
9 decibels (dB) are considered normally acceptable in suitable living environments.

10 Responses to noise vary, depending on the type and characteristics of the noise, the expected level of
11 noise, the distance between the noise source and the receptor, the receptor's sensitivity, and the time of
12 day. The most conspicuous problems related to noise are hearing loss and hearing impairment due to
13 masking. Other health impacts include stress and exacerbation of mental health problems; high blood
14 pressure and ischemic heart disease; sleep loss, distraction, and loss of productivity; and a general
15 reduction in the quality of life and opportunities for tranquility. Table 3-4 lists the sound level of some
16 familiar sources.

Table 3-4
Sounds Levels of Various Sources

Source	Sound Level (dB)
Near jet plane at takeoff	140
Gun muzzle blast	140
Threshold of pain	120
Loud rock music	115
Car horn	115
Thunder	110
Chainsaw	100
Lawn mower at 50 feet	90
Jack hammer	88
Dozer	85
Backhoe	80
Alarm clock	75
Normal conversation	60
Light traffic	50
Refrigerator	40
Rustle of leaves	20
Normal breathing	10

Sources: USEPA, 1974.

17 One significant response to noise is annoyance. A person's expectation of a sound level associated with
18 an activity has a direct bearing on the level of annoyance. The annoyance might be personal or
19 experienced as a group. The five factors identified as being indicators for estimating community
20 complaint reaction to noise are type of noise, amount of repetition, type of neighborhood, time of day,
21 and amount of previous exposure. For the Army, high sound levels are both part of the job of operating

1 weapons systems and a necessary training condition because soldiers must learn to function in an
2 environment similar to what they will encounter on the battlefield.

3 **3.7.1.2 Military Noise Sources**

4 Training activities are the primary sources of noise at Fort Hood. These activities include the use of fixed
5 and rotary-wing aircraft and heavy weapons firing.

6 The Army has recognized its potential for noise impact on communities adjacent to its installations and
7 has implemented the Installation Compatible Use Zone (ICUZ) program (DA PAM 200-1). As part of the
8 ICUZ program, Fort Hood has mapped ICUZ noise zones that depict the relationship between noise levels
9 and land use. ICUZ noise zones are defined as follows:

- 10 • **Zone I.** An area where the sound is less than 65 dB, A-weighted (ADNL), or 62 dB, C-
11 weighted (CDNL). This area, considered to have moderate to minimal noise exposure, is
12 acceptable for noise-sensitive land uses.
- 13 • **Zone II.** An area where the sound level is 65 to 75 dB (ADNL) or 62 to 70 dB (CDNL).
14 This area is considered to have significant noise exposure and is “normally unacceptable”
15 for noise-sensitive land uses.
- 16 • **Zone III.** An area where the sound level is greater than 75 dB (ADNL) or 70 dB (CDNL).
17 This zone is considered an area of severe noise exposure and is unacceptable for noise-
18 sensitive activities.

19 **3.7.2 Consequences**

20 **3.7.2.1 Proposed Action**

21 **3.7.2.1.1 Cantonment Alternative**

22 **Construction.** Short-term minor adverse effects would be expected. Implementation of this alternative
23 action would be expected to result in additional sources of noise during construction activities due to the
24 operation of construction equipment and construction activities in general. Noise produced by
25 construction equipment varies considerably depending on the type of equipment used and its operation
26 and maintenance. The receptors closest to the construction activities include persons occupying work
27 facilities and dormitories nearest to the construction sites. The minor adverse effects associated with
28 noise would usually be confined to daytime hours during the normal workweek, Monday through Friday.
29 Construction activities should be limited to daylight hours to reduce the noise stress and annoyance to
30 nearby dormitories.

31 Maneuver and troop training activities take place approximately one to two miles from the proposed
32 facilities. These activities do not involve live-fire heavy artillery training. The noise generated from these
33 training areas would not be significant to annoy the occupants any facilities since the training areas are
34 miles from the cantonment area. Thus, the proposed facility locations are compatible with DA PAM 200
35 guidelines.

36 **Flight Operations and Noise Contours.** Long-term intermittent minor adverse effects would be
37 expected. An additional Aviation UA would result in additional flight training time. The location of the

1 airfield is in an industrial area and no residential or hospital facilities are nearby. Results of the noise from
2 the added flight activity would only change the noise contours by 5 percent.

3 **3.7.2.1.2 Green Grass Alternative**

4 **Construction.** Short-term minor adverse effects would be expected. Implementation of the Green Grass
5 Alternative action would be expected to result in additional sources of noise during construction activities
6 due to the operation of construction equipment and construction activities in general. Noise produced by
7 construction equipment varies considerably depending on the type of equipment used and its operation
8 and maintenance. The receptors closest to the construction activities include persons occupying the
9 existing housing nearest to the construction sites. The minor adverse effects associated with noise
10 would usually be confined to daytime hours during the normal workweek, Monday through Friday.
11 Construction activities should be limited to daylight hours to reduce the noise stress and annoyance to
12 residents.

13 Maneuver and troop training activities take place approximately ten miles from the proposed facilities.
14 These activities do not involve live-fire heavy artillery training. The noise generated from these training
15 areas would not be significant to annoy the occupants of the proposed facilities. Thus, the proposed
16 facility location is compatible with DA PAM 200 guidelines.

17 **Flight Operations.** Long-term intermittent minor adverse effects would be expected. An additional
18 Aviation UA would result in additional flight training time. The majority of these flights would be out of
19 Hood Army Field rather than the Robert Gray Army/Killeen Joint field. Increased military operations
20 discussed in the Joint Use of RGAAF EA would result in noise levels over the proposed dormitory and
21 West Fort Hood facilities of 65 dB during the daylight hours due to touch and go activities. There
22 would be no additional significant impact to the occupants of the proposed facilities. Noise generated
23 from the Joint Airfield near the proposed site would be impacted by the commercial flights and military
24 touch and go activities.

25 **Noise Contours.** RGAAF noise contours are located in TAB 5(Fort Hood, 2000a). Results of the noise
26 zone modeling indicated that the temporary facilities, including the soldier's dormitories would experience
27 65-70 dBA during the daytime hours due to the military touch and go operations and the daily commercial
28 flight activities.

29 **3.7.2.2 No Action Alternative**

30 No effects would be expected.

31 **3.8 AIR QUALITY**

32 **3.8.1 Affected Environment**

33 **3.8.1.1 Regulatory Framework**

34 Air quality is regulated at the national level through regulations promulgated under the Clean Air Act
35 (CAA) of 1970 and its subsequent amendments. The act directed the U.S. Environmental Protection
36 Agency (EPA) to establish National Ambient Air Quality Standards (NAAQS) for air pollutants that
37 endanger public health and the environment. EPA subsequently adopted air quality standards for six

1 criteria pollutants: ozone (O₃), carbon monoxide (CO), nitrogen dioxide (NO₂), sulfur dioxide (SO₂),
 2 inhalable particulate matter (PM-10), and lead (Pb) particles. The CAA requires state or local
 3 governments to monitor ambient levels of these pollutants and to develop air quality management plans to
 4 ensure compliance with the NAAQS. Areas that violate these standards are designated “nonattainment”
 5 areas for the relevant pollutants. The EPA delegates authority to the Texas Commission on Environmental
 6 Quality (TCEQ) Office of Air Quality for monitoring and enforcing air quality regulations in Texas.
 7 Sources of air pollution are regulated under the TCEQ Air Quality Regulations, Title 30.

8 Fort Hood lies totally within the central portion of the EPA Air Quality Control Region (AQCR) #212, also
 9 known as the Austin-Waco Intrastate AQCR (USACE, 1999). The TCEQ, the agency with overall
 10 authority for air quality, has adopted the National Ambient Air Quality Standards (NAAQS) for six criteria
 11 pollutants—particulate matter (both particulate matter less than 10 microns in Diameter [PM₁₀ and PM_{2.5}],
 12 nitrogen dioxide, carbon monoxide, sulfur dioxide, and ozone (photochemical oxidants)—and has also
 13 adopted the federal standard for lead (Table 3-5).

14 Bell and Coryell counties, including all of Fort Hood, are considered to be unclassified or in attainment
 15 with regard to each of the NAAQS criteria pollutants (EPA website, 14 April 2004). Therefore, the
 16 General Conformity Rule demonstrating compliance with the State Implementation Plan (SIP) does not
 17 apply to Fort Hood, and a Record of Non-applicability (RONA) is not required.

18
 Table 3-5
 National Ambient Air Quality Standards (Primary)

Pollutant	Standard Value	Standard Type
Carbon Monoxide (CO)		
8-hour average	9 ppm	Primary
1-hour average	35 ppm	Primary
Nitrogen Dioxide (NO ₂)		
Annual arithmetic mean	0.053 ppm	Primary and secondary
Ozone (O ₃)		
1-hour average	0.12 ppm	Primary and secondary
Lead (Pb)		
Quarterly average	1.5 µg/m ³	Primary and secondary
Particulate (PM 10)		
Annual arithmetic mean	50 µg/m ³	Primary and secondary
24-hour average	150 µg/m ³	Primary and secondary
Sulfur Dioxide (SO ₂)		
Annual arithmetic mean	0.03 ppm	Primary
24-hour average	0.14 ppm	Primary
3-hour average	0.50 ppm	Secondary

Source: USEPA, 2004a

19
 20 **3.8.1.2 Fort Hood Air Emissions**

21 According to the regulations, Fort Hood is classified as a major source of air pollutant emissions that
 22 contribute to the nonattainment status of the region. Fort Hood operates under at Title V Operating

1 Permit (#0-01659) and several individual air permits. The Emissions Statement identifies and quantifies
 2 air emissions from stationary air Total annual criteria pollutant emissions from all stationary facilities at
 3 Fort Hood are listed in Table 3-6.

4 In 2003, TCEQ required Fort Hood to include all source of criteria pollutants resulting in the larger
 5 numbers in the 2003 report in Table 3-6.

Table 3-6
Fort Hood Stationary Source Emissions Summary (tons/year)

	VOCs	NO _x	CO	SO _x	PM-10	HAP
2002	87.0	6.3	0.2	0.6	0.6	
2003	290.7	74.9	604.0	1.3	100.3	2842.5

6 Note: VOCs = volatile organic compounds; NO_x = nitrous oxides; CO = carbon monoxide; SO_x = sulfur oxides; PM10 =
 7 particulate matter less than 10 microns in diameter; HAP = hazardous air pollutants. Methane constitutes 95% of the
 8 HAPs. Fort Hood does not emit reportable quantities of lead, a sixth criteria pollutant.

9 Source: Fort Hood Environmental Division, Air Manager, July 2004.

11 **3.8.2 Consequences**

12 **3.8.2.1 Proposed Action**

13 **3.8.2.1.1 Cantonment Alternative**

14 Short-term intermittent minor adverse effects would be expected within the ROI as a result of
 15 construction activities, training exercises, and increased automobile use. Heavy construction equipment
 16 and trucks would emit minor amounts of NO_x, PM-10, CO, SO_x, and VOCs. The proposed activity
 17 involves installation/construction of 287 facilities consisting of dormitory structures, maintenance shops
 18 for vehicle and equipment maintenance, an additional hangar for rotary-wing aircraft, dining facility, a
 19 brigade headquarters building, a fitness center, laundry facility and administrative facilities. The
 20 impervious surface areas for these facilities is estimated at 113 acres. These construction activities are
 21 estimated to occur over a one year period. The calculated emissions from installation of modular facilities
 22 and infrastructure from these activities are shown in Table 3-7.

Table 3-7
Total Annual Air Emissions From Construction Activities

Pollutant	Total Emissions (tons/yr)
Carbon monoxide (CO)	31.23
Nitrogen oxides (NO _x)	16.89
Particulate Matter (PM-10)	1.35
Sulfur oxides (SO _x)	1.02
Volatile organic compounds (VOCs)	4.47

Source: AECATS II, 2004.

1 The construction is schedule from September 04 to July 05. Although these construction activities would
2 produce dust and particulate matter, these actions pose no significant impact on air quality. Fugitive dust
3 emissions can easily be controlled and minimized by using standard construction practices such as

- 4 • Periodically wetting the area of construction,
- 5 • Covering open equipment used to convey materials likely to create air pollution, and
- 6 • Promptly removing spilled or tracked dirt from streets.

7 Once new facilities are occupied, there would be a demand for additional heating and air conditioning
8 units. These items would result in additional criteria pollutants being generated by natural gas boilers.
9 Boiler size would not exceed 10-MMBtuh in order to avoid the rule on Boiler NESHAPs. Low NOx
10 boilers would be installed in the new facilities reducing the emissions of pollutants. Approximately 50 new
11 boilers would be required that would be mitigated by modification of Fort Hood's Title V Operating
12 Permit. Additionally, maintenance performed on new aircraft and in new facilities would be required to
13 comply with NESHAP requirements and required modification to Fort Hood's Title V Operating Permit.

14 Long-term minor intermittent adverse effect would be expected from emissions of criteria pollutants
15 from aircraft operations, military equipment maneuvers, artillery exercises, and use of privately owned
16 vehicles. The additional Aviation UA would add 110 additional helicopters to the Fort Hood existing
17 inventory. These aircraft are composed of 48 Apaches, 50 Blackhawks, and 24 Chinooks. The estimated
18 air emissions from the activities other than construction shown above are listed in Table 3-8.

19
Table 3-8
Total Annual Air Emissions From Operational Activities

Activity	NOx	VOC	CO	PM	SOx
24 Chinooks @ 100 flight hours/yr	5.00	4.81	6.01	0.61	0.11
48 Apaches @ 100 flight hours/yr	9.14	9.01	9.34	0.77	0.22
38 Blackhawks @ 100 flight hours/yr	15.4	6.16	6.16	0.57	0.17
Operational Vehicles/Stationary Sources	1.0	0.67	6.8	0.08	0.09
New POVs due to incoming personnel	40.0	18.0	21.6	2.7	3.6
Totals	70.5	38.7	49.9	4.7	4.2

Source: AECATS II, 2004

20
21 The Hood Field operations at and increased helicopter flying is scheduled to start September 2005.
22 Training would involve pilot proficiency training and field artillery training. It is estimated that each new
23 helicopter could experience up to 100 hours flight time in one year. Fort Hood is located in an attainment
24 area and therefore the General Conformity Rule does not apply. The totals emissions of criteria pollutants
25 as a result of the proposed action would not violate any NAAQS or other Clean Air Act Title. Title V
26 Permit would need to be modified to include the new operational stationary sources at Fort Hood. The
27 emissions calculations are contained in TAB 6.

1 **3.8.2.1.2 Green Grass Alternative**

2 Short-term intermittent minor adverse effects would be expected within the ROI as a result of
3 construction activities, training exercises, and increased automobile use. Heavy construction equipment
4 and trucks would emit minor amounts of NO_x, PM-10, CO, SO_x, and VOCs. The proposed activity
5 involves installation/construction of temporary modular facilities consisting of 7-9 dormitory structures,
6 12 maintenance shops for vehicle and equipment maintenance, an additional hangar for rotary-wing
7 aircraft, extension of a tactical vehicle road leading from West Fort Hood to the training ranges (2.5
8 miles), dining facility, a brigade headquarters building, a fitness center, laundry facility and administrative
9 facilities. The impervious surface areas for these facilities is estimated at 450 acres. These construction
10 activities are estimated to occur over a one year period. The calculated emissions from installation of
11 modular facilities and infrastructure from these activities would be approximately 10 percent higher than
12 to those shown in Table 3-7.

13 The construction is schedule from September 04 to July 05. Although these construction activities would
14 produce dust and particulate matter, these actions pose no significant impact on air quality. Fugitive dust
15 emissions can easily be controlled and minimized by using standard construction practices such as

- 16 • Periodically wetting the area of construction,
- 17 • Covering open equipment used to convey materials likely to create air pollution, and
- 18 • Promptly removing spilled or tracked dirt from streets.

19 Once new facilities are occupied, there would be a demand for additional heating and air conditioning
20 units. These items would result in additional criteria pollutants being generated by natural gas boilers.
21 Boiler size would not exceed 10-MMBtuh in order to avoid the rule on Boiler NESHAPs. Low NO_x
22 boilers would be installed in the new facilities reducing the emissions of pollutants. Approximately 50 new
23 boilers would be required that would be mitigated by modification of Fort Hood's Title V Operating
24 Permit. Additionally, maintenance performed on new aircraft and in new facilities would be required to
25 comply with NESHAP requirements and required modification to Fort Hood's Title V Operating Permit.

26 Long-term minor intermittent adverse effect would be expected from emissions of criteria pollutants
27 from aircraft operations, military equipment maneuvers, artillery exercises, and use of privately owned
28 vehicles. The additional Aviation UA would add 110 additional helicopters to the Fort Hood existing
29 inventory. These aircraft are composed of 48 Apaches, 50 Blackhawks, and 24 Chinooks. The estimated
30 air emissions from the activities other than construction would be the same as those shown above in
31 Table 3-8.

32 The operations at West Fort Hood and increased helicopter flying is scheduled to start September 2005.
33 Training would involve pilot proficiency training and field artillery training. It is estimated that each new
34 helicopter could experience up to 100 hours flight time in one year. Fort Hood is located in an attainment
35 area and therefore the General Conformity Rule does not apply. The totals emissions of criteria pollutants
36 as a result of the proposed action would not violate any NAAQS or other Clean Air Act Title. Title V
37 Permit would need to be modified to include the new operational stationary sources at West Fort Hood.
38 An emissions calculations example for construction is contained in TAB 6.

1 **3.8.2.2 No Action Alternative**

2 Under the no action alternative there would be no implementation of the proposed action and therefore no
3 additional effects on air quality.

4 **3.9 SOCIOECONOMICS**

5 **3.9.1 Affected Environment**

6 **3.9.1.1 Demographics**

7 This section describes the contribution of Fort Hood to the economy and the sociological environment in
8 the region. The socioeconomic indicators used for this study include regional economic activity,
9 population, housing, and schools. In addition, recreational and community facilities, and public and social
10 services are discussed. These indicators characterize the region of influence (ROI). An ROI is a
11 geographic area selected as a basis on which social and economic impacts of project alternatives are
12 analyzed. The criteria used to determine the ROI are the residency distribution of Fort Hood employees,
13 commuting distances and times, and the location of businesses providing goods and services to Fort
14 Hood, its personnel, and their dependents. Based on these criteria, the ROI for the social and economic
15 environment is defined as Bell County and Coryell County, Texas. The ROI covers an area of 2,112
16 square miles.

17 The baseline year for socioeconomic data is 2002. This base year is the most recent year for which the
18 majority of socioeconomic indicators (e.g., population, employment, and housing data) are reasonably
19 available. Where 2002 data are not available, the most recent data available are presented.

20 **3.9.1.2 Economic Development**

21 Fort Hood provides a substantial contribution to the ROI economy, with 40,253 active duty military
22 personnel assigned to the post, and 3,092 civilian personnel working on the installation. Fort Hood's
23 annual post expenditures are in excess of \$8.7 million. Included in this amount are expenditures for
24 military and civilian payroll and non-appropriated funds contracts and salaries (Fort Hood, 2002b).

25 **Employment and Unemployment.** The ROI 2003 annual average civilian labor force was 123,481.
26 Some of the largest employers in the ROI include Fort Hood, the Killeen Independent School District,
27 Central Texas College District, Convergys, and Sallie Mae.

28 The ROI's 2003 annual unemployment rate was 5.6 percent, an increase from 3.4 percent in the year
29 2000. However, the ROI unemployment rate was still lower than the state of Texas' 2003 rate of 6.8
30 percent and the national unemployment rate of 6.0 percent (TWC, 2004).

31 **Income.** The per capita personal income (PCPI) of the ROI was \$24,332 in 2002. For comparison, the
32 PCPI of Texas was \$29,039, and the PCPI for the United States was \$30,906 (BEA, 2004).

33

1 3.9.1.3 Population

2 The ROI has seen continued population growth between 1990 and 2000. The ROI population was
3 255,301 in 1990 and grew to 319,163 by 2002, a 25 percent increase (U.S. Census Bureau, 2004). For
4 comparison, the population of Texas increased by 22.8 percent and the population of the United States
5 increased by 13.1 percent.

6 3.9.1.4 Housing

7 **On-post Family Housing.** There are 6,212 family housing units on Fort Hood. On-post housing is
8 typically fully occupied, though some units may be temporarily unavailable to allow maintenance to be
9 completed between tenants. Waiting time for Fort Hood on-post family housing ranges from 1- to 2-
10 months to more than two years, depending on rank and number of bedrooms required (Fort Hood DPW,
11 2004).

12 **On-post Unaccompanied Personnel Housing.** Unaccompanied personnel accommodations at Fort Hood
13 include 98 enlisted barracks, 76 guest quarters, and 394 in-transit quarters (Fort Hood, 2002b).

14 **Off-Post Housing.** There were 114,558 housing units in the ROI in 2000 (Table 3-9). Most Fort Hood
15 military and civilian personnel who live off post live in the cities of Killeen and Harker Heights within Bell
16 County, and the city of Copperas Cove in Coryell County. Vacancy rates have declined since 1990 as a
17 result of the transfer of the 5th Infantry Division to Fort Hood and strong population growth in the ROI.
18 Homeowner vacancy rates declined from 3.4 percent in 1990 to 2.3 percent in 2000, and rental vacancy
19 rates declined from 13.0 percent in 1990 to 7.6 percent in 2000 (U.S. Census Bureau, 2004). The ROI
20 had 9,101 vacant housing units in 2000. However, 642 of these units were for seasonal or recreational
21 use. Therefore, the number of vacant housing units available for sale or rent totaled 8,459.

22

Table 3-9
ROI Housing Quantity and Quality

Total Housing Units	114,558
Occupied Housing Units	105,457
Owner Occupied	58,577
Renter Occupied	46,880
Vacant Housing Units	9,101
Vacant for Seasonal, Recreational, or Occasional Use	642
Homeowner Vacancy Rate	2.3%
Rental Vacancy Rate	7.6%
Housing Units Lacking Complete Plumbing Facilities	466
Housing Units Lacking Complete Kitchen Facilities	527

Source: U.S. Census Bureau, 2004.

23

24 3.9.1.5 Quality of Life

25 **Law Enforcement and Fire Protection Services.** Law enforcement at Fort Hood is provided by a
26 Military Police Brigade of approximately 600 military personnel, and a Provost Marshall's Office (PMO)

1 that employs approximately 100 military and civilian personnel. Although Fort Hood does not have signed
2 mutual aid agreements with surrounding law enforcement agencies, the Military Police and PMO do work
3 cooperatively with the city of Killeen Police Department.

4 Fort Hood has five fire stations and employs approximately 90 personnel. In addition, the installation has
5 mutual aid fire service agreements with Bell, Coryell, Lampasas, and Williamson Counties, and 13 cities
6 within those counties.

7 **Medical Services.** The primary medical care facilities for active duty soldiers are battalion aid stations
8 and troop medical clinics. Specialty care and emergency medical services are provided by Darnall Army
9 Community Hospital. Darnall is a 198-bed facility with 128 surgical beds, and can expand to 339 beds
10 during contingencies (Greater Killeen Chamber of Commerce, 2000; DAHC, 2004). Through the military
11 health plan called TRICARE, about 141,000 active-duty, retired soldiers, and their families are enrolled in
12 Darnall's system of Family Care Clinics (DAHC, 2004). Clinics are located on Fort Hood and in the
13 surrounding communities of Killeen and Copperas Cove (Greater Killeen Chamber of Commerce, 2000).

14 The primary off-post healthcare provider in the greater Killeen area is Metroplex Health System, a 202-
15 bed multi-campus facility. The main healthcare center is the Metroplex Hospital in Killeen, a 117-bed
16 acute-care facility (Metroplex Health System, 2004).

17 **Schools.** The U.S. Department of Education provides federal impact aid to school districts that have
18 federal lands within their jurisdiction. This federal impact aid is authorized under Public Law 103-382 as
19 payment in lieu of taxes that would have been paid if the land were not held by the federal government.
20 School districts receive federal impact aid for each student whose parents live on or work on federal
21 property. The amount of federal impact aid a school district receives is dependent on the number of
22 "federal" students the district supports in relation to the total district student population. Schools receive
23 more federal impact aid for those students whose parents both live on and work on federal property.³
24 Total funding varies year by year according to congressional appropriations for the program, but in
25 general funding has ranged from \$200 to \$2,000 per pupil.

26 Based on military household residency patterns, about 95 percent of all children of military and federal
27 civilian families at Fort Hood are enrolled in Killeen Independent School District (KISD) or Copperas
28 Cove Independent School District (CCISD) (TRC, 1999). KISD student enrollment for the 2002-2003
29 school year was 31,258, and the student-to-teacher ratio was 14:1 (NCES, CCD, 2004). In the 2002-
30 2003 school year, about 6,500 children living on Fort Hood (or about 21 percent of the total KISD
31 student population) attended KISD (KISD, 2004). Because these children live on-post and attend a public
32 school district, KISD receives the highest level of federal impact aid for these students. CCISD total
33 student enrollment for the 2002-2003 school year was 7,599, and the student-to-teacher ratio was 14:1
34 (NCES, CCD, 2004).

35 **Family Support.** Fort Hood has a number of programs and services in place to assist employees and
36 their families, such as the Army Substance Abuse Program; Army Family Team Building; financial
37 guidance and assistance; legal assistance; the Army Family Team Building program; and employment
38 assistance for military family members. Fort Hood also has a Child Development Center, a Family Child
39 Care program, a Youth Services Program, and School Age Services Program that provides before-and-

³ Military A students are dependents of military employees residing on federal property. Military B students are dependents of military employees not residing on federal property. School districts receive the highest level of federal impact aid for Military A students, and a lower level for Military B students.

1 after-school childcare for children in grades 1 through 12. The Fisher House on Fort Hood provides
2 temporary housing for family members of patients at the Darnall Army Community Hospital.

3 **Shops and Services.** Services available on Fort Hood include a dental clinic, a credit union, a bank, travel
4 agency, a U.S. Post Office, a telecommunications office, several barber shops and beauty salons, optical
5 store, flower shop, laundry facilities and dry cleaners, shoe and watch repair shop, gas stations, auto
6 parts stores, a tire sales and service center, and two car wash stations. Fort Hood also has two large
7 commissaries, which combine a grocery store with a department store. There are also a 3 mini malls,
8 several food courts, two shoppettes, and a Class Six store on the installation.

9 In addition to the facilities available at Fort Hood, the ROI provides ample opportunity for shopping. In
10 downtown Killeen is the Killeen Mall, as well as numerous commercial areas with a vast array of
11 Asuperstores, @other retail stores, restaurants, and services. Two major metropolitan areas are within
12 easy driving distance. Austin, the capitol of Texas, is just 60 miles south of Fort Hood, and Dallas/Fort
13 Worth is 160 miles north.

14 **Recreation.** Fort Hood operates nine gymnasiums with varied combinations of exercise facilities (Greater
15 Killeen Chamber of Commerce, 2000). Facilities include basketball courts, racquetball courts, weight
16 rooms, swimming pools, and indoor tracks. Outdoor facilities include a 27-hole golf course, tennis
17 courts, basketball courts, soccer fields, tennis courts, and a skating center. The installation has
18 intramural soccer, basketball, softball, tennis, golf, baseball, and racquetball. There are four youth
19 centers on Fort Hood for children in first through twelfth grade that offer athletic, cultural, and
20 recreational programs, as well as summer camps. In addition, the installation has a 48-lane bowling
21 center; an auto crafts center; an arts and crafts center; hunting and fishing locations, with a pro-shop and
22 skeet range; two military museums; and bingo six days a week at the Community Events Center (Fort
23 Hood MWR, 2004).

24 The premier recreational sites in the ROI are Belton Lake and the Stillhouse Hollow Reservoir. The
25 Belton Lake Outdoor Recreation Area, located 14 miles northeast of Fort Hood, has 136 miles of
26 shoreline with recreational spots providing boat launching ramps, cottage rentals, a fishing marina, a
27 water slide, swimming facilities, an equestrian trail, mountain bike trails, paintball, and picnic and
28 camping areas. Stillhouse Hollow Reservoir located on the Lampasas River features 58 miles of shoreline
29 with six parks providing facilities similar to those at Belton Lake. Copperas Cove has extensive bicycling
30 trails, with more than a dozen trail rides ranging from ten to 75 miles on scenic roads and country lanes.

31 **3.9.1.6 Environmental Justice**

32 On February 11, 1994, President Clinton issued Executive Order 12898, *Federal Actions to Address*
33 *Environmental Justice in Minority and Low-Income Populations*. The Executive Order is designed to
34 focus the attention of federal agencies on the human health and environmental conditions in minority
35 communities and low-income communities. Environmental justice analyses are performed to identify the
36 disproportionate placement of high and adverse environmental or health impacts from proposed federal
37 actions on minority or low-income populations, and to identify alternatives that could mitigate these
38 impacts.

1 As of the 2000 Census, 58 percent of the ROI population was white and 42 percent was of a minority
2 race or ethnicity.⁴ The ROI had a lower percentage of minority populations compared to the state of
3 Texas, with a minority population of 48 percent (US Census Bureau, 2000). No concentrations of
4 minority populations have been identified within areas adjacent to Fort Hood.

5 Almost 11 percent of the ROI population had an income below poverty level.⁵ The ROI's poverty rate
6 was lower than Texas' rate of 15.4 percent and the national rate of 12.4 percent (US Census Bureau,
7 2004). No concentrations of low-income populations have been identified in the areas adjacent to Fort
8 Hood.

9 **3.9.1.7 Protection of Children**

10 Executive Order 13045 seeks to protect children from disproportionately incurring environmental health
11 or safety risks that might arise as a result of Army policies, programs, activities, and standards.
12 Historically, children have been present at Fort Hood as residents and visitors (e.g., users of recreational
13 facilities, family housing, schools, etc.). On such occasions, the Army has taken precautions for their
14 safety by a number of means, including, but not limited to, the use of fencing, limitations on access to
15 certain areas, and provision of adult supervision. Actions indicating potential disproportionate risks to
16 children are identified and addressed in the socioeconomic consequences section of this EA.

17 **3.9.2 Consequences**

18 **3.9.2.1 Proposed Action**

19 **3.9.2.1.1 Cantonment Alternative**

20 **Economic Development.** The economic effects of implementing the Proposed Action are estimated
21 using the Economic Impact Forecast System (EIFS) model. The EIFS model is a computer-based
22 economic tool that calculates multipliers to estimate the direct and indirect effects resulting from a given
23 action. Changes in spending, employment, and population represent the direct effects of the action.
24 Based on the input data and calculated multipliers, the model estimates ROI changes in sales volume,
25 income, employment, and population, accounting for the direct and indirect effects of the action. TAB
26 7 describes the EIFS model in more detail and presents the model input and output tables.

27 For purposes of this analysis, a change is considered significant if it falls outside the normal range of ROI
28 economic variations. To determine historical variability, the EIFS model calculates a rational threshold
29 value (RTV) profile for the ROI. This analytical process uses historical data for the ROI and calculates
30 fluctuations in sales volume, income, employment, and population patterns. The historical extremes for
31 the ROI become the thresholds of significance (the RTVs) for social and economic change. If the
32 estimated effect of an action falls above the positive RTV or below the negative RTV, the effect is
33 considered significant.

⁴ Minority populations included in the Census are identified as Black or African American; American Indian and Alaska Native; Asian; Native Hawaiian and other Pacific Islander; other race; of two or more races; and Hispanic.

⁵ Poverty status, used in this EA to define low-income status, is reported as the number of persons with income below poverty level. The 2000 Census defines the poverty level as \$8,794 of annual income, or less, for an individual and \$17,603 of annual income, or less, for a family of four.

1 **EIFS Model Results.** Short-term and long-term direct and indirect beneficial effects would be expected.
 2 The expenditures and employment increases associated with the Proposed Action at Fort Hood would
 3 increase sales volume, employment, income, and population in the ROI, as estimated by the EIFS model
 4 (Table 3-10, and TAB 7). Short-term economic benefits would result from the construction of the new
 5 ranges, the tactical vehicle road, helicopter hangar, and the temporary facilities to service the new
 6 soldiers. The effects would be short-term since they would last only for the duration of construction.
 7 Long-term beneficial effects would be associated with the addition of 8,000 soldiers and their
 8 dependents. Transfer of these soldiers to Fort Hood would directly increase regional employment and
 9 income. Expenditures made by these soldiers for the rental of or the purchase of property, and for other
 10 goods and services in the ROI, would result in indirect beneficial effects on the local economy through
 11 increased sales volumes and employment. These changes in sales volume, employment, and income
 12 would fall within historical fluctuations (i.e., within the RTV range) and be considered minor, although it
 13 should be noted that the change in employment (6.09 percent) is close to the region’s historical high
 14 increase in employment of 6.27 percent (Table 3-10).

Table 3-10
EIFS Model Output for the Proposed Action at Fort Hood

Indicator	Projected Change	Percentage Change	RTV Range
Direct Sales Volume	\$164,942,900		
Induced Sales Volume	\$199,581,000		
Total Sales Volume	\$364,523,900	5.57	-9.52% to 11.63%
Direct Income	\$210,867,000		
Induced Income	\$45,569,230		
Total Income	\$256,436,300	4.22	-7.03% to 10.14%
Direct Employment	9,020		
Induced Employment	1,235		
Total Employment	10,255	6.09	-7.08% to 6.27%
Local Population	19,920	6.540	-2.10% to 8.01%

15
 16 **Population.** The Proposed Action would increase the number of military personnel assigned to Fort
 17 Hood by 8,000. Including associated dependents (spouses, children), the population would increase by
 18 about 14,000. This equates to a 4 percent increase in the 2002 ROI population within one year. In
 19 addition, the increase in demand for services in the ROI by the incoming population, along with the jobs
 20 associated with construction activities at Fort Hood, would attract new workers to the ROI. Including
 21 this in-migrating population, the EIFS model estimated a total population increase of near 20,000 (Table
 22 3-10).

23 **Housing.** No significant effects would be expected. Off-post housing assets are available to absorb the
 24 population increase (Burrow, Burrow, Conner, 2004).

25 **Quality of Life.** The following identify the foreseen effects for each of the key components of quality of
 26 life.

1 *Law Enforcement and Fire Protection Services.* Short-term adverse effects would be expected. The
2 Proposed Action would increase the ROI population. With increased population comes increases in
3 incidents, accidents, and emergencies that could require a police or fire department response. Additional
4 police officers and fire personnel would need to be hired to maintain current ROI ratios of
5 officers/firepersons to civilians. Additional equipment (e.g., squad cars, fire engines, emergency medical
6 vehicles), as well as additional police and fire stations, could also be required to maintain adequate
7 response times to emergencies.

8 *Medical Services.* Short-term adverse effects would be expected. The increase in population would
9 increase the demand for medical services. Additional doctors, nurses, dentists, and other health care
10 professionals would be needed to serve the new population, as well as medical centers, clinics, and
11 hospital beds.

12 *Recreation.* Short-term adverse effects would be expected. The additional population would increase
13 demand for the available recreational facilities on the installation and in the ROI. Until new or expanded
14 facilities could be constructed to replace existing inadequate facilities (e.g., gymnasiums, swimming
15 pools, ball fields), adverse effects would be expected.

16 *Schools.* Short-term major adverse effects would be expected. The Proposed Action is expected to
17 increase the military student population by 4,371 (Burrow, Burrow, Conner, 2004). This equates to an
18 11 percent increase over the KISD and CCISD student enrollment for the 2002-2003 school year.
19 According to KISD historical records dating back to 1988, the largest increase in school enrollment was
20 an 8.53 percent increase that occurred between the 1992-93 and 1993-94 school years (KISD, 2004).
21 Temporary classrooms would need to be provided until schools could be expanded or new schools could
22 be constructed. In the long-term, the federal impact aid to the school districts would increase by an
23 estimated \$27.9 million per year (Burrow, Burrow, Conner, 2004). It should be noted that in addition to
24 the new military dependent students, the increase in ROI economic activity would also attract in-
25 migrating workers, some of whom would have families, further increasing the primary and secondary
26 student enrollment in the local school districts.

27 *Environmental Justice.* No effects would be expected. Implementation of the Proposed Action would
28 not result in disproportionate adverse environmental or health effects on low-income or minority
29 populations.

30 *Protection of Children.* Short-term minor adverse effects on the protection of children would be
31 expected. In the short term, because construction sites can be enticing to children, construction activity
32 on Fort Hood could be an increased safety risk. During construction, safety measures stated in 29 CFR
33 Part 1926, Safety and Health Regulations for Construction, and AR 385-10, Army Safety Program,
34 would be followed to protect the health and safety of residents on Fort Hood, as well as construction
35 workers. Barriers and “no trespassing” signs would be placed around construction sites to deter children
36 from playing in those areas, and construction vehicles and equipment would be secured when not in use.

37 3.9.2.1.2 *Green Grass Alternative*

38 The impacts from the Green Grass Alternative would be the same as those discussed above for the
39 Cantonment Alternative.

1 **3.9.2.2 No Action Alternative**

2 **Economic Development, Population, Housing, and Quality of Life.** No effects would be expected.
3 There would be no change in sales volume, employment, or population in the ROI.

4 **Environmental Justice.** No effects would be expected. Implementation of the No Action would not
5 result in disproportionate adverse environmental or health effects on low-income or minority populations.

6 **Protection of Children.** No effects would be expected. Implementation of the No Action would not
7 result in disproportionate environmental health or safety risks on children.

8 **3.10 TRANSPORTATION**

9 Transportation in and around Fort Hood is achieved via road networks, rail routes, and air systems.
10 Pedestrian walks, bike paths, and trails are also used to a limited extent for travel within the cantonment
11 area. This section describes the installation's transportation resources, their relative use, and their
12 importance to the surrounding communities.

13 **3.10.1 Affected Environment**

14 **3.10.1.1 Road Conditions and Traffic**

15 **On-Post Highways and Roads.** The evaluation of the existing roadway segments focuses on capacity,
16 which reflects the ability of the network to serve the traffic demand and volume. All roadways
17 throughout Fort Hood are classified as primary, secondary, or tertiary according to their relative
18 importance and function as part of the roadway network. Primary roadways include all installation roads
19 and streets that serve as the main distribution arteries for all traffic originating outside and within the
20 installation and that provide access to, through, and between various functional areas. Secondary
21 roadways include all installation roads and streets that supplement the primary roadways by providing
22 access to, between, and within the various functional areas (USACE, 1995).

23 A number of primary streets are routed continuously through the southern part of the Main Cantonment
24 Area and function primarily to collect and distribute traffic within Fort Hood. These roads are
25 constructed largely of concrete or asphaltic concrete and are considered to be in good condition. They
26 include Hood Road and Clear Creek Road, which provide access to U.S. Highway 190 to the south; Tank
27 Destroyer Boulevard, which provides access to the city of Killeen to the east and the city of Copperas
28 Cove to the west; Battalion Avenue, which primarily facilitates east-west movement in the Main
29 Cantonment Area and provides access to the city of Killeen via the Central Drive post entrance; and
30 Warrior Way Road, which transitions into the one-way pair of Old Ironsides Avenue and Hell on Wheels
31 Avenue just west of Martin Drive, both of which terminate at Clear Creek Road to the west. The
32 principal street providing access to West Fort Hood is Clarke Road, which runs in a north-south direction
33 from Turkey Run Road on the north to Grey Drive on the south. All of these roadways are multilane for
34 most of their length in the Fort Hood study area. Planned improvements to Fort Hood roadways include
35 the extension of 58th Street between Terminal Avenue and Santa Fe Avenue, and Support Avenue
36 between 62nd Street and Headquarters Avenue; construction of the New Headquarters Entrance; and a
37 realignment of 58th Street at Santa Fe Avenue .

38 **Off-Post Highways and Roads.** Interstate 35, U.S. Highways 84, 183, 190 and 195, and State Highway
39 36 serve Fort Hood. These arteries provide excellent means to get to and from the Waco and Dallas/Fort

1 Worth area in the north, the Austin/San Antonio region to the south, western Texas, and other nearby
2 communities and cities, including those in the southeast. Road compositions range from heavy-duty
3 asphaltic concrete to medium-duty asphalt.

4 **Traffic.** Traffic engineering studies indicate that approximately 146,880 vehicles per day (vpd) enter and
5 exit the Main Cantonment Area (TRC Mariah Associates, 2000). Major access points to Fort Hood are
6 Fort Hood East Gate (fed by Hwy 195) has an hourly average of over 1,000 vehicles entering between
7 5AM and 8AM. Other access point indicate Fort Hood Road (45,960 vpd), Clear Creek Road (29,260
8 vpd), Tank Destroyer Boulevard (17,570 vpd), and Warrior Way Road (15,480 vpd). These major post
9 entrances account for 108,270 vpd, or 77 percent of the total 140,880 vpd entering and exiting the Main
10 Cantonment Area. Other main connecting roads include Central Drive (7,080 vpd), Copperas Cove Road
11 (5,700 vpd), and Clark Road (4,410 vpd), which account for about 12 percent of the total 140,880 vpd
12 entering and exiting the Main Cantonment Area.

13 Existing traffic volumes at the Hood Road and Clear Creek Road entrances account for 53 percent of the
14 total traffic entering and exiting the Main Cantonment Area, and the traffic volume at each is 30 percent
15 higher than the 1986 traffic volumes. The existing daily traffic volume on Tank Destroyer Boulevard is
16 approximately 43 percent lower than that in 1986. This redistribution of traffic can be attributed to a
17 reduction of the speed limit along Tank Destroyer Boulevard from 35 miles per hour to 25 miles per hour;
18 construction of 300 family housing units in the Liberty Village area, an elementary school, and
19 housing/community facilities south of U.S. 190 and east of Clear Creek Road; and the increased usage of
20 the Warrior Way Road entrance since its opening in 1987.

21 Capacity analyses of the critical intersection locations on-post indicate that during the a.m. peak hour, all
22 of the intersections evaluated have acceptable levels of service. There are 43 signalized intersections in
23 the Main Cantonment Area of Fort Hood. Traffic -actuated signals have been added at seven locations,
24 and five pretimed or flashing signals have been replaced by traffic -actuated signals to improve traffic
25 flow.

26 Level-of-service (LOS) in the signalized intersections is a qualitative measure of operational conditions. It
27 is reported as seconds of stopped delay per vehicle and is directly related to stopped vehicle delay. Six
28 categories, letters A though F, are used to describe LOS. LOS A represents a very short delay (less than
29 5 seconds), and LOS F represents a very long delay (greater than 60 seconds). LOS D (an average delay
30 of 25.1 to 40 seconds) is the limit of acceptable operation in the Main Cantonmant Area at Fort Hood.
31 Intersections or approaches on Fort Hood operating LOS E or F result in unstable and congested traffic
32 operations.

33 Candidates for the Governor's Texas Enterprise Fund for Fort Hood traffic concerns are:

- 34 • Extension of State Highway 195 (Fort Hood Street) and new access control point,
- 35 • Widening of Tank Destroyer Boulevard to SH 116,
- 36 • US Highway 190 overpass/ammunition route, and
- 37 • Design/construction traffic reliever system at Mohawk and Clear Creek to handle RGAAF
38 traffic increases

1 **3.10.1.2 Public Transportation**

2 The region in and around Fort Hood provides public transportation services. The following paragraphs
3 describe these services.

4 **Buses.** Local bus service between the post and the cities of Killeen, Belton, and Temple is provided by
5 the South-Western Transit Company and is supported almost entirely by the Fort Hood population.
6 Greyhound, Arrow Coach Lines, and Texas Bus Lines provide inter-regional bus service. All of these
7 bus services can be used for ground transportation links to air passenger services in Killeen and Temple
8 and to rail service in Temple.

9 **Cabs.** Cab companies operating in the Fort Hood area include Checker Cab in Temple, Yellow Cab in
10 Killeen, and Kelly Cab in Killeen, and Cove Cab in Copperas Cove.

11 **Rail.** Fort Hood's on-post railroad system consists of approximately 9 miles of government-owned
12 tracks that are wholly contained within the South Fort Hood cantonment area, adjacent to Railhead Drive.
13 A new railhead at Copperas Cove has been completed. Commercial rail service to the on-post network is
14 serviced by the Atchison, Topeka & Santa Fe Railroad Company (ATSF) on the main line running from
15 the Houston, Texas, area through Temple, Belton, Killeen, and Fort Hood, to the west coast. Amtrak
16 passenger service is available at Temple .

17 **Air Transportation.** Air transportation includes passenger travel by commercial airline and charter
18 flights, business and recreational travel by private (general) aviation, and priority package and freight
19 delivery by commercial air carriers. The new proposed RGAAF would be the commercial or general
20 aviation airport in the ROI. RGAAF will be located in West Fort Hood adjacent to the proposed action
21 site. RGAAF would serve 29,750 general aviation operations during 2006.

22 **3.10.2 Consequences**

23 **3.10.2.1 Proposed Action**

24 **3.10.2.1.1 Cantonment Alternative**

25 Short-term minor adverse and long-term minor beneficial effects on traffic would be expected.
26 Increased traffic during rush hour would cause additional congestion as a result of the this alternative
27 action. However, the on-going gate and roadway projects on Fort Hood, and the projects under the
28 Governor's Texas Enterprise Funds would relieve much of the anticipated traffic congestion. Studies
29 performed by the Central Texas Council of Governments has recommend additional upgrades and road
30 improvement over the next 15 years to relieve the congestion on I-35, US 190 and HWY 195. No effects
31 would be expected on public transportation as planned community projects and the RGAAF would
32 accommodate the increases in demand for road and air traffic.

33 **3.10.2.1.2 Green Grass Alternative**

34 Effects would be the same as those discussed above for the Cantonment Alternative except Construction
35 of new on-post roads would be required in the "green grass" area.

36 **3.10.2.2 No Action Alternative**

37 No effects would be expected.

1 **3.11 UTILITIES**

2 **3.11.1 Affected Environment**

3 Sustaining Fort Hood's primary mission of training and readiness for the Army's III Corp is critical. Fort
4 Hood accomplished a *Power Projection Through Sustainability* in 2002 (Fort Hood, 2002c) that details
5 their strategy and goals for sustainability in the future. This publication outlines the requirements for Fort
6 Hood's future in resource demands and environmental stewardship for the preservation of resources.
7 Information on Water Distribution and Wastewater Collection Systems was obtained from the USACE,
8 Fort Worth District, *Fort Hood Utility Study*, October 2003. Personal communications with Mr. Walter
9 Thomas, Fort Hood DPW Master Planning, (254 287-9181), Mr. John Burrows, and Mr. S. Pinot
10 contributed to discussions in this utilities section.

11 **3.11.1.1 Potable Water**

12 Fort Hood is located in the Brazos River Basin. The source of water for Fort Hood is Belton Lake located
13 along the southeastern border of the installation. The Brazos River Authority, which regulates Fort
14 Hood's water allotment, has allocated the Bell County Water Control Improvement District (BCWCID),
15 the county water distribution facility, 42,800 acre-feet of water annually from Belton Lake. Of the total
16 12,000 acre-feet is reserved exclusively for Fort Hood. BCWCID guarantees Fort Hood a delivery of 16.0
17 million gallons per day (MGD). Fort Hood operates three public water distribution systems registered
18 with the state of Texas. The installation chlorinates the water at five location on post. In 2002 and 2003,
19 Fort Hood's peak consumption was 13.1 and 14.5 MGD respectively. In 2001, Fort Hood received a
20 NOV fro TCEQ for exceeding the daily contract limit of 16 MGD in 1999. Water for Texas 2002 lays out
21 a plan to provide sufficient water for all Texans, including Fort Hood, through 2050. There is ample water
22 available for the out years (Fort Hood, 2000c). However, the addition of 4-5000 more soldiers could put
23 the installation in jeopardy of exceeding the contract limit again.

24 There are sufficient water lines and pressure to accommodate the proposed Chinook hangar in the 7000
25 area of main post. An additional water pump may be required to meet fire codes. At West Fort Hood new
26 water lines would be required to tie into the existing water distribution and collection systems to meet the
27 demands of the proposed action. The USACE Fort Hood Utility Study indicates existing water lines and
28 systems are of sufficient size to accommodate the required increases of the proposed action.

29 **3.11.1.2 Wastewater System**

30 The majority of Fort Hood's wastewater is treated off-post. Fort Hood pumps an average of 1.4 billion
31 gallons per year of untreated wastewater from the main cantonment area and West Fort Hood to the
32 WCID No. 1 wastewater treatment plant. Fort Hood's wastewater collection system consists of 140
33 miles of sewer mains, 2,880 manholes, 40 lift stations, and 10 miles of force mains. Lift stations have
34 oil/water separators with backup generators to supply emergency power (Fort Hood, 2000c).

35 Fort Hood does treat and discharge a limited amount of domestic sewage and industrial waste at nine
36 locations on post. The treated effluent from North Fort Hood is discharged to Clear Creek and Leon
37 River under a NPDES permit. Effluent from the Belton Lake Outdoor Recreation Area (BLORA) is treated
38 at a small package plant that discharges to a permitted outfall. Additionally, Fort Hood has a Sanitary
39 Sewer Overflow Response Plan outlining specific actions to be performed during an overflow event.

40

1 A candidate for the Governor's Enterprise Fund for Fort Hood is a North Fort Sanitary Sewer Lift
2 Station to service the increase in training at North Hood.

3 There is sufficient capacity in the 7000 east cantonment area to support the new Chinook hangar. The
4 future demolition of Walker Family Housing would make available more capacity for future development.
5 Wastewater system in the West Fort Hood area is old (1950s) and in need of repair. The proposed action
6 would required upgrades to the wastewater system at West Fort Hood.

7 **3.11.1.3 Storm Water System**

8 Less than 10 percent of Fort Hood's total acreage is improved grounds occupied by buildings, parking
9 lots, and roadways. Storm water is collected from developed areas of the main cantonment area, West
10 Fort Hood and North Fort Hood. Some storm water is collected and passed through oil/water separators.
11 The storm water from Fort Hood leads to various creeks, the City of Killeen's storm sewers and Belton
12 Lake. Currently, Fort Hood has a permit for storm water discharges associated with industrial activities
13 identified in the TPDES General Permit (Fort Hood, 2000). Fort Hood is currently negotiating an Agreed
14 Order with TCEQ for a NOV issued in 2003 for violation effluent permits limits.

15 Construction storm water involves discharges from large construction activities that disturb 1 acre or
16 more of land. The contractor is responsible for obtaining the discharge permits. Fort Hood is currently
17 developing a Storm Water Management Plan (SWMP) and will have an active SWMP when the state of
18 Texas issues the MS4 permit and when Fort Hood submits a Notice of Intent (NOI) for the permit.
19 However, Fort Hood is currently implementing some portions of the draft SWMP.

20 **3.11.1.4 Energy Sources**

21 **Electricity.** ONCOR supplies power to Fort Hood at three existing substations. The usage of these three
22 substations is presently 60 percent of capacity. Fort Hood used an average of 1.2 million MMBtus of
23 electricity over the past three years. Construction is underway to provide a new substation on the west
24 side of the cantonment area that would service West Fort Hood. These four substations would provide an
25 electric capacity of 248 MWA. The capacity of Fort Hood's electricity is sufficient to handle an
26 infrastructure to support additional troops for the next 20 years before reaching 80 percent of its total
27 capacity.

28 **Natural Gas.** Fort Hood purchases natural gas from TXU. Atmos Energy of Dallas is planning to
29 purchase TXU by the end of 2004. Distribution of gas throughout the post is via installation distribution
30 lines running from three metered stations provide by TXU. Fort Hood uses an average of 1.0 million
31 MMBtus of fossil fuels over the past three years. There is sufficient capacity of gas on Fort Hood for
32 any future expected growth (Fort Hood, 2000).

33 **3.11.2 Consequences**

34 **3.11.2.1 Proposed Action**

35 **3.11.2.1.1 Cantonment Alternative**

36 **Potable Water Supply, Wastewater and Storm Water.** Short-term minor adverse effects would be
37 expected. Areas of new construction would need new delivery lines within the development area,
38 providing improved water delivery and reduced water exfiltration and loss. Fort Hood would have to

1 devote sufficient financial resources over the next 25 years to upgrade drinking water, wastewater, and
2 storm water systems meet the demands of the cantonment alternative and to ensure compliance. In light
3 of the TPDES 2003 NOV, additional wash racks and other activities that would generate industrial
4 wastewater might require medications to, or a new issued, TPDES. The addition of 4-5000 more
5 soldiers could put Fort Hood in jeopardy of exceeding the TPDES contract limit again.

6 **Energy.** Short-term minor adverse effects would be expected. The energy demands would be easily met
7 by the Fort Hood capacity of gas and electric resources. However, new gas and electric lines would need
8 to be run a short from the nearest distribution points to the proposed area.

9 **3.11.2.1.2 Green Grass Alternative**

10 The effects would be similar to the effects of the cantonment alternative discussed above expect power
11 a, gas and water lines would have to be run further distances.

12 **3.11.2.2 No Action Alternative**

13 No effects would be expected.

14 **3.12 HAZARDOUS AND TOXIC SUBSTANCES**

15 **3.12.1 Affected Environment**

16 Specific environmental statutes and regulations govern hazardous material and hazardous waste
17 management activities at Fort Hood. For the purpose of this analysis, the terms *hazardous waste*,
18 *hazardous materials*, and *toxic substances* include those substances defined as hazardous by the
19 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the Resource
20 Conservation and Recovery Act (RCRA), or the Toxic Substances Control Act (TSCA). In general, they
21 include substances that, because of their quantity, concentration, or physical, chemical, or toxic
22 characteristics, might present substantial danger to public health or welfare of the environment when
23 released into the environment.

24 **3.12.1.1 Hazardous Substance Management Systems**

25 Annually, Fort Hood receives letters of praise and accolades from the Texas Department of Health for
26 their excellent job in controlling toxic and hazardous substances.

27 **Hazardous Materials.** Maintenance support and specialized flight support operations currently use large
28 quantities of hazardous materials. These materials primarily consist of aviation fuel, ground vehicle fuel,
29 lubricants, hydraulic fluids, antifreeze, degreasers and solvents, chemical batteries, and paint-related
30 materials. These hazardous materials are used and temporarily stored at locations throughout the Fort
31 Hood cantonment area and HAAF, primarily in aircraft and vehicle maintenance complexes.

32 Hazardous materials are managed in accordance with AR 200-1, *Environmental Impacts of Army Actions*
33 (February 1997) Section 4 for the purpose of minimizing hazards to public health and damage to the
34 environment. Hazardous materials are also managed to minimize the generation of hazardous waste. Fort
35 Hood has implemented a Hazardous Material Management Program (HMMP) that centrally manages all
36 hazardous materials on the post. The concept of centralized control is to manage the materials “from
37 cradle to grave” and reduce hazardous waste generation. A Hazardous Materials Control Group (HMCG)
38 acts as the central nervous system for the Hood Hazardous Substance Management System (HMMS), a

1 HAZMAT tracking database used to track all hazardous materials at the installation's Supply Support
2 Activities (SSA). These systems allow Fort Hood to comply with EPA's reporting requirements under the
3 Emergency Planning and Right-To-Know Act (EPCRA) and Executive Order 12856, which mandates
4 DoD compliance with EPCRA.

5 Fort Hood's Spill Prevention, Control, and Countermeasure (SPCC) Plan and Installation Spill
6 Contingency Plan addresses the prevention of unintentional pollutant discharges from the bulk storage
7 and handling of petroleum products and other hazardous materials. The plans detail the specific storage
8 locations, the amount of material in potential spill sites throughout Fort Hood, and spill countermeasures.

9 All hazardous materials used on-post must be accompanied by a material safety data sheet (MSDS) that
10 details the hazards associated with each specific substance. Contractors working on-post must comply
11 with the Fort Hood HMMP and obtain approval for all hazardous materials brought on post. Material
12 containing polychlorinated biphenyls (PCBs), asbestos, and lead may not be introduced on military
13 installations.

14 **Hazardous Waste.** Fort Hood generates hazardous wastes as by-products of activities associated with
15 meeting troop and equipment training and readiness requirements. The vast majority of the hazardous
16 waste is generated during vehicle, aircraft, and equipment maintenance activities. Waste streams include
17 adhesives, acids and bases, NBC filters and kits, and universal wastes. Minor sources of hazardous
18 waste include facilities and activities such as medical and dental facilities (outdated or damaged
19 pharmaceuticals, x-ray print developing solution), print shop, photo lab, and decommissioning of PCB-
20 containing outdoor electrical equipment. Fort Hood has eliminated their on-post 90-day hazardous waste
21 storage accumulation points and their TSDF in 2001, leaving limited on-post infrastructure associated
22 with hazardous waste handling and storage. The only on-post components of hazardous waste
23 management would be the satellite accumulation areas and the less-than-90-day storage points.
24 Hazardous waste is collected by off-post hazardous waste disposal contractors within 90 days of
25 accumulation start. Fort Hood recycles antifreeze, used oil, contaminated fuel, oil filters, and many
26 solvents for reuse rather than disposal. In addition, on-site silver recovery from photochemical
27 processes has eliminated this waste stream. Hazardous waste paints and paint related materials,
28 pesticides, fluorescent lamps, batteries, and mercury containing devices are classified on Fort Hood as
29 universal waste that result in the reduction of HW reported. In 1992 Fort Hood generated, stored and
30 reported 1.1 million pounds of hazardous waste. By 2003, although the volume of waste generated had
31 remained the same, management practices had reduced the storage and reporting requirements to only
32 29,000 pounds of hazardous waste. The continued use of solvents by distillation/purification processes
33 has significantly reduced the hazardous waste generated on-post. The management of certain hazardous
34 waste on Fort Hood as universal waste has significantly reduced storage and reporting requirements.

35 **Asbestos, Lead-Based Paint, PCB.** Asbestos management is regulated by EPA and the Occupational
36 Safety and Health Administration (OSHA). Asbestos fiber emissions into ambient air are regulated in
37 accordance with Section 112 of the Clean Air Act, which established the National Emissions Standards
38 for Hazardous Air Pollutants (NESHAPs). The NESHAP regulations address the demolition or renovation
39 of buildings with ACM. TSCA and the Asbestos Hazard Emergency Response Act (AHERA) provide the
40 regulatory basis for handling ACM in kindergarten through 12th grade school buildings. AHERA and
41 OSHA regulations cover worker protection for employees who work around or remediate ACM. Fort
42 Hood's Regulation 200-11 establishes responsibilities and procedures for work involving ACM, lead, and
43 PCB's. Fort Hood is actively removing structures that contain these toxic substances. Eighty-seven
44 percent of the family housing units are free of these substances.

1 **Pesticides.** Fort Hood uses an Integrated Pest Management (IPM) philosophy for all pest control
2 activities. IPM is a comprehensive approach to pest control or prevention that uses pest control methods
3 that avoid damage and minimize adverse side effects in nontarget organisms and the environment.
4 Chemical control methods are employed as a last resort if other methods (sanitation, engineering,
5 biological, mechanical, physical, and cultural control methods) prove ineffective or impractical. Pest
6 control at Fort Hood is mostly used for general household and nuisance pests in housing, and disease
7 vector pests.

8 **Radon.** Radon is a naturally occurring, colorless, and odorless radioactive gas that is produced by the
9 decay of naturally occurring uranium. Radon is found in high concentrations in rocks containing
10 uranium, granite, shale, phosphate, and pitchblende. No federal or state standards regulate radon
11 exposure at present. EPA has made testing recommendations for both residential structures and schools.
12 For residential structures, using a 2- to 7-day charcoal canister test, a level between 4 and 20 picocuries
13 per liter (pCi/L) should lead to additional screening within a few years. For levels of 20 to 200 pCi/L,
14 additional confirmation sampling should be performed within a few months. If radon exceeds 200 pCi/L,
15 the structure should be evacuated immediately.

16 The Army established the Army Radon Reduction Program (ARRP) to investigate and mitigate health
17 risks to Army personnel and their families due to radon. As specified in AR 200-1, Chapter 11, ARRP
18 calls for an initial phase to identify indoor radon levels in those structures that pose the highest risk, a
19 long-term measurement/mitigation phase to assess the need for mitigation of structures where the health
20 risk appears to be relatively small, mitigation where warranted, and a post-mitigation phase to verify and
21 document the effectiveness of the mitigation measures taken.

22 Based on personal communications with Fort Hood personnel (Niemann, personal communication, 2000),
23 radon has been detected in several of the housing units across Fort Hood. Based on an investigation
24 conducted by the III Corps and Fort Hood (1998), several of the housing units are currently undergoing
25 mitigation for elevated radon levels greater than the action level of 4 picocuries per liter.

26 **Storage Tanks.** Fort Hood has nine USTs containing petroleum products at five locations on the
27 installation. Two tanks service generators at the hospital and III Corps HQ, and seven provide gasoline
28 for automobiles. All tanks meet or exceed the requirements of 30 Texas Administrative Code 334.
29 Approximately 450 aboveground tanks are located throughout Fort Hood for POL storage. All ASTs
30 have secondary containment, spill plans for spill control and countermeasures, and meet requirements of
31 40 CFR 112.

32 **IRP Sites.** A four acre berm pit located at West Fort Hood contaminated with POL has been remediated
33 and closed in Feb 1999. A battery utilization unit for lead-acid batteries was removed and decontaminated
34 in 1997. A suspect radioactive material storage cave was examined and analyzed. Results proved to be
35 clean to background standards. No known or suspect abandon landfills exist on West Fort Hood.

36 3.12.1.2 Solid Waste Management

37 Fort Hood demonstrates excellence in environmental stewardship with their Solid Waste Management
38 Plan (SWMP) and their Qualified Recycling Program (QRP). These programs service an installation of
39 approximately 214,000 acres and a daily population of approximately 75,000. Both programs have
40 exceeded their annual target goals resulting in many awards such as the Army Recycling Award and the
41 White Housing Closing the Circle Award.

1 **Recycling Program.** Fort Hood's QRP has been in effect since the early 1980s and today is a self
2 supporting program managed by Fort Hood DPW Environmental Division. The contents of the 800
3 recycling containers located throughout Fort Hood are brought to a central recycling center for
4 processing and shipment. Under the Source Segregation Policy and the diversion objectives of the QRP,
5 Fort Hood has exceeded their goals in recycling cardboard, plastic, paper, metal, aluminum cans, MREs,
6 toner cartridges, CD-ROMs, and tennis shoes. During the past ten years Fort Hood has increased their
7 recycling tonnage from 900 to 6,000 tons per year. The average month recycling tonnage is 400-500.

8 **Solid Waste Program.** Fort Hood landfill is located in Coryell County and operates under Permit Number
9 1866. Solid waste collection is accomplished under contract with a private refuse contractor. The
10 installation employees a Source Segregation policy for all solid waste, and in conjunction with the QRP
11 has increased the life of their landfill capacity to an additional 63 years. Fort Hood is actively engaged in
12 technology advancements for solid waste processing and has set a goal of no solid waste disposal in by
13 the year 2029.

14 3.12.2 *Consequences*

15 3.12.2.1 *Proposed Action*

16 3.12.2.1.1 *Cantonment Alternative*

17 Long-term negligible impacts to the landfill would be expected. The life of the landfill and outstanding
18 recycling program would easily accommodate any increase in solid waste generated by additional troops
19 and their dependents residing on post property.

20 The proposed action does not include the installation of petroleum storage tanks at West Fort Hood.

21 Long-term minor adverse effects would be expected from the limited amounts of hazardous material used
22 in household applications and maintenance facilities. These materials would be controlled, treated, and
23 classified as described in Section 3.12.1.1. Prior to any construction all areas would be surveyed for
24 UXO.

25 The generation of any hazardous waste would be treated as described in Section 3.12.1.1 and any
26 solvents used would be recycled and reused.

27 No effects would be expected on toxic substance usage as military policy prohibits the use of such
28 materials on installations.

29 3.12.2.1.2 *Green Grass Alternative*

30 The effects from the Green Grass Alternative would be the same as those for the Cantonment
31 Alternative.

1 **3.12.2.2 No Action Alternative**

2 No effects would be expected from not implementing the no action alternatives.

3 **3.13 SUMMARY OF FINDINGS AND CONCLUSIONS**

4 The summary of findings would be similar for both the Cantonment and Green Grass Alternatives.
5 Short-term and long-term major beneficial effects would be realized by the economy due to the influx of
6 people. Long-term beneficial effects would be realized with more federal aid to the school system.
7 Short-term minor adverse effects would be expected on air quality, hazardous materials/waste,
8 recreation, medical facilities, law enforcement and fire protection, traffic and utilities. Short-term major
9 adverse effects would be expected on the school district as a result of student influx, utilities, and
10 wastewater. Long-term minor adverse effects would be expected on airspace, training land use, air
11 quality due to increased helicopter flight activities, intermittent noise from flight activities at RGAAF for
12 the Green Grass Alternative, potential cultural sites, vegetation, and wildlife due to habitat loss. Long-
13 term major impacts would be realized on soil erosion from increased training, and surface water and
14 water quality from increased erosion and runoff.

15 **3.14 CUMULATIVE EFFECTS SUMMARY**

16 Cumulative effects are defined by the CEQ in 40 CFR 1508.7 as the “impacts on the environment which
17 result from the incremental impact of the action when added to other past, present, and reasonable
18 foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such
19 other actions.”

20 Seven actions on and near Fort Hood warrant identification:

- 21 • *Residential Communities Initiative Program.* In 2001, Fort Hood transferred operational
22 management of its on-post family housing to a private sector developer. The transaction has led
23 to demolition, renovation, and construction to provide an end state inventory of more than 6,200
24 family housing units.
- 25 • *Joint Use.* In August 2004, the installation’s Robert Gray Army Airfield entered joint use service
26 with the City of Killeen.
- 27 • *Urban Assault Course.* Fort Hood recently approved construction of an urban assault course,
28 shoot house, and associated support facilities on the east side of West Range Road within the
29 restricted live-fire area. The new facilities will support training of personnel in environments that
30 simulate anticipated 21st century combat scenarios.
- 31 • *Digitization of Ranges.* In on-going projects, Fort Hood continues to digitize existing ranges to
32 enhance realism and improve scoring accuracy so that Soldiers may obtain greater benefit from
33 their training. A most recent proposal extends to digitization of aerial ranges for use by rotary-
34 wing aircraft stationed at Fort Hood.
- 35 • *Road Improvements.* In addition to the tactical vehicle road that is part of the proposed action,
36 there are three pending road projects that would benefit traffic flow at the post and in adjacent
37 municipalities: (1) extension of State Highway 195 and establishment of a new Control Access
38 Point to divert traffic during peak hours from on-post residential areas, (2) widening of Tank

1 Destroyer Boulevard to four lanes from Clear Creek Road to Clark Road and establishment of a
2 single commercial cargo entrance at Clark Road and U.S. Highway 190, the proposed addition of
3 a reliever route on US 190 in Copperas Cove, and (3) improvements providing for an
4 overpass/cloverleaf or widening of Clear Creek Road and State Highway 201 for travelers to
5 Killeen-Fort Hood Regional Airport.

- 6 • *Sanitary Sewer Lift Station.* To meet growing use of North Fort Hood as a training area and
7 billeting cantonment for Reserve Component forces, Fort Hood proposes to construct a lift
8 station to pump wastewater to the Gatesville treatment plant.

- 9 • *Texas A&M University Campus.* Legislation pending in Congress would authorize Fort Hood's
10 transfer of approximately 672 acres to the Texas A&M University System for development of a
11 campus to serve 20,000 students. The essentially undeveloped land in the southeastern portion
12 of West Fort Hood, in Training Area 27, is located along State Highway 195, southeast of Robert
13 Gray Army Airfield.

14 In conjunction with the Cantonment and Green Grass Alternative actions, the foregoing past, present, and
15 reasonably foreseeable actions would have two effects in common. First, they beneficially affect Fort
16 Hood's capacity to perform its mission by providing for the infrastructure necessary for growth. In
17 particular, accommodation of increased traffic loads that would accompany additional Soldiers and
18 university students enabling a higher quality of life for those who must commute to work or otherwise
19 travel in the vicinity of the post. Second, there would be beneficial effects on socioeconomics at and
20 near Fort Hood. Construction of new family housing on post through the Residential Communities
21 Initiative would be of a magnitude to address military housing needs. Economic benefits derived from
22 construction and increased population would be short-term and long-term, respectively. In light of the
23 capacity of the region to absorb growth and the size of the area affected, the cumulative impacts to
24 infrastructure or socioeconomics would be insignificant.

25 **3.15 MITIGATION SUMMARY**

26 Mitigation actions would be expected to reduce, avoid, or compensate for most adverse effects. Table 3-
27 11 summarizes the possible mitigation measures to be taken for each affected resource.

Table 3-11
Summary of Best Management Practices and Possible Mitigation Measures

Land Use

- Adhere to optimal land use plans outlined in the *Fort Hood Real Property Master Plan* when siting new developments.
 - Acquire more land and/or reduce acreage allotted for cattle grazing for additional training
-

Aesthetics and Visual Resources

- Design facilities in a regionally appropriate architectural style.
 - Revegetate disturbed areas with native vegetation.
 - Maintain trees and native vegetation wherever possible.
-

Air Quality

- Modify Title V Permit for West Fort Hood Operation's stationary sources
 - Spray water on construction work sites to reduce fugitive dust emissions.
 - Cover open equipment used to convey materials likely to create air pollutants.
 - Promptly removing spilled or tracked dirt from streets.
-

Noise

- Limit construction activities to daylight hours.
 - Use sound-dampening construction equipment and materials to attenuate noise.
 - Consider noise-proofing dormitory structures such as use of double pane windows
-

Geology and Soils

- Installation would develop a comprehensive Range Management Plan consistent with the INRMP that would provide better control over training and grazing to ensure sustainability of training areas.
 - Use appropriate BMPs (such as silt fences, straw bale dikes, diversion ditches, riprap channels, water bars, and water spreaders) to reduce soil erosion and sedimentation.
-

Water Resources

- Upgrade drinking water and sewer water lines to handle increased demand
 - Contractor to obtain TPDES Construction General Permit with accompanying Storm Water Prevention Plan.
 - Use BMPs, such as silt fencing and hay bales, to control surface erosion and runoff.
 - Follow protocols outlined in the storm water NPDES and TPDES permits and state sediment and erosion control guidelines.
 - Implement a Storm Water Pollution Prevention Plan.
 - Reseed and revegetate area following construction activities.
-

Biological Resources

Vegetation

- Limit disturbed areas to the current footprint areas plus a minimal amount of adjacent construction staging area.
- Employ erosion control practices and tree-protection devices at all proposed sites to protect vegetation and habitat.
- Follow state and local BMPs to minimize runoff and sedimentation to surface waters and wetlands during site preparation and construction.

Wildlife

- Preserve associated roads, existing parks, and blocks of connective native vegetation on each site to act as buffers and wildlife corridors.
- Use tree-protection BMPs during construction of new developments to maintain natural habitat areas.

Wetlands

- Avoid construction activities within 100 feet of known wetlands. If it is necessary to disturb wetlands, conduct a wetland delineation to determine exact wetland boundaries and acreage and implement appropriate mitigation for wetland loss.
 - If necessary following delineation, obtain appropriate Section 404 permits from the Corps of Engineers to dredge and fill wetlands. As appropriate, mitigate for losses of wetland acreage in the footprint with constructed wetlands.
-

Table 3-11
Summary of Best Management Practices and Possible Mitigation Measures (continued)

Cultural Resources

- Include clauses in construction contracts with provisions suspending work until a mitigation determination is made in the event that archeological artifacts are unearthed during construction.
 - For known archeological sites ensure avoidance and protection by using a buffer area.
 - Maintain coordination with State Historic Preservation Office and federally recognized Indian tribes.
-

Socioeconomics Environmental Justice and Protection of Children

- Secure construction vehicles and equipment when not in use.
 - Place barriers and “No Trespassing” signs around construction sites where practicable.
 - Building products that contain hazardous/toxic materials are forbidden.
 - Plan for the build of three-four new elementary schools
-

Traffic and Transportation

- Minimize traffic congestion associated with the movement of construction vehicles on the installation and through access points by locating landfill cells for construction debris in proximity to the project sites.
 - Limit construction vehicle access to designated gates at Fort Hood.
-

Utilities

Potable Water

- Install water-efficient control devices, such as low-flow showerheads, faucets, and toilets, in all new facilities.

Wastewater

- Upgrade the wastewater collection system and design improvements to handle proposed action.

Energy

- Install energy -efficient interior and exterior lighting fixtures and controls in all new units. Build new units to SPiRiT energy efficiency standards.
-

Hazardous and Toxic Substances

- Use environmentally friendly solvents, greases, and materials during construction.
 - Fully comply with all provisions of the Fort Hood Pollution Prevention Plan.
 - Use only the Fort Hood HMCG in ordering and managing hazardous material on Fort Hood
 - Survey for UXO on land before any construction or new activities.
-

Solid Waste Disposal and Recycling

- Use BMPs to ensure that maximum amounts of materials recycled and that landfill disposal is minimized.
 - Comply with local and state source separation laws.
-

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- 3 Killeen Public Library
4 205 E. Church Avenue
5 Killeen, TX 76541
6
7 Copperas Cove Public Library
8 501 South Main Street
9 Copperas Cove, Texas
10
11 Texas Historical Commission
12 Mr. Lawrence Oaks
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14 P.O. Box 12276, Capitol Station
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TAB 1 ACRONYMS, ABBREVIATIONS & KEY TERMS

ACM	asbestos-containing material	HPP	Historic Preservation Plan
ADNL	average day night level	IAW	in accordance with
AR	Army Regulation	ICUZ	Installation Compatibility Use Zone
BAH	Basic Allowance for Housing	KISD	Killeen Independent School District
BCWCID	Bell County Water Control Improvement District	kv	kilovolt
BMP	best management practice	kVA	kilovolt-ampere
C&D	construction and demolition	kW	kilowatt
CCISD	Copperas Cove Independent School District	KWh	kilowatt-hours
CDMP	Community Development and Management Plan	LBP	lead-based paint
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	L _{dn}	day-night level
CFR	Code of Federal Regulations	mgd	million gallons per day
CO	carbon monoxide	MHPI	Military Housing Privatization Initiative
CRM	Cultural Resources Manager	MOA	Memorandum of Agreement
CRMP	cultural resource management plan	MTMC	Military Traffic Management Command
DA	Department of the Army	NAAQS	National Ambient Air Quality Standards
DA PAM	Department of the Army Pamphlet	NCO	noncommissioned officer
DoD	Department of Defense	NEPA	National Environmental Policy Act
DPW	Directorate of Public Works	NESHAP	National Emissions Standards for Hazardous Air Pollutants
EA	Environmental Assessment	NFH	North Fort Hood
EBS	Environmental Baseline Survey	NHPA	National Historic Preservation Act
EIFS	Economic Impact Forecast System	NO _x	nitrogen oxides
EPA	U.S. Environmental Protection Agency	NPDES	National Pollutant Discharge Elimination System
ESMP	Endangered Species Management Plan	NRCS	Natural Resources Conservation Service
ETIS	Environmental Technical Information System	NRHP	National Register of Historic Places
FAC	facultative	OBL	obligate
FACW	facultative wetland	OSHA	Occupational Safety and Health Administration
FEMA	Federal Emergency Management Agency	PA	Programmatic Agreement
FH	Fort Hood	PCB	polychlorinated biphenyl
FHFH	Fort Hood Family Housing, LP	PCPI	Per Capita Personal Income
FONSI	Finding of No Significant Impact	PM	particulate matter
FPPA	Farmland Protection Policy Act	PMO	Provost Marshall's Office
GIS	geographic information system	ppm	parts per million
HAAF	Hood Army Airfield	psi	pounds per square inch
HABS	Historic American Building Survey	PVC	polyvinyl chloride
HEPA	High efficiency particulate air	RCI	Residential Communities Initiative
		RCRA	Resource Conservation and Recovery Act

TAB 1 ACRONYMS, ABBREVIATIONS & KEY TERMS

RFI	RCRA Facility Investigation	TEXCOM	US Army Test and Experimentation Command
RFQ	Request for Qualifications		
RGAAF	Robert Gray Army Airfield	TNRCC	Texas Natural Resource Conservation Commission
ROI	Region of Influence		
		TSCA	Toxic Substance Control Act
RTV	Rational Threshold Value	TU	Texas Utility
SHIP	Self-help Issue Point	TWRB	Texas Water Resources Board
SHPO	State Historic Preservation Officer	USACERL	U.S. Army Construction Engineering Research Laboratories
SO _x	sulfur dioxides		
SPCC	Spill Prevention Control and Countermeasure	USACE	U.S. Army Corps of Engineers
		USC	U.S. Code
SWMU	Solid Waste Management Unit	USDA	U.S. Department of Agriculture
SWPPP	Stormwater Pollution Prevention Plan	USFWS	U.S. Fish and Wildlife Service
		USGS	U.S. Geologic Survey
TES	Traffic Engineering Studies	VOC	volatile organic compounds
		vpd	vehicles per day

Key Terms

Components. Major elements of the Army based on individuals' service obligations. The Army consists of two principal components: the active component and the reserve component. Members of the active component perform their duties on a full-time basis. Members of the reserve component, consisting of the U.S. Army Reserve and the Army National Guard, usually perform their duties on a part-time basis (with a commitment for 2 weeks of training on a full-time basis annually). The Army consists of approximately 480,000 soldiers in the active component, 350,000 soldiers in the Army National Guard and 205,000 soldiers in the Army Reserve, and a civilian workforce of approximately 220,000 people.

Echelons of Army Operational Forces. Different sized elements or organizations within the Army that carry out missions. The basic building block of all Army organizations is the individual *soldier*. A small group of soldiers organized to conduct infantry maneuver and fires is called a *squad*. The next larger unit is known as a *platoon*. In ascending order, the next larger echelons are the Army's *companies* (or batteries or troops), *battalions* (or squadrons), *brigades* (or regiments or groups), *divisions*, *corps*, and *Armies*. Brigades consist of battalions and smaller units and usually have 3,000 or more personnel. Brigades vary in size depending on the nature of their primary mission and their equipment. "Heavy" brigades of armored and mechanized forces generally have more personnel than "light" brigades, which consist mainly of dismounted infantry. Divisions have the necessary integral arms and services required for sustained combat. Capable of performing any tactical mission and designed to be largely self-sustaining, divisions are the basic units of maneuver at the tactical level. Divisions, which consist of brigades, battalions, and smaller units, vary in size. A corps is the deployable level of command required to synchronize and sustain combat operations.

Institutional Army. That portion of the Army that generates and sustains the capabilities of the deployable operating forces. Functions of Army Headquarters and other elements of the production and sustaining base include recruiting, training, equipping and maintaining, organizing, mobilizing and demobilizing, and administering forces to be provided to the warfighting Commanders-in-Chief of the unified commands.

TAB 1 ACRONYMS, ABBREVIATIONS & KEY TERMS

National Military Strategy. The Chairman of the Joint Chiefs of Staff, in consultation with the Joint Chiefs of Staff and the Combatant Commanders, is responsible for the articulation and issuance of the National Military Strategy. The National Military Strategy conveys the advice of the Chairman and the Joint Chiefs of Staff on the strategic direction of the Armed Forces in implementing the guidance in the President's National Security Strategy. The current strategy calls for shaping, responding to, and preparing now to address the challenges and opportunities confronting the Nation. The strategic national military objectives are to defend and protect U.S. interests through promoting peace and stability and, when necessary, defeating adversaries. The four strategic concepts governing the use of forces are strategic agility, overseas presence, power projection, and decisive force.

National Security Strategy. The National Security Strategy, formulated by the President, sets forth national security goals. The current strategy advances the Nation's fundamental and enduring security needs: protection of the lives and safety of Americans; maintenance of the sovereignty of the United States, with its values, institutions, and territories intact; and provision for the prosperity of the Nation and its people. It further establishes as a core objective "to enhance our security with effective diplomacy and with military forces that are ready to fight and win."

Spectrum of Operations. The range of actions the Army might be called on to take to support the objectives of the National Security Strategy and the National Military Strategy. The spectrum of operations is often expressed by its order of ascending intensity. At the lower end of the spectrum are domestic disaster relief, environmental operations, domestic civil support, military-to-military contacts, arms control, humanitarian assistance, security assistance, counterdrug operations, show of force, and peace operations. Progressing toward higher intensities, the spectrum includes noncombatant evacuations, counterterrorism, peace enforcement, raids, strikes, insurgencies, limited conventional conflict, regional conventional war, tactical nuclear war, global conventional war, and strategic nuclear war.

Unit of Action. Units of action (UA) are streamlined units that are more capable of independent action due to their improved organization and enhanced equipment. They are permanently task organized to the way they will fight. The new brigade-based structure upon which UAs are based replaces current arrangements designed for the Cold War when the Army was prepared to fight giant set-piece battles on European soil and when most support roles were organized at the division level. Compared to existing brigade combat teams, UAs have greater capacity for rapid packaging and responsive and sustained employment to support combatant commanders.

Unit of Employment. Units of employment (UE), typically division- and corps-like elements, are highly tailorable, high-level echelons that integrate and synchronize Army forces for full spectrum operations at the higher tactical and operational levels of war or conflict. UEs focus on battles, major operations, and decisive land campaigns in support of joint operational and strategic objectives. UEs have the inherent capacity to interact effectively with multinational forces as well as with interagency, nongovernmental organizations, and private organizations. A UE at the corps level is referred to as "UEy" and at the division level as UEx. UEs represent standardization of the seven types of division headquarters now existing throughout the Army.

Warfighting Forces. Army doctrine recognizes three principal types of warfighting Forces. *Combat arms* refers to units and soldiers that close with and destroy enemy forces or provide firepower and destructive capabilities on the battlefield. The branches and functions included are Air Defense Artillery, Armor/Cavalry, Aviation, Field Artillery, Infantry, Special Forces, and Corps of Engineers. *Combat support* refers to units and soldiers that provide critical combat functions in conjunction with combat arms units and soldiers. The branches and functions included are Chemical Corps, civil affairs, psychological operations, Military Intelligence, Military Police Corps, and Signal Corps. *Combat service support* refers

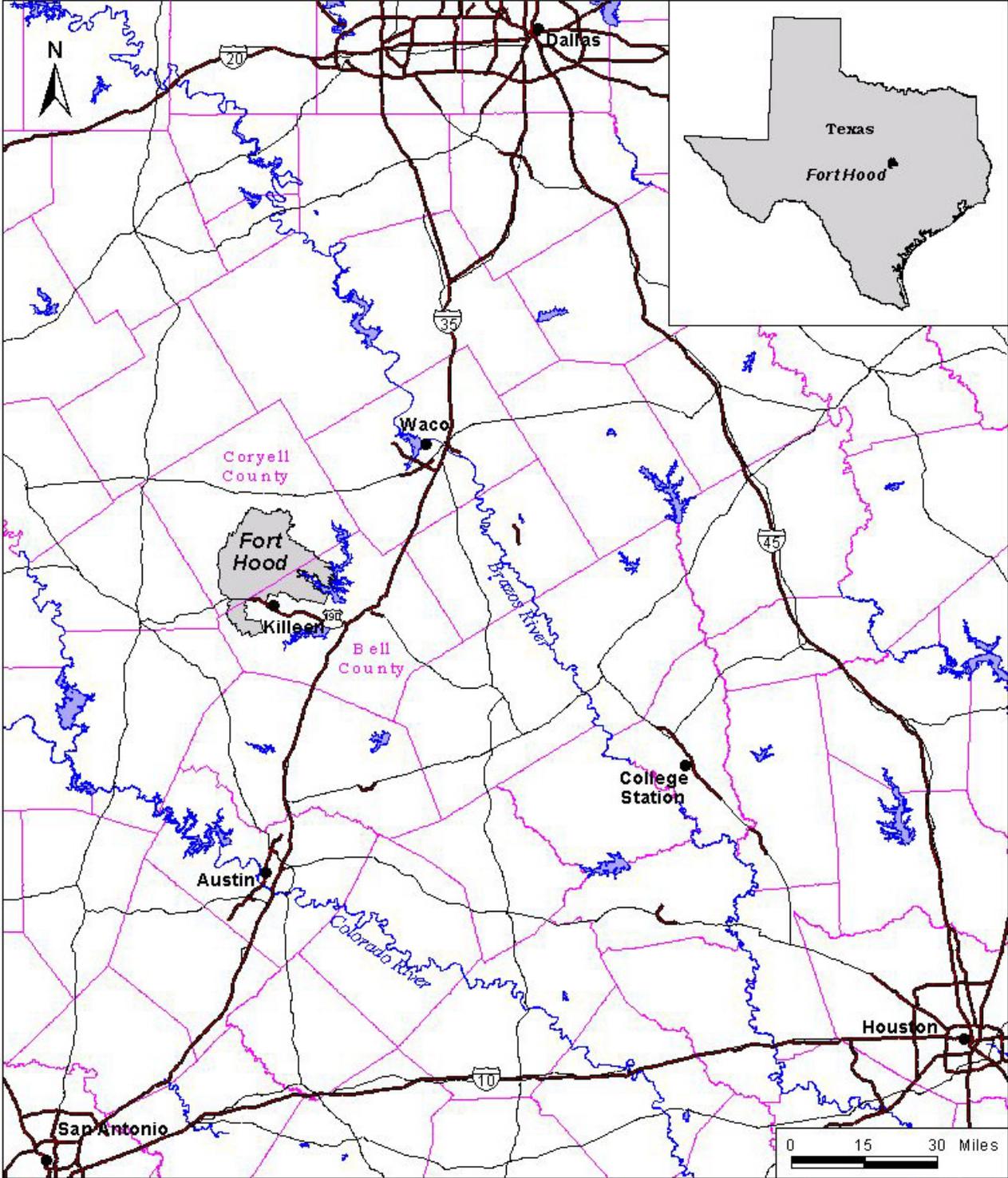
TAB 1 ACRONYMS, ABBREVIATIONS & KEY TERMS

to the essential capabilities, functions, activities, and tasks necessary to sustain all elements of operating forces in theater at all levels of war. Combat service support ensures the aspects of supply, maintenance, transportation, health services, and other services required by aviation and ground combat troops to permit those units to accomplish their missions in combat. The branches and functions included are Adjutant General Corps, Acquisition Corps, Chaplain Corps, Finance Corps, Judge Advocate General Corps, Medical Corps, Ordnance Corps, Transportation Corps, and Quartermaster Corps.

TAB 2
III Corps Assets at Fort Hood

1
2
3
4 **III Corps** assets at Fort Hood consist of the III
5 Corps command group and several separate
6 brigades and battalions, including 3d Signal
7 Brigade, 13th Finance Group, 89th Military
8 Police Brigade, 504th Military Intelligence
9 Brigade, and the 21st Cavalry – Air Combat.
10 The 13th Corps Support Command consists of
11 a command group and Special Troop Battalion
12 (Headquarters Company; I Company, 158th
13 Aviation; 53d Quartermaster Company; 289th
14 General Support Company); 4th Corps
15 Material Management Center; 49th Military
16 Coordination Command, 49th Transport
17 Battalion; 2d Chemical Battalion; 62d
18 Engineer Battalion; 64th Corps Support Group;
19 180th Transport Battalion; and 544th
20 Maintenance Battalion. The 1st Medical
21 Brigade consists of a command group and the
22 21st Combat Support Hospital, 36th Medical
23 Evacuation Battalion, 61st Area Support
24 Medical Battalion, and six medical
25 detachments.
26
27 **1st Cavalry Division** assets at Fort Hood
28 include a command group; *1st Brigade* (2d
29 Battalion, 5th Cavalry; 2 Battalion, 8th Cavalry;
30 and 1st Battalion, 12th Cavalry (Armor)); *2d*
31 *Brigade* (1st Battalion, 5th Cavalry
32 (Mechanized); 1st Battalion, 8th Cavalry
33 (Armor); and 2d Battalion, 12th Cavalry
34 (Armor)); *3d Brigade* (2d Battalion, 7th
35 Cavalry; 3d Battalion, 8th Cavalry; and 1st
36 Battalion, 9th Cavalry); *4th Brigade*
37 (*Aviation*) (1st Battalion, 7th Cavalry (Armor);
38 1st Battalion, 227th Aviation Regiment; and 2d
39 Battalion, 227th Regiment); *Division Artillery*
40 (1st Battalion, 82d Field Artillery; 2d
41 Battalion, 82d Field Artillery; 3d Battalion,
42 82d Field Artillery; 1st Battalion, 21st Field
43 Artillery, and 68th Chemical Company);
44 *Division Support Command* (Division
45 Material Management Center; 15th Forward
46 Support Battalion; 27th Main Support
47 Battalion; 115th Forward Support Battalion;
48 215th Forward Support Battalion; and 615th
49 Aviation Support Battalion); *Engineer*
50 *Brigade* (8th Engineer Battalion; 20th Engineer
51 Battalion, and 1st Engineer Battalion); and

52 separate units (4th Battalion, 5th Air Defense
53 Artillery; 13th Signal Battalion; 312th Military
54 Intelligence Battalion; and 545th Military
55 Police Company).
56
57 **4th Infantry Division** assets at Fort Hood
58 include a command group; *1st Brigade Combat*
59 *Team* (1st Battalion, 22d Infantry; 1st Battalion,
60 66th Armor; 3d Battalion, 66th Armor; and
61 299th Engineer Battalion); *2d Brigade Combat*
62 *Team* (1st Battalion, 67th Armor; 3d Battalion,
63 67th Armor; 2d Battalion, 8th Infantry; and
64 588th Engineer Battalion); *4th Brigade*
65 (*Aviation*) (1st Battalion, 4th Aviation; 2d
66 Battalion, 4th Aviation; and 1st Battalion, 10th
67 Cavalry Regiment); *Division Artillery* (3d
68 Battalion, 16th Field Artillery; 4th Battalion,
69 42d Field Artillery; and 2d Battalion, 20th
70 Field Artillery); *Division Support Command*
71 (4th Forward Support Battalion; 204th Forward
72 Support Battalion; 704th Main Support
73 Battalion; and 404th Aviation Support
74 Battalion); and separate units (1st Battalion,
75 44th Air Defense Artillery; 4th Military Police
76 Company; 104th Military Intelligence
77 Battalion; 124th Signal Battalion; and 612th
78 Engineer Detachment). Units located at Fort
79 Carson, Colorado, include the *3d Brigade*
80 *Combat Team* (1st Battalion, 8th Infantry; 1st
81 Battalion, 12th Infantry; 1st Battalion, 68th
82 Armor; and 4th Engineer Battalion), as well as
83 the 3d Battalion, 29th Field Artillery (part of
84 Division Artillery) and the 64th Forward
85 Support Battalion (part of Division Support
86 Command).
87
88
89
90



Installation Location

Fort Hood
Killeen, Texas

Figure 1-1



LEGEND

 Proposed Construction Boundary

Green Grass Site

Fort Hood
Kileen, Texas
Figure 2-1

Source: Fort Hood GIS, 2000.



LEGEND

 Installation Boundary

Tactical Vehicle Road

Fort Hood
Killeen, Texas
Figure 2-2

Source: Fort Hood GIS, 2000.



LEGEND

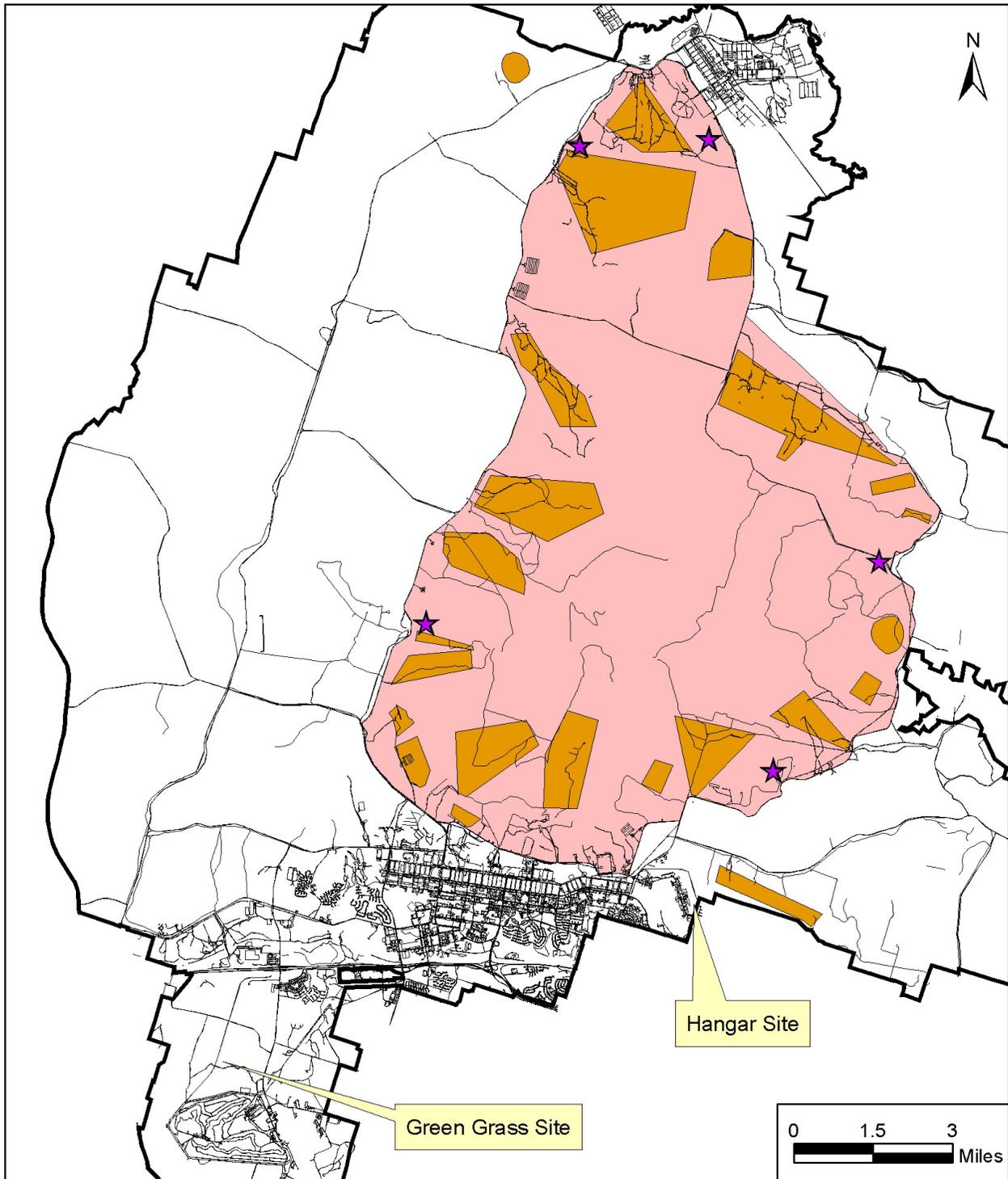
 Installation Boundary

Hangar Site

Fort Hood
Kileen, Texas

Source: Fort Hood GIS, 2000.

Figure 2-3



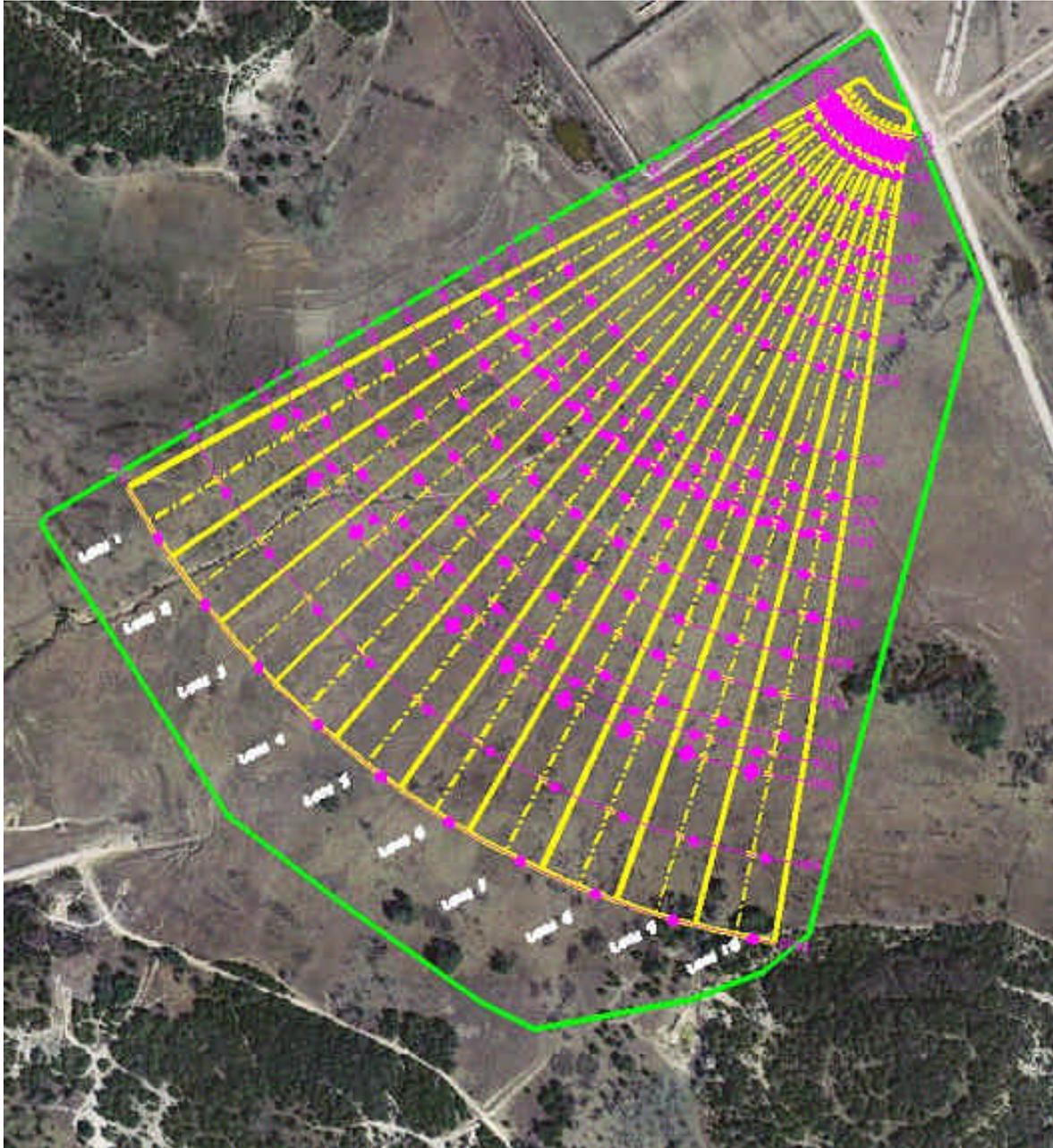
LEGEND

- ★ Proposed Small Arms Ranges
- Ranges
- Live Fire Areas
- ▭ Installation Boundary
- ∩ Roads

Source: Fort Hood GIS, 2000.

Live Fire and Range Areas

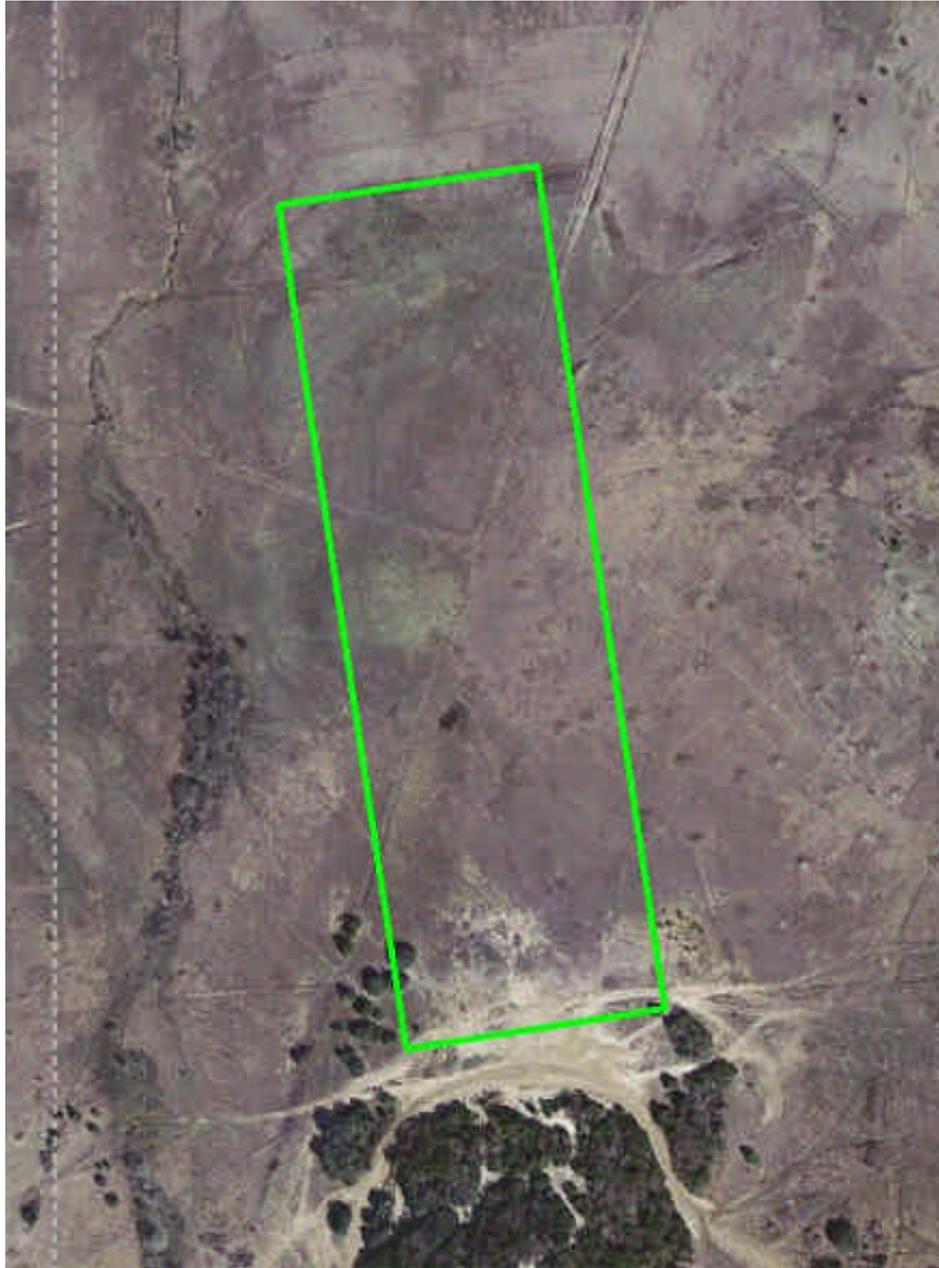
Fort Hood
Killeen, Texas
Figure 2-4



- 10-lane
- Located South of North Rifle Charlie
- TA 61

Proposed Multi-Purpose Machine Gun Range

Figure 2-5



- 10-lane
- Located at Morter Point 7 (between Sugarloaf and Trapnell machine gun range)
- TA 93

Proposed Designated Marksman Range

Figure 2-6



- 2-lane
- East of Trapnell machine gun range
- TA 93

Proposed Sniper Range

Figure 2-7

Vascular Plant List of Fort Hood Military Reservation, Bell and Coryell Counties, Texas

compiled by L.L. Sanchez, updated May 1998

Family Species {Synonym}

Acanthaceae

Dicliptera brachiata (Pursh) Spreng.
Dyschoriste linearis (Torr. & Gray) Kuntze
Justicia americana (L.) Vahl
Ruellia drummondiana (Nees) Gray
Ruellia humilis Nutt.
Ruellia metziae Tharp
Ruellia nudiflora (Engelm. & Gray) Urban var. *nudiflora*
Ruellia nudiflora (Engelm. & Gray) Urban var. *runyonii* (Tharp & Barkl.)
B.L. Turner
{*Ruellia runyonii* Tharp & Barkl.}

Common Names

Acanthus Family

dicliptera
snake herb
American water-willow
drummond's wild petunia
low wild petunia
wild petunia
common wild petunia
wild petunia

Aceraceae

Acer grandidentatum Nutt. var. *sinuosum* (Rehd.) Little
Acer negundo L.

Maple Family

bigtooth maple
boxelder

Adiantaceae

Adiantum capillus-veneris L.
Argyrochosma dealbata (Pursh) Windham
{*Notholaena dealbata* (Pursh) Kunze}
Cheilanthes alabamensis (Buckl.) Kunze
Cheilanthes wrightii Hook.
Pellaea atropurpurea (L.) Link

Family

maidenhair fern
cloakfern

Alabama lipfern
lipfern
purple cliff brake

Agavaceae

Nolina lindheimeriana (Scheele) Wats.
Nolina texana S. Wats.
Yucca arkansana Trel. or *constricta*
Yucca pallida McKelvey
Yucca rupicola Scheele

Family

devil's shoestring
sacahuista
Arkansa yucca
pale-leaf yucca
twisted-leaf yucca

Aizoaceae

Mollugo verticillata L.

Carpet-weed Family

Indian chickweed

Alismataceae

Echinodorus cf. berteroi (Spreng.) Fassett
{*Echinodorus rostratus* (Nutt.) Engelm. ex Gray}

Water Plantain Family

burhead

Amaranthaceae

Alternanthera caracasana Kunth
Amaranthus blitoides S. Wats.
Amaranthus palmeri S. Wats.
Iresine heterophylla Standl.

Amaranth Family

matt chaff-flower
prostrate pigweed
pigweed
bloodleaf

Amaryllidaceae

Cooperia drummondii Herb.
Cooperia pedunculata Herb.

Amaryllis Family

cebolleta
rain-lily

Anacardiaceae

Rhus lanceolata (Gray) Britt.
Rhus trilobata Nutt.
{*Rhus aromatica* Ait.}

Sumac Family

flame-leaf sumac
fragrant sumac

Family Species {Synonym}

Rhus virens Lindheimer ex Gray
Toxicodendron radicans (L.) Kuntze

Apiaceae

Bifora americana Benth. & Hook. f. ex S. Wats.
Chaerophyllum tainturieri Hook.
Ciclospermum leptophyllum (Pers.) Sprague ex Britt. & Wilson
 {*Apium leptophyllum* (Pers.) F. Muell. ex Benth.}
Cymopterus macrorhizus Buckl.
Daucus pusillus Michx.
Eryngium leavenworthii Torr. & Gray
Hydrocotyle umbellata L.
Hydrocotyle verticillata Thunb. var. *triradiata* (A. Rich.) Fern.
Polytaenia nuttallii DC.
Sanicula canadensis L.
Spermolepis inermis (Nutt. ex DC.) Math. & Const.
Torilis arvensis (Huds.) Link

Apocynaceae

Amsonia ciliata Walt. var. *tenuifolia* (Raf.) Woods.
Amsonia longiflora Torr.
Apocynum cannabinum
Vinca major L.

Aquifoliaceae

Ilex decidua Walt.

Araceae

Arisaema dracontium (L.) Schott
Xanthosoma sagittifolium Schott

Aristolochiaceae

Aristolochia serpentaria L.

Asclepiadaceae

Asclepias asperula (Dcne.) Woods.
Asclepias oenotheroides Cham. & Schlecht.
Asclepias verticillata L.
Asclepias viridiflora Raf.
Asclepias viridis Walt.
Cynanchum racemosum (Jacq.) Jacq. var. *unifarium* (Scheele) E. Sundell
 {*Cynanchum unifarium* (Scheele) Woods.}
Matelea biflora (Raf.) Woods.
Matelea edwardsensis Correll
Matelea gonocarpa (Walt.) Shinnars
Matelea reticulata (Engelm. ex Gray) Woods.

Aspleniaceae

Asplenium resiliens Kunze

Asteraceae

Ageratina havanensis (Kunth) King & H.E. Robins.
 {*Eupatorium havanense* Kunth}
Ambrosia artemisiifolia L.
Ambrosia psilostachya DC.
Ambrosia trifida L.

Common Names

evergreen sumac
 poison ivy

Parsley Family

prairie bishop's-weed
 chervil
 celery

big-root cymopterus
 rattlesnake-weed
 eryngo
 water-pennywort
 water-pennywort
 prairie-parsley
 black snakeroot
 scale-seed
 hedge-parsley

Dogbane Family

blue-star
 blue-star
 Indian hemp
 periwinkle

Holly Family

deciduous holly

Arum Family

green dragon
 elephant ear

Birthwort Family

Virginia Dutchman's pipe

Milkweed Family

antelope-horns
 hierba de zizotes
 milkweed
 wand milkweed
 green milkweed
 cynanchum

purple milkvine
 Plateau milkvine
 milkvine
 milkvine

Family

little ebony spleenwort

Aster Family

shrubby boneset
 short ragweed
 western ragweed
 giant ragweed

Family Species {Synonym}

Amphiachyris dracunculoides (DC.) Nutt.
 {*Xanthocephalum drancunculoies* (DC.) Shinners}
Aphanostephus skirrhobasis (DC.) Trel. var. *skirrhobasis*
Arnoglossum plantagineum Raf.
 {*Cacalia plantaginea* (Raf.) Shinners}
Artemisia ludoviciana Nutt.
Aster drummondii Lindl. var. *texanus* (Burgess) A.G. Jones
 {*Aster texanus* Burgess }
Aster ericoides L.
Aster spinosus Benth.
Aster subulatus Michx. var. *ligulatus* Shinners

Baccharis neglecta Britt.
Baccharis salicina Torr. & Gray
Bidens frondosa L.
Brickellia cylindracea Gray & Engelm.
Brickellia eupatorioides (L.) Shinners var. *eupatorioides*
 {*Kuhnia eupatorioides* L.}
Calyptocarpus vialis
Carthamus lanatus L.
Centaurea americana Nutt.
Centaurea melitensis L.
Chaetopappa asteroides Nutt. ex DC.
Chaetopappa bellidifolia (Gray & Engelm.) Shinners

Cirsium terraenigrae Shinners
Cirsium texanum Buckl.
Conyza canadensis (L.) Cronq. var. *glabrata* (Gray) Cronq.
Coreopsis tinctoria Nutt.
Eclipta prostrata (L.) L.
 {*Eclipta alba* L.}

Elephantopus carolinianus Raeusch.
Engelmannia pinnatifida Gray ex Nutt.
Erechtites hieraciifolia (L.) Raf. ex DC.
Erigeron modestus Gray
Erigeron philadelphicus L.
Erigeron strigosus Muhl. ex Willd.
Erigeron tenuis Torr. & Gray
Eupatorium coelestinum L.
Eupatorium serotinum Michx.
Evax prolifera DC.
Evax verna Raf.
Gaillardia pulchella Foug.
Gaillardia suavis (Gray & Engelm.) Britt. & Rusby
Gnaphalium pensilvanicum Willd.
Gnaphalium obtusifolium L.
Grindelia lanceolata Nutt.
Gutierrezia texana (DC.) Torr. & Gray var. *texana*
 {*Xanthocephalum texanum* (DC.) Shinners}
Helenium amarum (Raf.) H. Rock
Helenium microcephalum DC.
Helenium eligans DC.
Helianthus annuus L.
Helianthus maximiliani Schrad.
Heterotheca canescens (DC.) Shinners

Common Names

broomweed

 lazy daisy
 Indian plantain

 western mugwort
 Texas aster

 heath aster
 Mexican devil-weed
 hierba del marrano, annual
 aster
 Roosevelt weed
 groundsel-tree
 beggar-ticks
 brickell-bush
 false boneset

 straggler daisy
 distaff-thistle
 basket-flower
 malta star-thistle
 leastdaisy
 hairy leastdaisy, dwarf
 white aster
 thistle
 Texas thistle
 horse-weed
 coreopsis
 yerba de tago

 elephant's foot
 Engelmann daisy
 fireweed
 prairie fleabane
 Philadelphia fleabane
 white-top
 fleabane
 blue mist-flower
 white boneset
 round-head rabbit-tobacco
 flat-head rabbit-tobacco
 Indian blanket
 pincushion daisy
 cudweed
 fragrant cud-weed
 fall gumweed
 snakeweed

 yellow bitterweed
 sneezeweed
 sneezeweed
 common sunflower
 Maximilian sunflower
 gray golden-aster

Family Species {Synonym}

Heterotheca subaxillaris (Lam.) Britt. & Rusby
 {*Heterotheca latifolia* Buckl.}
Hymenopappus artemisiifolius DC.
Hymenopappus scabiosaeus L'Her. var. *corymbosus* (Torr. & Gray) B.L.
 Turner
Iva angustifolia Nutt. ex DC.
Iva annua L.
Iva xanthifolia Nutt.
Krigia cespitosa (Raf.) Chambers
 {*Krigia gracilis* (DC.) Shinnery}
Lactuca ludoviciana (Nutt.) Riddell
Lactuca serriola L.
Lactuca tatarica (L.) C.A. Mey. var. *pulchella* (Pursh) Breitung
 {*Lactuca pulchella* (Pursh) DC.}
Liatris mucronata DC.
Lindheimera texana Gray & Engelm.
Lygodesmia texana (Torr. & Gray) Greene
Marshallia caespitosa Nutt. ex DC. var. *signata* Beadle & F.E. Boynt.
Melampodium leucanthum Torr. & Gray
Palafoxia callosa (Nutt.) Torr. & Gray
Parthenium hysterophorus L.
Pectis angustifolia Torr.
Pluchea camphorata (L.) DC.
Pluchea odorata (L.) Cass.
Pyrrhopappus pauciflorus (D. Don) DC.
 {*Pyrrhopappus multicaulis* DC. var. *geiseri* (Shinnery) Northington}
Ratibida columnifera (Nutt.) Woot. & Standl.
 {*Ratibida columnaris* (Sims) D. Don}
Rudbeckia hirta L.
Senecio glabellus Poir.
Senecio obovatus Muhl. ex Willd.
Silphium albiflorum Gray
Silphium radula Nutt.
 {*Silphium asperrimum* Hook.}
Simsia calva (Engelm. & Gray) Gray
Smallanthus uvedalia (L.) MacKenzie ex Small
 {*Polymnia uvedalia* (L.) L. var. *densipilis* Blake}
Solidago canadensis L. var. *scabra* Torr. & Gray
Solidago gigantea Ait.
Solidago nemoralis Ait.
Solidago radula Nutt.
Sonchus asper (L.) Hill
Taraxacum officinale G.H. Weber ex Wiggers
Tetraneuris linearifolia (Hook.) Greene
 {*Hymenoxys linearifolia* Hook.}
Tetraneuris scaposa (DC.) Greene var. *scaposa*
 {*Hymenoxys scaposa* (DC.) Parker var. *glabra* (Nutt.) Parker}
Thelesperma filifolium (Hook.) Gray var. *filifolium*
Thelesperma simplicifolium Gray
Verbesina encelioides (Cav.) Benth. & Hook. f. ex Gray
Verbesina lindheimeri Robins. & Greenm.
Verbesina virginica L.
Vernonia baldwinii Torr.
Vernonia x guadalupensis Heller
Vernonia lindheimeri Gray & Engelm.
Viguiera dentata (Cav.) Spreng.

Common Names

camphor weed

 wooly-white
 old plainsman

 sump-weed
 marsh-elder
 sump-weed
 dwarf dandelion

 lettuce
 prickly lettuce
 blue lettuce

 gay-feather
 Lindheimer daisy
 skeleton-plant
 Barbara's-buttons
 black-foot daisy
 palafoxia
 false ragweed
 pectis
 camphor-weed
 marsh fleabane
 Texas dandelion

 Mexican hat

 brown-eyed susan
 butterweed
 golden groundsel
 white rosin-weed
 rosin-weed

 bush sunflower
 bear's-foot

 tall goldenrod
 goldenrod
 prairie goldenrod
 goldenrod
 sow thistle
 common dandelion
 slender-leaf bitterweed

 slender-stem bitterweed

 green-thread
 Navajo tea
 cowpen daisy
 Lindheimer crown-beard
 frostweed
 western ironweed
 hybrid ironweed
 wooly ironweed
 golden-eye

Family Species {Synonym}

Xanthium strumarium L.

Berberidaceae

Berberis trifoliolata Moric.

Bignoniaceae

Campsis radicans (L.) Seem.

Chilopsis linearis (Cav.) Sweet

Boraginaceae

Heliotropium indicum L.

Heliotropium tenellum (Nutt.) Torr.

Heliotropium torreyi I.M. Johnston

Lithospermum arvense L.

{*Buglossoides arvense* (L.) I.M. Johnst.}

Lithospermum incisum Lehm.

Myosotis macrosperma Engelm.

Onosmodium molle Michx. ssp. *bejariense* (DC. ex A. DC.) Cochrane

{*Onosmodium bejariense* DC. ex A. DC.}

Onosmodium molle Michx. ssp. *occidentale* (Mackenzie) Cochrane

Tiquilia cansecens (DC.) A. Richards. var. *cansecens*

{*Coldenia cansecens* DC.}

Brassicaceae

Capsella bursa-pastoris (L.) Medik.

Cardamine parviflora L. var. *arenicola* (Britt.) Schulz.

Draba cuneifolia Nutt. ex Torr. & Gray var. *cuneifolia*

Erysimum capitatum (Hook.) Greene

Erysimum repandum L.

Lepidium austrinum Small

Lepidium virginicum L. var. *medium* (Greene) C.L. Hitchc.

Lesquerella recurvata (Engelm. ex Gray) S. Wats.

Nasturtium officinale R. Br.

Rapistrum rugosum (L.) All.

Cactaceae

Echinocereus reichenbachii (Terscheck ex Walp.) Haage f. var.

reichenbachii

Echinocactus texensis

Coryphantha sulcata (Engelm.) Britt. & Rose

Opuntia engelmannii Salm-Dyck var. *lindheimeri* (Engelm.) Parfitt &

Pinkava

{*Opuntia lindheimeri* Engelm.}

Opuntia leptocaulis DC.

Callitrichaceae

Callitriche heterophylla Pursh

Campanulaceae

Lobelia cardinalis L. ssp. *cardinalis*

Triodanis coloradoensis (Buckl.) McVaugh

Triodanis perfoliata (L.) Nieuwl. var. *perfoliata*

Capparidaceae**Common Names**

cocklebur

Barberry Family

agarito, algeritas

Catalpa Family

trumpet-honeysuckle

desert willow

Borage Family

turnsole

white heliotrope

heliotrope

buglossoides

pucoon

scorpion-grass, forget-me-not

false-gromwell

false-gromwell

oreja de perro, dog's ear

Mustard Family

shepherd's purse

bitter-cress

whitlow-grass

wall-flower

peppergrass

peppergrass

bladder-pod

water-cress

wild turnip

Cactus Family

lace cactus

horse crippler

nipple cactus

Texas prickly pear

tasajillo

Water-starwort Family

water-starwort

Bluebell Family

cardinal flower

western Venus looking-glass

Venus' looking-glass

Caper Family

Family Species {Synonym}

Polanisia dodecandra (L.) DC.

Caprifoliaceae

Abelia grandiflora Rehd.

Lonicera albiflora Torr. & Gray

Lonicera japonica Thunb.

Sambucus canadensis L.

Symphoricarpos orbiculatus Moench

Viburnum rufidulum Raf.

Caryophyllaceae

Arenaria benthamii Fenzl ex Torr. & Gray

Arenaria serpyllifolia L.

Cerastium brachypodum (Engelm. ex Gray) B.L. Robins.

Cerastium glomeratum Thuill.

Paronychia virginica Spreng.

Polycarpon tetraphyllum L.

Silene antirrhina L.

Stellaria media (L.) Vill.

Chenopodiaceae

Chenopodium album L.

Chenopodium ambrosioides L.

Monolepis nuttalliana (J.A. Schultes) Greene

Cistaceae

Helianthemum rosmarinifolium Pursh.

Lechea mucronata Raf.

Lechea san-sabeana (Buckl.) Hodgdon

Lechea tenuifolia Michx.

Commelinaceae

Commelina erecta L.

Tinantia anomala (Torr.) C.B. Clarke

{*Commelinantia anomala* (Torr.) Woods.}

Tradescantia edwardsiana Tharp

Tradescantia humilis Rose

Convolvulaceae

Convolvulus equitans Benth.

Cuscuta sp.

Cuscuta cuspidata Engelm.

Cuscuta exaltata Englem.

Dichondra carolinensis Michx.

Evolvulus nuttallianus J.A. Schultes

Evolvulus sericeus Sw.

Ipomoea cordatotriloba Dennst. var. *cordatotriloba*

{*Ipomoea trichocarpa* Ell.}

Ipomoea cordatotriloba Dennst. var. *torreyana* (Gray) D. Austin

{*Ipomoea trichocarpa* Ell. var. *torreyana* (Gray) Shinnery}

Ipomoea lacunosa L.

Cornaceae

Cornus drummondii C.A. Mey.

Crassulaceae**Common Names**

clammy-weed

Honeysuckle Family

abelia

white honeysuckle

Japanese honeysuckle

common elder-berry

coral-berry

southern black-haw

Pink Family

sandwort

thyme-leaved sandwort

mouse-ear chickweed

mouse-ear chickweed

whitlow-wort

polycarp

sleepy catchfly

chickweed

Goosefoot Family

pigweed

Mexican tea

poverty weed

Rockrose Family

rockrose

pin-weed

San Saba pin-weed

pin-weed

Spiderwort Family

widow's tears, day flower

false day flower

plateau spiderwort

spiderwort

Morning Glory Family

Texas bindweed

dodder

dodder

shin oak dodder

pony-foot

silky evolvulus

white evolvulus

purple bindweed

purple bindweed

morning glory

Dogwood Family

rough-leaf dogwood

Orpine Family

Family Species {Synonym}

Sedum nuttallianum Raf.
Sedum pulchellum Michx.

Cucurbitaceae

Cucurbita foetidissima Kunth
Ibervillea lindheimeri (Gray) Greene

Cupressaceae

Juniperus ashei Buchh.
Juniperus pinchotii Sudw.
Thuja occidentalis L.

Cyperaceae

Carex amphibola Steud.
Carex blanda Dew.
Carex edwardsiana Bridges & Orzell
Carex microdonta Torr. & Hook.
Carex muehlenbergii Schkuhr ex Willd.
Carex oligocarpa Schkuhr ex Willd.
Carex onusta Mack.
Carex planostachys Kunze
Carex retroflexa Muhl.
Cyperus acuminatus Torr. & Hook. ex Torr.
Cyperus lupulinus (Spreng.) Marcks ssp. *lupulinus*
 {*Cyperus filiculmis* Vahl}
Cyperus ochraceus Vahl
Cyperus odoratus L.
Cyperus cf. polystachyos Rottb. var. *filicinus* (Vahl) C.B. Clarke
 {*Cyperus cf. filicinus* Vahl}
Cyperus retroflexus Buckl.
 {*Cyperus uniflorus* Torr. & Hook.}
Cyperus strigosus L.
Eleocharis acutisquamata Buckl.
Eleocharis montevidensis Kunth
Eleocharis palustris (L.) Roemer & J.A. Schultes
 {*Eleocharis macrostachya* Britt.}
Eleocharis quadrangulata (Michx.) Roemer & J.A. Schultes
Fimbristylis puberula (Michx.) Vahl var. *puberula*
Fuirena simplex Vahl
Scirpus pendulus Muhl.
Scirpus saximontanus Fern.
Scleria triglomerata Michx.

Ebenaceae

Diospyros texana Scheele
Diospyros virginiana L.

Equisetaceae

Equisetum laevigatum A. Br.

Euphorbiaceae

Acalypha gracilens Gray var. *delzii* L. Mill.
Acalypha lindheimeri Muell.-Arg.
Acalypha ostryaefolia
Argythamnia humilis
Argythamnia mercurialina (Nutt.) Muell.-Arg. var. *mercurialina*

Common Names

yellow stonecrop
 purple stonecrop

Gourd Family

buffalo-gourd
 globe-berry

Cypress Family

Ashe juniper, cedar
 red-berry juniper
 Oriental arbor-vitae

Sedge Family

sedge
 sedge
 plateau sedge
 sedge
 sedge
 sedge
 sedge
 sedge
 flatsedge
 flatsedge
 flatsedge
 flatsedge
 flatsedge
 flatsedge
 spikerush
 spikerush
 common spikerush
 spikerush
 hairy fimbry
 umbrella-grass
 bulrush
 bulrush
 whip-grass

Persimmon Family

Mexican persimmon
 common persimmon

Horsetail Family

cola de caballo

Spurge Family

three-seeded mercury
 three-seeded mercury
 three-seeded mercury
 wild mercury

Family Species {Synonym}

Chamaesyce fendleri (Torr.& Gray) Small var. *fendleri*
 {*Euphorbia fendleri* Torr.& Gray }
Chamaesyce maculata (L.) Small
 {*Euphorbia maculata* L.}
Chamaesyce missurica (Raf.) Shinners
 {*Euphorbia missurica* Raf.}
Chamaesyce nutans (Lag.) Small
 {*Euphorbia nutans* Lag.}
Chamaesyce revoluta (Engelm.) Small
 {*Euphorbia revoluta* Engelm.}
Chamaesyce serpens (Kunth) Small
 {*Euphorbia serpens* Kunth}
Chamaesyce villifera (Scheele) Small
 {*Euphorbia villifera* Scheele}
Cnidocolus texanus (Muell.-Arg.) Small
Croton alabamensis E.A. Sm. ex Chapman var. *texensis* Ginzburg
Croton fruticosus Engelm. ex Torr.
Croton monanthogynus Michx.
Croton texensis (Klotzsch) Muell.-Arg.
Euphorbia bicolor Engelm. & Gray
Euphorbia cyathophora Murr.
Euphorbia dentata Michx.
Euphorbia heterophylla L.
Euphorbia marginata Pursh
Euphorbia roemeriana Scheele
Euphorbia spathulata Lam.
Phyllanthus polygonoides Nutt. ex Spreng.
Stillingia texana I.M. Johnston
Tragia brevispica Engelm. & Gray
Tragia ramosa Torr.

Common Names

spurge
 spurge
 spurge
 eyebane
 spurge
 hierba de la golondrina
 hairy spurge
 bull nettle
 Alabama croton
 encinilla, shrubby croton
 prairie-tea
 Texas croton
 snow-on-the-prairie
 poinsettia
 spurge
 catalina
 snow-on-the-mountain
 Roemer's spurge
 spurge
 leaf-flower
 queen's delight
 climbing noseburn
 noseburn

Fabaceae

Acacia angustissima (P. Mill.) Kuntze var. *hirta* (Nutt.) B.L. Robins.
Acacia farinacea (L.) Willd.
Amorpha fruticosa L.
Astragalus lotiflorus Hook.
Astragalus nuttallianus DC. var. *nuttallianus*
Astragalus wrightii Gray
Cercis canadensis L. var. *texensis* (S. Wats.) M. Hopkins
Chamaecrista fasciculata (Michx.) Greene
 {*Cassia fasciculata* Michx. var. *rostrata* (Woot. & Standl.) B.L. Turner}
Cologania angustifolia Kunth
Dalea aurea Nutt. ex Pursh
Dalea compacta Spreng. var. *pubescens* (Gray) Barneby
 {*Petalostemum pulcherrimum* (Heller) Heller}
Dalea enneandra Nutt.
Dalea frutescens Gray
Dalea hallii Gray
Dalea multiflora (Nutt.) Shinners
 {*Petalostemon multiflorum* Nutt.}
Dalea tenuis (Colt.) Shinners
 {*Petalostemon tenuis* (Colt.) Heller}
Desmanthus illinoënsis (Michx.) MacM. ex B.L. Robins. & Fern.
Desmanthus leptolobus Torr. & Gray
Desmanthus velutinus Scheele
Desmodium glabellum (Michx.) DC.

Legume Family

fern acacia
 huisache
 bastard indigo
 low milk-vetch
 Nuttall's milk-vetch
 milk-vetch
 redbud
 partridge pea
 longleaf cologania
 golden dalea
 purple prairie clover
 dalea
 black dalea
 Hall's dalea
 white prairie clover
 prairie clover
 prairie bundleflower
 slender-lobe bundleflower
 velvet bundleflower
 tick-trefoil

Family Species {Synonym}

Desmodium paniculatum (L.) DC. var. *paniculatum*
Desmodium psilophyllum Schlecht.
Eysenhardtia texana Scheele
Galactia regularis (L.) B.S.P.
Gleditsia triacanthos L.
Indigofera miniata Ortega var. *leptosepala* (Nutt. ex Torr. & Gray) B.L.
 Turner
Lespedeza procumbens Michx.
Lespedeza texana Britt.
Lespedeza virginica (L.) Britt.
Lotus unifoliolatus (Hook.) Benth. var. *unifoliolatus*
 {*Lotus purshianus* F.E. & E.G. Clem.}
Lupinus texensis Hook.
Medicago lupulina L.
Medicago minima (L.) L.
Medicago orbicularis (L.) Bartalini
Melilotus albus Lam.
Melilotus indicus (L.) All.
Melilotus officinalis (L.) Lam.
Mimosa biuncifera Benth.
Mimosa borealis Gray
Mimosa quadrivalvis L. var. *latidens* (Small) Barneby
 {*Schrankia latidens* (Small) K. Schum.}
Mimosa roemeriana Scheele
 {*Mimosa quadrivalvis* L. var. *platycarpa* (Gray) Barneby}
 {*Schrankia roemeriana* (Scheele) Blank.}
Neptunia lutea (Leavenworth) Benth.
Parkinsonia aculeata L.
Pediomelum cuspidatum (Pursh) Rydb.
 {*Psoralea cuspidata* Pursh}
Pediomelum cyphocalyx (Gray) Rydb.
 {*Psoralea cyphocalyx* Gray}
Pediomelum hypogaeum (Nutt.) Rydb. var. *scaposum*
 {*Psoralea hypogaea* T. & G. var. *scaposa* Gray}
Pediomelum latestipulatum (Shiners) W. Mahler
 {*Psoralea latestipulata* Shiners
Pediomelum linearifolium (Torr. & Gray) J. Grimes
 {*Psoralea linearifolia* Torr. & Gray}
Pediomelum rhombifolium (Torr. & Gray) Rydb.
 {*Psoralea rhombifolia* Torr. & Gray}
Prosopis glandulosa Torr. var. *glandulosa*
Prosopis glandulosa Torr. var. *torreyana* (L. Benson) M.C. Johnston
Psoralidium tenuiflorum (Pursh) Rydb.
 {*Psoralea tenuiflora* Pursh}
Rhynchosia senna Gillies ex Hook. var. *texana* (Torr. & Gray) M.C.
 Johnston
 {*Rhynchosia texana* Torr. & Gray}
Robinia pseudo-acacia L.
Senna marilandica (L.) Link
 {*Cassia marilandica* L.}
Senna roemeriana (Scheele) Irwin & Barneby
 {*Cassia roemeriana* Scheele}
Sesbania exaltata (Raf.) Rydb. ex A.W. Hill
 {*Sesbania macrocarpa* Muhl. ex Raf.}
Sesbania vesicaria (Jacq.) Ell.
Sophora affinis Torr. & Gray

Common Names

panicle-leaf tick-trefoil
 simple-leaf tick-trefoil
 vara dulce, kidney wood
 milkpea
 honey locust
 scarlet pea

 trailing bush clover
 Texas bush clover
 slender bush clover
 deer vetch

 Texas bluebonnet
 black medick
 small bur-clover
 button clover
 white sweet clover
 sour clover
 yellow sweet clover
 cat's-claw mimosa
 pink mimosa
 sensitive brier

 sensitive brier

 yellow-puff
 retama
 Indian-turnip

 wand psoralea

 psoralea

 scruf-pea

 narrow-leaf psoralea

 brown-flowered psoralea

 honey mesquite
 mesquite
 scurfy pea

 snoutbean

 black locust
 Maryland senna

 two-leaved senna

 bequilla

 bladder pod
 Eve's necklace

Family Species {Synonym}

Sophora secundiflora (Ortega) Lag. ex DC.
Strophostyles helvula (L.) Ell.
Vicia angustifolia L.
Vicia ludoviciana Nutt. ssp. *leavenworthii* (Torr. & Gray) Lassetter & Gunn
 {*Vicia leavenworthii* Torr. & Gray}
Vicia sativa L. ssp. *nigra* (L.) Ehrh.
 {*Vicia angustifolia* L.}
Vicia villosa Roth ssp. *varia* (Host) Corb.

Fagaceae

Quercus buckleyi (Buckl.) Nixon & Dorr
Quercus fusiformis Small
Quercus macrocarpa Michx.
Quercus marilandica Muenchh.
Quercus muhlenbergii Engelm.
Quercus shumardii
Quercus sinuata Walt. var. *breviloba* (Torr.) C.H. Muller
Quercus stellata Wangenh.

Fumariaceae

Corydalis curvisiliqua Engelm.

Gentianaceae

Centaurium beyrichii (Torr. & Gray) B.L. Robins. var. *beyrichii*
Centaurium texense (Griseb.) Fern.
Eustoma russellianum (Hook.) G. Don
 {*Eustoma grandiflorum* (Raf.) Shinnery }

Geraniaceae

Erodium cicutarium (L.) L'Her. ex Ait.
Erodium texanum Gray
Geranium carolinianum L.
Geranium texanum (Trel.) Heller

Haloragaceae

Myriophyllum heterophyllum Michx.

Hippocastanaceae

Aesculus glabra Willd. var. *arguta* (Buckl.) B.L. Robins.
 {*Aesculus arguta* Buckl.}

Hydrophyllaceae

Nemophila phacelioides Nutt.
Nama hispidum Gray
Phacelia congesta Hook.

Iridaceae

Nemastylis geminiflora Nutt.
Sisyrinchium chilense Hook.
 {*Sisyrinchium ensigerum* Bickn. }

Juglandaceae

Carya illinoensis (Wangenh.) K. Koch
Juglans major (Torr.) Heller
Juglans nigra L.

Common Names

Texas mountain laurel
 amerique bean
 narrow-leaved vetch
 deer pea vetch

common vetch

hairy vetch

Beech Family

Texas oak, Buckley oak
 plateau live oak
 bur oak
 blackjack oak
 chinkapin oak
 Shumard oak
 shin oak
 post oak

Fumitory Family

scrambled eggs

Gentian Family

mountain pink
 Lady Bird's centaury
 bluebells

Geranium Family

pin clover
 stork's-bill
 wild geranium
 cranesbill

Water-milfoil Family

water-milfoil

Buckeye Family

Texas buckeye, white
 buckeye

Waterleaf Family

baby blue-eyes
 sand bells
 blue-curls

Iris Family

celestials
 blue-eyed grass

Walnut Family

pecan
 Arizona walnut
 black walnut

Family Species {Synonym}**Juncaceae**

Juncus effusus L.
Juncus interior Wieg.
Juncus marginatus Rostk.
Juncus tenuis Willd.
Juncus texanus (Engelm.) Coville
Juncus torreyi Coville

Krameriaceae

Krameria lanceolata Torr.

Lamiaceae

Brazoria scutellarioides Engelm. & Gray
Hedeoma acinoides Scheele
Hedeoma drummondii Benth.
Hedeoma reverchonii (Gray) Gray var. *reverchonii*
Lamium amplexicaule L.
Lycopus americanus Muhl. ex W. Bart.
Marrubium vulgare L.
Monarda citriodora Cerv. ex Lag. ssp. *citriodora*
Monarda punctata L.
Physostegia intermedia (Nutt.) Engelm. & Gray
Salvia azurea Michx. ex Lam. var. *grandiflora* Benth.
Salvia engelmannii Gray
Salvia farinacea Benth.
Salvia roemeriana Scheele
Salvia texana (Scheele) Torr.
Scutellaria drummondii Benth.
Scutellaria ovata Hill
Scutellaria resinosa Torr.
 {*Scutellaria wrightii* Gray}
Teucrium canadense L.
Teucrium laciniatum Torr.
Trichostema brachiatum L.

Lauraceae

Lindera benzoin (L.) Bl.

Liliaceae

Allium canadense L. var. *canadense*
Allium drummondii Regel
Allium porrum
Androstaphium coeruleum (Scheele) Greene
Camassia scilloides (Raf.) Cory
Erythronium mesochoreum Knerr
Muscari neglectum Guss. ex Ten.
 {*Muscari racemosum* (L.) Lam. & DC.}
Nothoscordum bivalve (L.) Britt.
Zigadenus nuttallii (Gray) S. Wats.

Linaceae

Linum berlandieri Hook. var. *berlandieri*
 {*Linum rigidum* Pursh var. *berlandieri* (Hook.) Torr. & Gray}
Linum grandiflorum Desf.
Linum pratense (Nort.) Small

Common Names**Rush Family**

soft rush
 rush
 rush
 slender-rush
 rush
 rush

Ratany Family

ratany

Mint Family

prairie brazoria
 annual pennyroyal
 mock pennyroyal
 mock pennyroyal
 henbit
 water-horehound
 common horehound
 purple horsemint
 spotted beabalm
 false dragon-head
 giant blue sage
 Engelmann's sage
 mealy sage
 cedar sage
 Texas sage
 Drummond's skullcap
 heart-leaf skullcap
 bushy skullcap

 American germander
 cut-leaf germander
 flux-weed

Laurel Family

spicebush

Lily Family

Canada garlic
 wild onion
 leeks
 funnel-flower
 wild hyacinth
 dog's-tooth violet
 grape-hyacinth

 crow-poison
 death camas

Flax Family

yellow flax

 flax
 meadow flax

Family Species {Synonym}

Linum rigidum Pursh
Linum rupestre (Gray) Engelm. ex Gray

Loasaceae

Mentzelia oligosperma Nutt. ex Sims

Loganiaceae

Mitreola petiolata (J.F. Gmel.) Torr. & Gray
 {*Cynoctonum mitreola* (L.) Britt.}

Lythraceae

Ammannia coccinea Rottb.
Lythrum californicum Torr. & Gray

Malvaceae

Abutilon incanum (Link) Sweet
Callirhoë involucrata (Torr.) Gray
Callirhoë pedata (Nutt. ex Hook.) Gray
 {*Callirhoë digitata* Nutt. var. *stipulata* Waterfall}
Herissantia crispa (L.) Briz.
Malvaviscus drummondii Torr. & Gray
 {*Malvaviscus arboreus* Dill. ex Cav. var. *drummondii* (Torr. & Gray)
 Schery}
Rhynchosida physocalyx (Gray) Fryxell
Sida abutifolia P. Mill.
 {*Sida filicaulis* Torr. & Gray}
Sphaeralcea coccinea (Nutt.) Rydb. ssp. *coccinea*

Marsileaceae

Marsilea vestita Hook. & Grev.

Meliaceae

Melia azedarach L.

Menispermaceae

Cocculus carolinus (L.) DC.

Moraceae

Maclura pomifera (Raf.) Schneid.
Morus alba L.
Morus microphylla Buckl.
Morus rubra L.
Ficus carica L.

Najadaceae

Najas guadalupensis (Spreng.) Magnus

Nyctaginaceae

Mirabilis albida (Walt.) Heimerl
Mirabilis linearis (Pursh) Heimerl
Mirabilis nyctaginea (Michx.) MacM.

Oleaceae

Forestiera pubescens Nutt.
Fraxinus pensylvanica Marsh.

Common Names

yellow flax
 rock flax

Stick-leaf Family

stick-leaf

Logania Family

miterwort

Loosestrife Family

tooth-cup
 loosestrife

Mallow Family

Indian-mallow
 winecup
 standing winecup
 bladder-mallow
 Drummond wax-mallow,
 turk's cap
 buffpetal
 spreading sida
 scarlet globe-mallow

Pepperwort Family

water clover

Mahogany Family

Chinaberry-tree

Moonseed Family

red-berried moonseed

Mulberry Family

bois d'arc, Osage orange
 white mulberry
 Texas mulberry
 red mulberry
 common fig

Water-nymph Family

common water-nymph

Four-o'clock Family

white four-o'clock
 four-o'clock
 wild four-o'clock

Olive Family

elbow-bush
 red ash

Family Species {Synonym}

Fraxinus texensis (Gray) Sarg.
 {*Fraxinus americana* L. var. *texensis* Gray}
Ligustrum lucidum Ait.

Common Names

Texas ash

Onagraceae

Calylophus serrulatus (Nutt.) Raven
Calylophus berlandieri Spach ssp. *berlandieri*
 {*Calylophus drummondianus* Spach ssp. *berlandieri* (Spach) Towner
 & Raven}
Calylophus berlandieri Spach ssp. *pinifolius* (Engelm. & Gray) Towner
 {*Calylophus drummondianus* Spach}
Gaura coccinea Pursh
Gaura longiflora Spach
 {*Gaura filiformis* Small}
Gaura parviflora Dougl. ex Lehm.
Gaura sinuata Nutt. ex Ser.
Gaura suffulta Engelm. ex Gray
Ludwigia octovalvis (Jacq.) Raven
Ludwigia palustris (L.) Ell.
Ludwigia repens J.R. Forst.
Oenothera brachycarpa Gray
Oenothera jamesii Torr. & Gray
Oenothera laciniata Hill

Oenothera macrocarpa Nutt. ssp. *macrocarpa*
 {*Oenothera missouriensis* Sims}
Oenothera rhombipetala Nutt. ex Torr. & Gray

Oenothera speciosa Nutt.
Oenothera triloba Nutt.
Stenosiphon linifolius (Nutt. ex James) Heynh.

Orchidaceae

Corallorrhiza wisteriana Conrad
Hexalectris spicata (Walt.) Barnh.
Spiranthes cernua (L.) L.C. Rich.

Oxalidaceae

Oxalis dillenii Jacq.
Oxalis drummondii Gray

Papaveraceae

Argemone albiflora Hornem. ssp. *texana* G.B. Ownbey
Argemone aurantiaca G.B. Ownbey

Passifloraceae

Passiflora affinis Engelm.
Passiflora lutea L.

Pedaliaceae

Proboscidea louisianica (P. Mill.) Thellung

Phrymaceae

Phryma leptostachya L.

Phytolaccaceae**Evening Primrose Family**

yellow evening primrose
 squarebud primrose
 squarebud primrose
 scarlet gaura
 gaura
 lizard-tail
 wavy-leaved gaura
 wild honeysuckle
 water-primrose
 marsh purslane
 creeping primrose-willow
 evening primrose
 river primrose
 cut-leaved evening
 primrose
 fluttermill
 four-point evening
 primrose
 showy primrose
 stemless evening primrose
 false gaura

Orchid Family

spring coral-root
 crested coral-root
 ladies' tresses

Wood-sorrel Family

yellow wood-sorrel
 purple wood-sorrel

Poppy Family

white prickly poppy
 prickly poppy

Passion-flower Family

passion-flower
 yellow passion-flower

Unicorn-plant Family

unicorn-plant, devil's claw

Lopseed Family

lopseed

Pokeweed Family

Family Species {Synonym}

Phytolacca americana L.
Rivina humilis L.

Plantaginaceae

Plantago helleri Small
Plantago rhodosperma Dcne.
Plantago wrightiana Dcne.

Platanaceae

Platanus occidentalis L.

Poaceae

Aegilops cylindrica Host
Andropogon gerardii Vitman var. *gerardii*
Andropogon glomeratus (Walt.) B.S.P.
Aristida glauca (Nees) Walp.
Aristida oligantha Michx.
Aristida purpurea Nutt.
Aristida purpurea Nutt. var. *longiseta* (Steud.) Vasey
 {*Aristida longiseta* Steud.}
Aristida purpurea Nutt. var. *nealleyi* (Vasey) Allred
 {*Aristida purpurea* Nutt. var. *glauca* (Nees) A. & N. Holmgren}
Aristida purpurea Nutt. var. *wrightii* (Nash) Allred
 {*Aristida wrightii* Nash}
Arundo donax L.
Avena fatua L.
Avena sativa L.
Bothriochloa barbinodis (Lag.) Herter var. *perforata* (Trin. ex Fourn.)
 Gould
Bothriochloa ischaemum (L.) Keng var. *songarica* (Rupr. ex Fisch. & C.A.
 Mey.) Celarier & Harlan
Bothriochloa laguroides (DC.) Herter ssp. *torreyana* (Steud.) Allred &
 Gould
 {*Bothriochloa saccharoides* (Sw.) Rydb. var. *torreyana* (Steud.)
 Gould}
 {*Bothriochloa longipaniculata* (Gould) Allred & Gould}
Bouteloua curtipendula (Michx.) Torr. var. *caespitosa* Gould & Kapadia
Bouteloua hirsuta Lag. subsp. *hirsuta*
Bouteloua hirsuta Lag. subsp. *pectinata* (Featherly) J. Wipff & S.D. Jones
Bouteloua rigidiseta (Steud.) A.S. Hitchc.
Bouteloua trifida Thurb.
Brachiaria fasciculata (Sw.) Parodi
 {*Panicum fasciculatum* Sw.}
Bromus catharticus Vahl
 {*Bromus unioloides* Kunth}
Bromus japonicus Thunb. ex Murr.
Bromus pubescens Muhl. ex Willd.
 {*Bromus purgans* L.}
Bromus tectorum L.
Buchloë dactyloides (Nutt.) Engelm.
Catapodium rigidum (L.) C.E. Hubb.
Cenchrus carolinianus Walt.
 {*Cenchrus pauciflorus* Benth.}
Cenchrus spinifex Cav.
 {*Cenchrus incertus* M.A. Curtis }
Chasmanthium latifolium (Michx.) Yates

Common Names

pokeweed
 pigeon-berry

Plantain Family

plantain
 red-seeded plantain
 plantain

Plane-tree Family

sycamore

Grass Family

goatgrass
 big bluestem
 bushy bluestem
 three-awn
 oldfield three-awn
 purple three-awn
 red three-awn

 three-awn
 Wright three-awn

 giant reed
 wild oats
 oats
 pinhole bluestem
 King Ranch bluestem
 silver bluestem
 sideoats grama
 hairy grama
 tall grama
 Texas grama
 red grama
 browntop brachiaria
 rescuegrass
 Japanese brome
 brome
 cheatgrass, downy brome
 buffalo grass
 grassbur
 grassbur
 creekoats

Family Species {Synonym}

Chloris andropogonoides Fourn.
Chloris cucullata Bisch.
Chloris latisquamea Nash
Chloris subdolichostachya Muell.
Chloris verticillata Nutt.
Coelorachis cylindrica (Michx.) Nash
Cynodon dactylon (L.) Pers.
Dichanthelium aciculare (Desv. ex Poir.) Gould & C.A. Clark
Dichanthelium acuminatum (Sw.) Gould & C.A. Clark
 var. *fasciculatum* (Torr.) Freckmann
 {*Dichanthelium acuminatum* (Sw.) Gould & C.A. Clark var. *implicatum*
 (Scribn.) Gould & C.A. Clark}
Dichanthelium acuminatum (Sw.) Gould & C.A. Clark
 var. *lindheimeri* (Nash) Gould & C.A. Clark
Dichanthelium depauperatum (Muhl.) Gould
Dichanthelium lanuginosum
Dichanthelium laxiflorum (Lam.) Gould
Dichanthelium oligosanthos (J.A. Schultes) Gould var. *scribnerianum*
 (Nash) Gould
Dichanthelium pedicellatum (Vasey) Gould
Dichanthelium sphaerocarpon (Ell.) Gould var. *sphaerocarpon*
Dichanthium annulatum Stapf.
Digitaria ciliaris (Retz.) Koel.
Digitaria cognata (J.A. Schultes) Pilger var. *cognata*
 {*Leptoloma cognatum* (J.A. Schultes) Chase}
Echinochloa colona (L.) Link
Echinochloa crus-galli (L.) Beauv. var. *crus-galli*
Eleusine indica (L.) Gaertn.
Elymus canadensis L.
Elymus virginicus L.
Eragrostis barrelieri Daveau
Eragrostis cilianensis (All.) Lut. ex Janchen
Eragrostis curtipedicellata Buckl.
Eragrostis hirsuta (Michx.) Nees
Eragrostis intermedia A.S. Hitchc.
Eragrostis pilosa (L.) Beauv.
Eragrostis secundiflora J. Presl
Eragrostis sessilispica Buckl.
Eragrostis spectabilis (Pursh) Steud.
Eriochloa sericea (Scheele) Munro ex Vasey
Erioneuron pilosum (Buckl.) Nash
Festuca versuta Beal
Glyceria striata (Lam.) A.S. Hitchc.
Hordeum pusillum Nutt.
Leersia virginica Willd.
Leptochloa dubia (Kunth) Nees
Leptochloa mucronata (Michx.) Kunth
 {*Leptochloa filiformis* (Lam.) Beauv.}
Limnodea arkansana (Nutt.) L.H. Dewey
Lolium perenne L. ssp. *multiflorum* (Lam.) Husnot
Lolium temulentum L.
Muhlenbergia capillaris (Lam.) Trin. var. *trichopodes* (Ell.) Vasey
 {*Muhlenbergia expansa* (Poir.) Trin.}
Muhlenbergia lindheimeri A.S. Hitchc.
Muhlenbergia reverchonii Vasey & Scribn.
Muhlenbergia schreberi J.F. Gmel.

Common Names

fingergrass
 hooded fingergrass
 fingergrass
 fingergrass
 windmill fingergrass
 Carolina jointtail
 bermuda grass
 dichanthelium
 woolly dichanthelium

 woolly dichanthelium

 dichanthelium

 openflower dichanthelium
 Scribner dichanthelium

 dichanthelium
 roundseed dichanthelium
 Kleberg bluestem
 southern crabgrass
 fall witchgrass

 junglerice
 common barnyardgrass
 goosegrass
 Canada wildrye
 Virginia wildrye
 Mediterranean lovegrass
 stinkgrass
 gummy lovegrass
 hairy lovegrass
 plains lovegrass
 India lovegrass
 red lovegrass
 tumble lovegrass
 lovegrass
 Texas cupgrass
 hairy tridens
 fescue
 fowl manna-grass
 little barley
 white grass
 green sprangletop
 red sprangletop

 ozarkgrass
 ryegrass
 darnel
 gulf muhly

 Lindheimer's muhly
 seep muhly
 nimblewill

Family Species {Synonym}

Nassella leucotricha (Trin. & Rupr.) Barkworth
 {*Stipa leucotricha* Trin. & Rupr.}
Panicum capillare L.
Panicum hallii Vasey
Panicum obtusum Kunth
Panicum oligosanthos Schult.
Panicum virgatum L.
Paspalum dilatatum Poir.
Paspalum floridanum Michx.
Paspalum pubiflorum Rupr. ex Fourn. var. *pubiflorum*
Paspalum setaceum Michx.
Paspalum urvillei Steud.
Phalaris canariensis L.
Phalaris caroliniana Walt.
Poa annua L.
Poa arachnifera Torr.
Schedonnardus paniculatus (Nutt.) Trel.
Schizachyrium scoparium (Michx.) Nash
Setaria parviflora (Poir.) Kerguelen
 {*Setaria geniculata* Beauv.}
Setaria reverchonii (Vasey) Pilger
Setaria scheelei (Steud.) A.S. Hitchc.
Setaria viridis (L.) Beauv.
Sorghastrum nutans (L.) Nash
Sorghum halepense (L.) Pers.
Sphenopholis obtusata (Michx.) Scribn.
Sporobolus asper (Michx.) Kunth var. *asper*
Sporobolus clandestinus (Biehler) A.S. Hitchc.
 {*Sporobolus asper* (Michx.) Kunth var. *clandestinus* (Biehler)
 Shinnery}
Sporobolus compositus (Poir.) Merr. var. *compositus*
 {*Sporobolus asper* (Michx.) Kunth}
Sporobolus compositus (Poir.) Merr. var. *drummondii* (Trin.) Kartesz &
 Gandhi
 {*Sporobolus asper* (Michx.) Kunth var. *pilosus* (Vasey) A.S. Hitchc.}
Sporobolus cryptandrus (Torr.) Gray
Sporobolus ozarkanus Fern.
 {*Sporobolus vaginiflorus* (Torr.) Wood var. *ozarkanus* (Fern.)
 Shinnery}
Tridens albescens (Vasey) Woot. & Standl.
Tridens flavus (L.) A.S. Hitchc.
Tridens muticus (Torr.) Nash var. *muticus*
Trisetum interruptum Buckl.
Triticum aestivum L.
Vulpia octoflora (Walt.) Rydb.

Polemoniaceae

Gilia incisa Benth.
Ipomopsis rubra (L.) Wherry
Phlox drummondii Hook.
Phlox pilosa L. ssp. *riparia* Wherry
Phlox roemeriana Scheele

Polygalaceae

Polygala alba Nutt.
Polygala lindheimeri Gray

Common Names

Texas wintergrass

 common witchgrass
 Hall's panicum
 vinemesquite
 panicum
 switchgrass
 dallis grass
 Florida paspalum
 paspalum
 paspalum
 Vaseygrass
 canary grass
 Carolina canarygrass
 annual bluegrass
 Texas bluegrass
 tumblegrass
 little bluestem
 knotroot bristlegrass,
 perennial bristlegrass
 Reverchon bristlegrass
 bristlegrass
 bristlegrass
 yellow indiagrass
 Johnsongrass
 prairie wedgescale
 tall dropseed
 tall dropseed

 tall dropseed

 meadow dropseed

 sand dropseed
 sheathing dropseed

 white tridens
 purpletop
 slim tridens
 prairie false oat
 wheat
 common sixweeksgrass

Phlox Family

cut-leaf gilia
 standing cypress
 Drummond phlox
 prairie phlox
 gold-eye phlox

Milkwort Family

white milkwort
 purple milkwort

Family Species {Synonym}

Polygala verticillata L.

Polygonaceae

Eriogonum annuum Nutt.

Eriogonum longifolium Nutt.

Polygonum densiflorum Meisn.

Polygonum lapathifolium L.

Rumex crispus L.

Rumex hastatulus Ell.

Rumex pulcher L.

Portulacaceae

Portulaca oleracea L.

Portulaca pilosa L.

{*Portulaca mundula* I.M. Johnston}

Primulaceae

Samolus ebracteatus Kunth ssp. *cuneatus* (Small) Henrickson

{*Samolus cuneatus* Small}

Samolus valerandi L. ssp. *parviflorus* (Raf.) Hulten

{*Samolus parviflorus* Raf.}

Rafflesiaceae

Pilostyles covillei Rose

Ranunculaceae

Anemone berlandieri Pritz.

{*Anemone heterophylla* Nutt. ex Torr. & Gray}

Aquilegia canadensis L.

Clematis pitcheri Torr. & Gray

Clematis texensis Buckl.

Delphinium carolinianum Walt. ssp. *vimineum* (D. Don) Warnock

{*Delphinium vimineum* D. Don}

Delphinium carolinianum Walt. ssp. *virescens* (Nutt.) Brooks

{*Delphinium virescens* Nutt.}

Ranunculus macranthus Scheele

Rhamnaceae

Berchemia scandens (Hill) K. Koch

Ceanothus herbaceus Raf.

Frangula caroliniana (Walt.) Gray

{*Rhamnus caroliniana* Walt.}

Ziziphus jujuba Mill.

Rosaceae

Crataegus crus-galli L.

Geum canadense Jacq. var. *camporum* (Rydb.) Fern. & Weatherby

Photinia serrulata

Prunus mexicana S. Wats.

Prunus munsoniana W. Wight & Hedrick

Prunus persica (L.) Batsch

Prunus umbellata Ell.

Pyrus communis L.

Pyrus malus L.

Rosa eglanteria L.

Rosa multiflora Thunb.

Common Names

milkwort

Knotweed Family

wild buckwheat

wild buckwheat

knotweed

knotweed

yellow dock

heart sorrel

fiddle dock

Purslane Family

purslane

chisme

Primrose Family

water-pimpernel

water-pimpernel

Rafflesia Family

pilostyles

Crowfoot Family

wind-flower

columbine

purple leather flower

scarlet leather flower

prairie larkspur

prairie larkspur

large buttercup

Buckthorn Family

supple-jack

redroot

Carolina buckthorn

jujube

Rose Family

hawthorn

white avens

red-tipped photinia

Mexican plum

wild-goose plum

peach

flatwood plum

common pear

common apple

sweet-brier

Japanese rose

Family Species {Synonym}

Rubus aboriginum Rydb.
Rubus bifrons Vest ex Tratt.
Rubus riograndis Bailey
 {*Rubus trivialis* Michx.}

Common Names

dewberry
 dewberry
 southern dewberry

Rubiaceae

Cephalanthus occidentalis L.
Galium aparine L.
Galium circaezans Michx.
Galium pilosum Ait.
Galium texense Gray
Galium virgatum Nutt.
Hedyotis nigricans (Lam.) Fosberg var. *nigricans*
Sherardia arvensis L.

Madder Family

common buttonbush
 catchweed bedstraw
 woods bedstraw
 hairy bedstraw
 Texas bedstraw
 southwest bedstraw
 bluets
 spurwort, field-madder

Rutaceae

Ptelea trifoliata L.
Zanthoxylum hirsutum Buckl.

Citrus Family

wafer-ash
 tickle-tongue

Salicaceae

Populus deltoides Bartr. ex Marsh.
Salix nigra Marsh.

Willow Family

eastern cottonwood
 black willow

Sapindaceae

Cardiospermum halicacabum L.
Sapindus saponaria L. var. *drummondii* (Hook. & Arn.) L. Benson
Unghadia speciosa Endl.

Soap-berry Family

common balloon-vine
 soap-berry
 Mexican buckeye

Sapotaceae

Sideroxylon lanuginosum Michx. ssp. *lanuginosum*
 {*Bumelia lanuginosa* (Michx.) Pers.}
Sideroxylon lanuginosum Michx. ssp. *oblongifolium* (Nutt.) T.D.
 Pennington
Sideroxylon lanuginosum Michx. ssp. *rigidum* (Gray) T.D. Pennington

Sapodilla Family

coma, wooly bumelia

 coma

 coma

Scrophulariaceae

Agalinis heterophylla (Nutt.) Small ex Britt.
Bacopa monnieri (L.) Pennell
Buchnera americana L.
 {*Buchnera floridana* Grand.}
Castilleja purpurea (Nutt.) G. Don var. *purpurea*
Leucospora multifida (Michx.) Nutt.
Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm.
 {*Maurandya antirrhiniflora* Humb. & Bonpl. ex Willd.}
Mecardonia procumbens (P. Mill.) Small
 {*Mecardonia vandellioides* (Kunth) Pennell}
Penstemon cobaea Nutt.
Penstemon laxiflorus Penn.
Verbascum thapsus L.
Veronica americana Schwein. ex Benth.
Veronica peregrina L. var. *xalapensis* (H.B.K.) Penn.

Figwort Family

prairie agalinis
 water-hyssop
 bluehearts

 prairie paintbrush
 leucospora
 snapdragon vine

 mecardonia

 fox-glove
 loose-flowered penstemon
 common mullein
 American brooklime
 purslane speedwell

Simaroubaceae

Ailanthus altissima (P. Mill.) Swingle

Quassia Family

tree-of-heaven

Smilacaceae**Family**

Family Species {Synonym}

Smilax bona-nox L.
Smilax tamnoides L.
 {*Smilax hispida* Muhl. }
Smilax rotundifolia L.

Solanaceae

Bouchetia erecta DC.
Chamaesaracha sordida (Dunal) Gray
Datura wrightii Regel
Physalis cinerascens (Dunal) A.S. Hitchc. var. *cinerascens*
 {*Physalis viscosa* L. var. *cinerascens* (Dunal) Waterfall }
Physalis longifolia Nutt. var. *longifolia*
 {*Physalis virginiana* P. Mill. var. *sonorae* (Torr.) Waterfall }
Physalis viscosa L.
Solanum carolinense L.
Solanum dimidiatum Raf.
Solanum elaeagnifolium Cav.
Solanum rostratum Dunal
Solanum triquetrum Cav.

Styracaceae

Styrax platanifolius Engelm.

Thelypteridaceae

Thelypteris kunthii (Desv.) Morton

Tamaricaceae

Tamarix chinensis Lour.
 {*Tamarix pentandra* Pallas }

Typhaceae

Typha angustifolia L.

Ulmaceae

Celtis laevigata Willd.
Celtis reticulata Torr.
Ulmus americana L.
Ulmus crassifolia Nutt.
Ulmus rubra Muhl.

Urticaceae

Boehmeria cylindrica (L.) Sw.
Parietaria pensylvanica Muhl. ex Willd.
Urtica chamaedryoides Pursh

Valerianaceae

Valerianella amarella (Lindheimer ex Engelm.) Krok
Valerianella radiata (L.) Dufr.

Verbenaceae

Callicarpa americana L.
Glandularia bipinnatifida (Nutt.) Nutt. var. *bipinnatifida*
 {*Verbena bipinnatifida* Nutt. }
Glandularia pumila (Rydb.) Umber
 {*Verbena pumila* Rydb. }

Common Names

cat-brier
 bristly green-brier

 common green-brier

Nightshade Family

bouchetia
 false nightshade
 jimson-weed
 yellow ground cherry

 ground cherry

 yellow ground cherry
 Carolina horse-nettle
 western horse-nettle
 silver-leaf nightshade
 buffalo bur
 Texas nightshade

Storax Family

sycamore-leaf snow bell

Family

southern shield fern

Tamarisk Family

tamarisk

Cat-tail Family

narrow-leaved cat-tail

Elm Family

Texas sugarberry
 netleaf hackberry
 American elm
 cedar elm
 slippery elm

Nettle Family

false nettle
 pellitory
 ortiguilla

Valerian Family

corn salad
 corn salad

Vervain Family

American beautyberry
 Dakota vervain

 pink vervain

Family Species {Synonym}

Lantana urticoides Hayek
 {*Lantana horrida* sensu Moldenke, non Kunth}
Phyla nodiflora (L.) Greene
 {*Phyla incisa* Small}
Verbena brasiliensis Vell.
Verbena halei Small
Verbena neomexicana (Gray) Small
Verbena xutha Lehm.
Vitex agnus-castus L.

Violaceae

Hybanthus verticillatus (Ort.) Baill.

Viscaceae

Phoradendron tomentosum (DC.) Engelm. ex Gray

Vitaceae

Ampelopsis arborea (L.) Koehne
Ampelopsis cordata Michx.
Cissus incisa Des Moulins
Parthenocissus heptaphylla (Buckl.) Small
Parthenocissus quinquefolia (L.) Planch.
Parthenocissus vitacea (Knerr) A.S. Hitchc.
Vitis cinerea (Engelm.) Millard var. *helleri* (Bailey) M.O. Moore
 {*Vitis berlandieri* Planch.}
Vitis monticola Buckl.
Vitis mustangensis Buckl.
Vitis riparia Michx.
Vitis vulpina L.

Zygophyllaceae

Kallstroemia hirsutissima Vail ex Small

Common Names

Texas lantana, calico bush

 Texas frog-fruit

 Brazilian vervain
 Texas vervain
 hillside vervain
 Gulf vervain
 chaste-tree

Violet Family

green violet

Mistletoe Family

mistletoe

Grape Family

pepper-vine
 heart-leaf ampelopsis
 ivy treebine, cow-itch
 seven-leaf creeper
 Virginia creeper
 thicket creeper
 Spanish grape

 sweet mountain grape
 mustang grape
 riverbank grape
 fox grape

Caltrop Family

carpetweed

Figure 3-1

**RGAAF/Killeen Joint Use Facility
Existing 1999 Noise Contours**

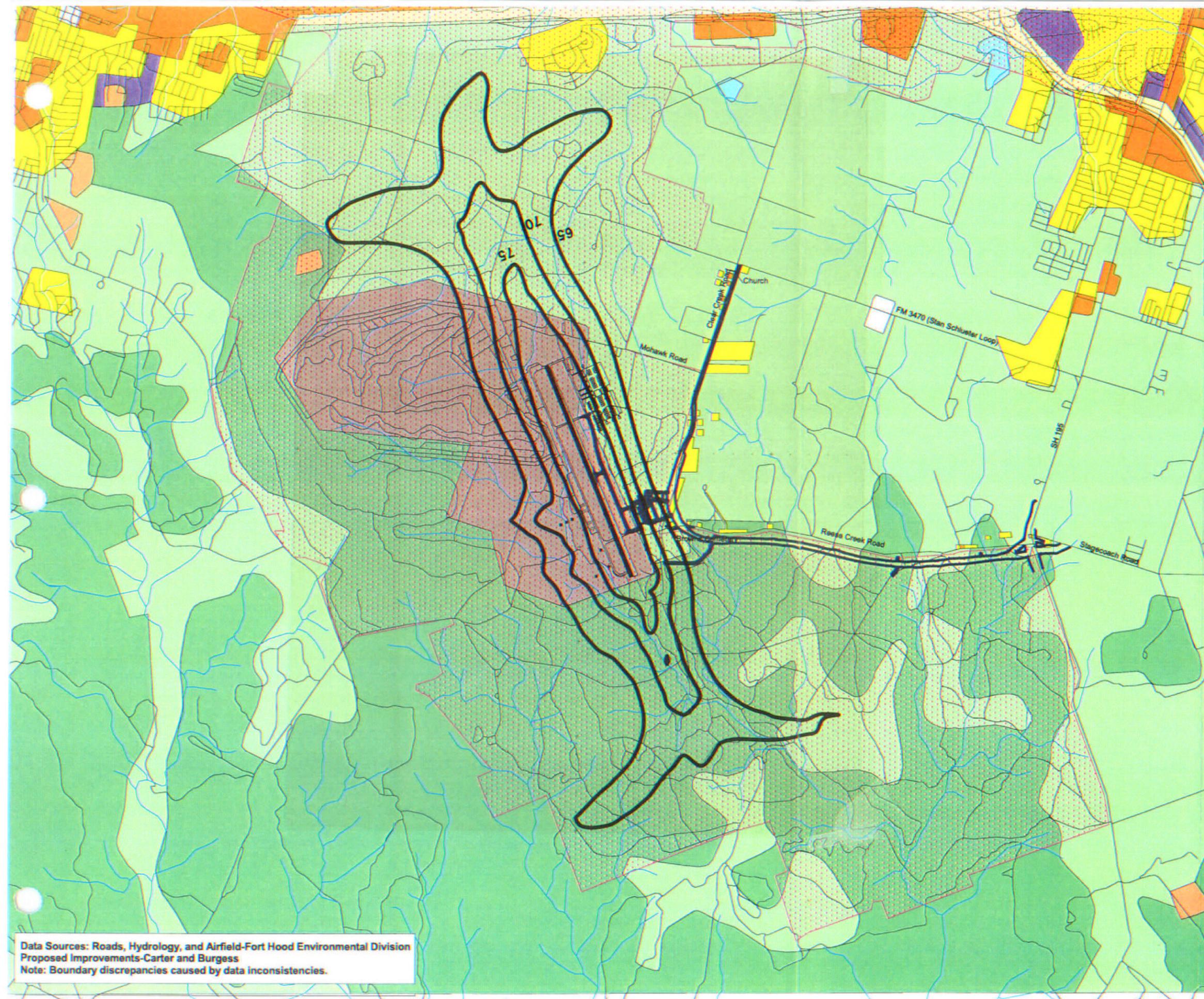
-  Proposed Improvements
-  Creeks
-  Roads
-  Fort Hood Boundary
-  Military Installation
-  Commercial
-  Residential
-  Urban or Built-Up Land
-  Transportation
-  Agricultural
-  Forest
-  Water
-  Strip Mines, Quarries, and Gravel Pits

1000 0 1000 Feet


1" = 4,000'

8/3/99

Page 1 of 1



Data Sources: Roads, Hydrology, and Airfield-Fort Hood Environmental Division
Proposed Improvements-Carter and Burgess
Note: Boundary discrepancies caused by data inconsistencies.

Fort Hood Calculator for Construction, Operations and Flight Emissions																
This is an est. for land prep and installation of the new modular buildings																7/7/2004
Assumptions:																
(1) Equipment will operate 8 hours per day for new construction																
(2) Construction will take 1 year																
(3) LDGVs are construction workers traveling 40 miles per day to and from construction site																
(4) Construction involves clearing grubbing, water, sewage & pwer lines, roads, parking lots, streets, sidewalks																
Construction Vehicle	Units	# of Vehic	# of Miles/	No Hrs/day	# of Days	Total # of	EF NOx	EF VOC	EF PM10	CO EF	SOx EF	NOx (Tons)	VOC (Tons)	PM10 (Ton	CO (Tons/	SOx(Tons/yr)
Light Duty Gasoline V	lb/mile	20	40	N/A	250	200000	0.007	0.021	0.0003	0.237	0.0004	0.7	2.1	0.03	23.7	0.04
Light Duty Gasoline Tr	lb/mile	3	10	N/A	250	7500	0.003	0.007	0.0002	0.068	0.0001	0.01125	0.02625	0.00075	0.255	0.000375
Heavy Duty Gasoline Tr	lb/mile	2	80	N/A	150	24000	0.01	0.006	0.0003	0.066	0.0004	0.12	0.072	0.0036	0.792	0.0048
Light Duty Diesel Truc	lb/mile	2	70	N/A	150	21000	0.004	0.002	0.001	0.008	0.001	0.042	0.021	0.0105	0.084	0.0105
Heavy Duty Diesel Tru	lb/mile	2	30	N/A	150	9000	0.045	0.014	0.006	0.053	0.007	0.2025	0.063	0.027	0.2385	0.0315
Track Tractor	lb/hour	0	N/A	0	0	0	1.26	0.121	0.112	0.346	0.137	0	0	0	0	0
Wheeled Tractor	lb/hour	1	N/A	8	100	800	0.892	0.098	0.058	3.59	0.09	0.3568	0.0392	0.0232	1.436	0.036
Wheeled Loader	lb/hour	1	N/A	8	100	800	1.89	0.25	0.172	0.572	0.182	0.756	0.1	0.0688	0.2288	0.0728
Concrete Truck	lb/hour	2	N/A	8	200	3200	1.69	0.149	0.139	0.674	0.142	2.704	0.2384	0.2224	1.0784	0.2272
Shipping Truck	lb/hr	2	N/A	8	40	640	1.691	0.152	0.139	0.674	0.142	0.54112	0.04864	0.04448	0.21568	0.04544
Dump/haul Truck	lb/hour	2	N/A	8	60	960	1.69	0.149	0.138	0.674	0.142	0.8112	0.07152	0.06624	0.32352	0.06816
Water Truck	lb/hour	1	N/A	8	200	1600	1.69	0.149	0.138	0.674	0.142	1.352	0.1192	0.1104	0.5392	0.1136
Gas Forklift	lb/hour	2	N/A	8	200	3200	0.412	0.56	0.112	0.674	0.017	0.6592	0.896	0.1792	1.0784	0.0272
Diesel Forklift	lb/hour	1	N/A	8	100	800	1.691	0.152	0.139	0.145	0.044	0.6764	0.0608	0.0556	0.058	0.0176
Soil Roller/Compactor	lb/hour	2	N/A	8	60	960	1.691	0.201	0.139	0.046	0.007	0.81168	0.09648	0.06672	0.02208	0.00336
Motor Grader	lb/hour	2	N/A	8	200	3200	0.703	0.04	0.061	0.151	0.086	1.1248	0.064	0.0976	0.2416	0.1376
Excavator	lb/hour	2	N/A	8	45	720	1.691	0.152	0.139	0.675	0.143	0.60876	0.05472	0.05004	0.243	0.05148
Bulldozer	lb/hour	1	N/A	8	200	1600	4.16	0.186	0.138	0.674	0.137	3.328	0.1488	0.1104	0.5392	0.1096
Frontend Loader	lb/hour	1	N/A	8	200	1600	1.89	0.25	0.172	0.046	0.007	1.512	0.2	0.1376	0.0368	0.0056
Backhoe Loader	lb/hr	1	N/A	8	60	480	1.26	0.121	0.112	0.046	0.006	0.3024	0.02904	0.02688	0.01104	0.00144
Crane	lb/hr	1	N/A	8	40	320	1.691	0.149	0.139	0.674	0.149	0.27056	0.02384	0.02224	0.10784	0.02384
Off Road Vehicle(Misc)							4.16	0.187	0.255	1.79	0.454	0	0	0	0	0
Totals							Total Construction Emissions per year					16.89067	4.47289	1.35365	31.22906	1.028095
Fort Hood Calculator for Operational Emissions																
Assumptions: Modular Strenght 3,570; Accompanied 2,067; additional dependents 4,341. 20% single soldiers have cars.																7/7/2004
Operational Item	Units	# of Vehic	# of Miles/	No Hrs/day	# of Days	Total # of	EF NOx	EF VOC	EF PM10	CO EF	SOx EF	NOx (Tons)	VOC (Tons)	PM10 (Ton	CO (Tons/	SOx(Tons/yr)
POVs on post	lb/mile	1000	10	200	2000000		0.007	0.002	0.0003	0.0024	0.0004	7	2	0.3	2.4	0.4
POVs off post	lb/mile	2000	40	200	16000000		0.004	0.002	0.0003	0.0024	0.0004	32	16	2.4	19.2	3.2
Light Duty Gasoline V	lb/mile	10	20	N/A	250	50000	0.007	0.021	0.0003	0.237	0.0004	0.175	0.525	0.0075	5.925	0.01
Light Duty Gasoline Tr	lb/mile	3	10	N/A	250	7500	0.003	0.007	0.0002	0.068	0.0001	0.01125	0.02625	0.00075	0.255	0.000375
Heavy Duty Gasoline Tr	lb/mile	2	20	N/A	150	6000	0.01	0.006	0.0003	0.066	0.0004	0.03	0.018	0.0009	0.198	0.0012
Light Duty Diesel Truc	lb/mile	2	20	N/A	150	6000	0.004	0.002	0.001	0.008	0.001	0.012	0.006	0.003	0.024	0.003
Heavy Duty Diesel Tru	lb/mile	2	20	N/A	150	6000	0.045	0.014	0.006	0.053	0.007	0.135	0.042	0.018	0.159	0.021
Shipping Truck	lb/hr	2	N/A	4	40	320	1.691	0.152	0.139	0.674	0.142	0.27056	0.02432	0.02224	0.10784	0.02272
Dump/haul Truck	lb/hour	2	N/A	4	60	480	1.69	0.149	0.138	0.674	0.142	0.4056	0.03576	0.03312	0.16176	0.03408
Boilers		20					0.0011	0.0001	0.0001	0.0009	0	0.002	0.002	0.002	0.018	0
Total Operations Emissions												40.04141	18.67933	2.78751	28.4486	3.692375
Helicopter Activity	Units	# helos		No Hours		Total Hrs	Lb. Emissions are per hour of flight									
CH47	Chinook	24		100		2400	4.17	4.01	0.51	5.01	0.09	5.004	4.812	0.612	6.012	0.108
UH60	BlackHwk	38		100		3800	8.11	3.24	0.03	3.24	0.09	15.409	6.156	0.057	6.156	0.171
AH64	Apache	48		100		4800	3.81	3.75	0.32	3.89	0.09	9.144	9	0.768	9.336	0.216
Total for New Helicopter Emissions per year						11000						29.557	19.968	1.437	21.504	0.495

Economic Impact Forecast System (EIFS) Model

Socioeconomic Impact Assessment

Socioeconomic impacts are linked through cause-and-effect relationships. Military payrolls and local procurement contribute to the economic base for the ROI. In this regard, the addition of 8,000 soldiers to Fort Hood, as well as the construction of the tactical vehicle road, temporary facilities to service the incoming soldiers, and construction of the helicopter hanger would have a multiplier effect on the local and regional economy. With the proposed action, direct jobs would be created, generating new income and increasing personal spending. This spending generally creates secondary jobs, increases business volume, and increases revenues for schools and other social services.

The Economic Impact Forecast System

The U.S. Army, with the assistance of many academic and professional economists and regional scientists, developed EIFS to address the economic impacts of NEPA-requiring actions and to measure their significance. As a result of its designed applicability, and in the interest of uniformity, EIFS should be used in NEPA assessments. The entire system is designed for the scrutiny of a populace affected by the actions being studied. The algorithms in EIFS are simple and easy to understand, but still have firm, defensible bases in regional economic theory.

EIFS is implemented as an on-line system supported by the U.S. Army Environmental Policy Institute (AEPI) through the Computer Information Science Department of Clark Atlanta University, Georgia. The system is available to anyone with an approved user-id and password. University staff and the staff of AEPI are available to assist with the use of EIFS.

The databases in EIFS are national in scope and cover the approximately 3,700 counties, parishes, and independent cities that are recognized as reporting units by federal agencies. EIFS allows the user to define an economic ROI by identifying the counties, parishes, or cities to be analyzed. Once the ROI is defined, the system aggregates the data, calculates multipliers and other variables used in the various models in EIFS, and prompts the user for forecast input data.

The EIFS Model

The basis of the EIFS analytical capabilities is the calculation of multipliers that are used to estimate the impacts resulting from Army-related changes in local expenditures or employment. In calculating the multipliers, EIFS uses the economic base model approach, which relies on the ratio of total economic activity to basic economic activity. Basic, in this context, is defined as the production or employment engaged to supply goods and services outside the ROI or by federal activities (such as military installations and their employees). According to economic base theory, the ratio of total income to basic income is measurable (as the multiplier) and sufficiently stable so that future changes in economic activity can be forecast. This technique is especially appropriate for estimating aggregate impacts and makes the economic base model ideal for the EA and EIS process.

The multiplier is interpreted as the total impact on the economy of the region resulting from a unit change in its base sector; for example, a dollar increase in local expenditures due to an expansion of its military installation. EIFS estimates its multipliers using a location quotient approach based on the concentration of industries within the region relative to the industrial concentrations for the nation.

The user inputs into the model the data elements which describe the Army action: the change in expenditures, or dollar volume of the construction project(s); change in civilian or military employment;

average annual income of affected civilian or military employees; the percent of civilians expected to relocate due to the Army's action; and the percent of military living on-post. Once these are entered into the EIFS model, a projection of changes in the local economy is provided. These are projected changes in sales volume, income, employment, and population. These four indicator variables are used to measure and evaluate socioeconomic impacts. Sales volume is the direct and indirect change in local business activity and sales (total retail and wholesale trade sales, total selected service receipts, and value-added by manufacturing). Employment is the total change in local employment due to the proposed action, including not only the direct and secondary changes in local employment, but also those personnel who are initially affected by the military action. Income is the total change in local wages and salaries due to the proposed action, which includes the sum of the direct and indirect wages and salaries, plus the income of the civilian and military personnel affected by the proposed action. Population is, of course, the increase or decrease in the local population as a result of the proposed action.

The Proposed Action would increase the number of soldiers permanently stationed at Fort Hood by 8,000. In addition, a tactical vehicle road, a helicopter hangar, and temporary facilities to service the incoming soldiers would be constructed on the installation. The current working estimate for the cost of construction of these facilities (\$142,000,000) was divided over the projected 2-year initial development period (2004 through 2006) and entered as the change in expenditures (\$71,000,000 per year). The 8,000 soldiers were entered as the change in military employment. The PCPI of the ROI (\$24,332) was entered as the average income of the affected military. An estimated 3 percent of the incoming soldiers would be living on-post in the newly constructed barracks.¹

The Significance of Socioeconomic Impacts

Once model projections are obtained, the Rational Threshold Value (RTV) profile allows the user to evaluate the significance of the impacts. This analytical tool reviews the historical trends for the defined region and develops measures of local historical fluctuations in sales volume, income, employment, and population. These evaluations identify the positive and negative changes within which a project can affect the local economy without creating a significant impact. The greatest historical changes define the boundaries that provide a basis for comparing an action's impact on the historical fluctuation in a particular area. Specifically, EIFS sets the boundaries by multiplying the maximum historical deviation of the following variables:

		<u>Increase</u>	<u>Decrease</u>
Sales Volume	X	100%	75%
Income	X	100%	67%
Employment	X	100%	67%
Population	X	100%	50%

These boundaries determine the amount of change that will affect an area. The percentage allowances are arbitrary, but sensible. The maximum positive historical fluctuation is allowed with expansion because economic growth is beneficial. While cases of damaging economic growth have been cited, and although the zero-growth concept is being accepted by many local planning groups, military base reductions and closures generally are more injurious to local economics than are expansion.

The major strengths of the RTV are its specificity to the region under analysis and its basis on actual historical data for the region. The EIFS impact model, in combination with the RTV, has proven successful in addressing perceived socioeconomic impacts. The EIFS model and the RTV technique for

¹ The Proposed Action includes construction of 131 barracks. Assuming 2 men per barrack, a total of 262 men, or 3 percent of the incoming soldiers (262/8,000=0.33), would live on-post.

measuring the intensity of impacts have been reviewed by economic experts and have been deemed theoretically sound.

The following are the EIFS input and output data for construction and the RTV values for the ROI. These data form the basis for the socioeconomic impact analysis presented in Section 4.9.2.1.

EIFS REPORT: FORT HOOD MODULARITY EA

PROJECT NAME

Fort Hood Modularity EA

STUDY AREA

48027 Bell County, TX

48099 Coryell County, TX

FORECAST INPUT

Change In Local Expenditures	\$71,000,000
Change In Civilian Employment	0
Average Income of Affected Civilian	\$0
Percent Expected to Relocate	0
Change In Military Employment	8,000
Average Income of Affected Military	\$24,332
Percent of Military Living On-post	3

FORECAST OUTPUT

Employment Multiplier	2.21	
Income Multiplier	2.21	
Sales Volume – Direct	\$164,942,900	
Sales Volume – Induced	\$199,581,000	
Sales Volume – Total	\$364,523,900	5.57%
Income – Direct	\$210,867,000	
Income - Induced	\$45,569,230	
Income – Total (place of work)	\$256,436,300	4.22%
Employment – Direct	9,020	
Employment – Induced	1,235	
Employment – Total	10,255	6.09%
Local Population	19,920	
Local Off-base Population	19,322	6.54%

RTV SUMMARY

	Sales Volume	Income	Employment	Population
Positive RTV	11.63%	10.14%	6.27%	8.01%
Negative RTV	-9.52%	-7.03%	-7.08%	-2.10%

RTV DETAILED

SALES VOLUME

Year	Value	Adj_Value	Change	Deviation	%Deviation
1969	454317	1985365	0	0	0
1970	517760	2138349	152984	56290	2.63
1971	565694	2240148	101799	5105	0.23
1972	690423	2644320	404172	307478	11.63
1973	785944	2837258	192938	96244	3.39
1974	892222	2899722	62464	-34230	-1.18
1975	1007278	3001688	101967	5273	0.18
1976	1135804	3202967	201279	104585	3.27
1977	1218319	3216362	13395	-83299	-2.59
1978	1348908	3318314	101951	5257	0.16
1979	1371213	3030381	-287933	-384627	-12.69
1980	1553815	3014401	-15980	-112674	-3.74
1981	1778075	3129412	115011	18317	0.59
1982	1926894	3198644	69232	-27462	-0.86
1983	2064580	3323974	125330	28636	0.86
1984	2353189	3623911	299937	203243	5.61
1985	2528490	3767450	143539	46845	1.24
1986	2633150	3844399	76949	-19745	-0.51
1987	2714518	4207503	363104	266410	6.33
1988	2859336	3888697	-318806	-415500	-10.68
1989	2931512	3781650	-107047	-203741	-5.39
1990	3020083	3714702	-66948	-163642	-4.41
1991	2868008	3384249	-330453	-427147	-12.62
1992	3390004	3864605	480355	383661	9.93
1993	3813490	4232974	368369	271675	6.42
1994	4198698	4534594	301620	204926	4.52
1995	4374356	4593074	58480	-38214	-0.83
1996	4611251	4703476	110402	13708	0.29
1997	4750806	4750806	47330	-49364	-1.04
1998	4911458	4813229	62423	-34271	-0.71
1999	5178075	4970952	157723	61029	1.23
2000	5461917	5079583	108631	11937	0.23

INCOME

Year	Value	Adj_Value	Change	Deviation	%Deviation
1969	501791	2192827	0	0	0
1970	567422	2343453	150626	11868	0.51
1971	624395	2472604	129151	-9607	-0.39
1972	758797	2906192	433588	294830	10.14
1973	888355	3206961	300769	162011	5.05
1974	992225	3224731	17770	-120988	-3.75
1975	1126140	3355897	131166	-7592	-0.23
1976	1275025	3595570	239673	100915	2.81
1977	1369178	3614630	19060	-119698	-3.31
1978	1522664	3745753	131123	-7635	-0.2
1979	1590862	3515805	-229948	-368706	-10.49
1980	1829923	3550051	34246	-104512	-2.94
1981	2093193	3684020	133969	-4789	-0.13
1982	2275769	3777776	93757	-45001	-1.19
1983	2449039	3942953	165176	26418	0.67
1984	2788957	4294994	352041	213283	4.97
1985	3016147	4494059	199065	60307	1.34
1986	3155355	4606818	112759	-25999	-0.56
1987	3288500	5097175	490356	351598	6.9
1988	3486521	4741669	-355506	-494264	-10.42
1989	3645726	4702986	-38682	-177440	-3.77
1990	3761737	4626937	-76050	-214808	-4.64
1991	3690907	4355270	-271667	-410425	-9.42
1992	4285856	4885876	530606	391848	8.02
1993	4751280	5273921	388045	249287	4.73
1994	5181761	5596302	322381	183623	3.28
1995	5444070	5716273	119971	-18787	-0.33
1996	5783898	5899576	183303	44545	0.76
1997	6071749	6071749	172173	33415	0.55
1998	6364695	6237401	165652	26894	0.43
1999	6758612	6488267	250866	112108	1.73
2000	7132356	6633091	144824	6066	0.09

EMPLOYMENT

Year	Value	Change	Deviation	%Deviation
1969	84657	0	0	0
1970	86247	1590	-1289	-1.49
1971	86375	128	-2751	-3.18
1972	93431	7056	4177	4.47
1973	98741	5310	2431	2.46
1974	102690	3949	1070	1.04
1975	106803	4113	1234	1.16
1976	111121	4318	1439	1.29
1977	113141	2020	-859	-0.76
1978	116079	2938	59	0.05
1979	110560	-5519	-8398	-7.6
1980	113470	2910	31	0.03
1981	116930	3460	581	0.5
1982	117140	210	-2669	-2.28
1983	117879	739	-2140	-1.82
1984	122209	4330	1451	1.19
1985	126969	4760	1881	1.48
1986	128843	1874	-1005	-0.78
1987	132831	3988	1109	0.83
1988	135150	2319	-560	-0.41
1989	135497	347	-2532	-1.87
1990	134385	-1112	-3991	-2.97
1991	124141	-10244	-13123	-10.57
1992	135169	11028	8149	6.03
1993	147279	12110	9231	6.27
1994	158786	11507	8628	5.43
1995	163794	5008	2129	1.3
1996	165704	1910	-969	-0.58
1997	168351	2647	-232	-0.14
1998	171656	3305	426	0.25
1999	174568	2912	33	0.02
2000	176786	2218	-661	-0.37

POPULATION

Year	Value	Change	Deviation	%Deviation
1969	153274	0	0	0
1970	160303	7029	1998	1.25
1971	164506	4203	-828	-0.5
1972	182540	18034	13003	7.12
1973	203911	21371	16340	8.01
1974	209172	5261	230	0.11
1975	208269	-903	-5934	-2.85
1976	217154	8885	3854	1.77
1977	219762	2608	-2423	-1.1
1978	223925	4163	-868	-0.39
1979	219993	-3932	-8963	-4.07
1980	215958	-4035	-9066	-4.2
1981	220807	4849	-182	-0.08
1982	226549	5742	711	0.31
1983	229601	3052	-1979	-0.86
1984	231777	2176	-2855	-1.23
1985	239632	7855	2824	1.18
1986	240129	497	-4534	-1.89
1987	246347	6218	1187	0.48
1988	248996	2649	-2382	-0.96
1989	252860	3864	-1167	-0.46
1990	255995	3135	-1896	-0.74
1991	252206	-3789	-8820	-3.5
1992	257110	4904	-127	-0.05
1993	272288	15178	10147	3.73
1994	292778	20490	15459	5.28
1995	296903	4125	-906	-0.31
1996	301687	4784	-247	-0.08
1997	304561	2874	-2157	-0.71
1998	307900	3339	-1692	-0.55
1999	308150	250	-4781	-1.55
2000	314252	6102	1071	0.34

***** End of Report *****