

Fort Campbell

Installation Sustainability Baseline



September 2003



Message from the Garrison Commander



In a 4 December 2000 letter, the Secretary of the Army challenged the participants in the first Army Worldwide Environmental & Energy Conference to strive towards a common vision of sustainable installations:

“The goal is to map out a new vision for the management of our installations, a holistic approach to sustaining our installations well into the 21st Century while simultaneously fostering transformation... Installation commanders will need to integrate the critical components of energy and natural resource management, construction, procurement, and environmental protection for our long-term success... Our installations must be fully functional now, thirty years from now, and well into the next century. This means we must not deplete our irreplaceable resources and must also reduce our polluting emissions as much as possible... The land resources we depend on for training and testing need to be fully accessible and utilizable, and we must protect the invaluable natural resources entrusted to our care as jealously as we do the freedom that Americans entrust us to safeguard.”

The directive from the Army leadership is clear: we must manage our resources to support the present mission of Fort Campbell – ***To support training, mobilization, and deployment of mission-ready forces. We provide services, facilities and a safe environment for our soldiers, civilians, retirees, veterans and their families while transforming for the future*** – without compromising our ability to accomplish our future missions.

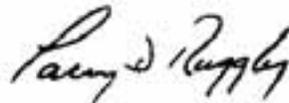
Fort Campbell is one of the nation’s premier power projection platforms. We are strategically located on the Tennessee/Kentucky state line and possess a unique capability to deploy mission-ready contingency forces by air, rail, highway and inland waterway. Fort Campbell is proud to be the home of the only Air Assault Division in the world, the 101st Airborne Division (Air Assault). We are also the home of two important Special Operations Command units, the 5th Special Forces Group (Airborne) and the 160th Special Operations Aviation Regiment (Airborne). Additionally, we are the home to the 101st Corps Support Group, the 86th Combat Support Hospital, the 716th MP Battalion, and sizable Medical and Dental activities. We also provide training and mobilization support for numerous Army National Guard and Army Reserve units. Fort Campbell is truly an Army installation that supports active and reserve component units, Army civilians, Army families, retirees and veterans.

Fort Campbell is one of the largest military reservations in the world. The “City of Fort Campbell” is a self-sustaining military community supporting approximately 276,000 soldiers, family members, reserve component soldiers, retirees, and civilian employees. We cherish the natural, cultural, and historical significance of this place—where we live, work, and train. We derive our living from this land and its resources, but more importantly, it defines our values, history, and the ultimate legacy that we leave behind for future generations to build upon. Our responsibility to those future generations requires us to sustain our resources through wise stewardship, conservative management, and cooperative regional planning. This is the proud legacy that must define Fort Campbell now and well into the future.

Tough challenges confront us in our quest to sustain this legacy in the 21st century, and to leave a positive legacy for future generations. Each of these challenges will require the integration of sound economic principles, mission focus, and environmental stewardship while we continue to focus on providing the kind of customer service and support necessary for our units to maintain the highest possible state of readiness. As we address the sustainability challenges outlined in this document, we will continue to adhere to our vision - ***To be the benchmark for the Army in people, readiness, resources and transformation.***

At our Installation Sustainability Workshop, which will take place 9-11 September of this year, we will bring together Fort Campbell, our higher headquarters, the Department of the Army and members of the local and regulatory communities. At this conference, we will set 25-year goals addressing the daunting challenges described in this baseline. We must recognize the importance of both our needs and our responsibilities as regional citizens—as well as those of our partners.

Meeting these challenges will not be easy. Commitment and cooperation will be required across environmental, facilities, procurement, and operations staffs. Nor will we succeed without the vigorous participation and support of our neighbors, our headquarters in Atlanta and Washington, and our partners in local, state and federal agencies. Here is my charge to you: examine the issues set forth in this document, determine the end state we want to achieve, set aggressive, attainable, and quantifiable goals and pull together as teams with the right stakeholders to ensure Fort Campbell's history of proud service to the nation and the world continues indefinitely.



Larry D. Ruggley
Colonel, U.S. Army
Garrison Commander

Table of Contents

Executive Summary.....	1
Training Support.....	3
Infrastructure.....	21
Procurement.....	41
Regional Development.....	57
Transportation.....	69
Appendix A – Acronyms and Abbreviations.....	A-1



Sustainability Challenges

Training Support – Fort Campbell exists to provide trained, combat-ready units and forces to the nation. How can Fort Campbell ensure that installation lands and infrastructure will support training and combat readiness and sustain the natural resources upon which it depends?

Infrastructure – Facility construction, operation, maintenance, and demolition at Fort Campbell are costly and produce many environmental impacts, but are vital to providing good quality of life. How can Fort Campbell provide infrastructure that meets the needs of users, and reduces overall costs, environmental impacts, waste, and dependence on non-renewable energy sources?

Procurement – Fort Campbell's procurement of products and services significantly contributes to costs, waste, and exposures to health and environmental hazards. How can Fort Campbell purchase products and services that will reduce life cycle costs, impacts from waste disposal, and exposures to hazards, while promoting sustainable manufacturing and stimulating local/national markets for environmentally preferable products?

Regional Development – The Clarksville-Hopkinsville Metropolitan Statistical Area (MSA) is among the fastest growing in the region and part of the most rapidly growing area in the United States. How can Fort Campbell and its regional partners ensure sustainable regional development that protects and enhances the mission of Fort Campbell, the regional environment, and the regional quality of life?

Transportation – Traffic congestion, dependence on oil, and vehicle emissions contribute to a growing regional air quality problem. How does Fort Campbell support its rapid deployment mission and ensure cost-effective, reliable, safe, secure, and pollution-free transportation systems in partnership with the local communities and states?



Executive Summary

THIS PAGE INTENTIONALLY LEFT BLANK



Challenge

Fort Campbell exists to provide trained, combat-ready units and forces to the nation. How can Fort Campbell ensure that installation lands and infrastructure will support training and combat readiness and sustain the natural resources upon which it depends?

Key Considerations

- **Range Capabilities** – Appropriate, adequate, and available ranges and maneuver space must be a key consideration now and into the future. The Range Development Plan (RDP) identifies programs and projects to address current and projected needs.
- **Endangered Species** – A number of plant and animal species exist in and around the Fort Campbell area that require special management, including the federally listed endangered Indiana bat and gray bat. Several state-listed threatened or endangered plant and animal species are also found on-post. The presence of endangered species has not restricted training up to now. The scheduling of some non-training activities such as timber harvesting or bridge maintenance has been adjusted due to the presence of the bats. To protect some sensitive plant species, activities such as mowing and intense off-road vehicle traffic are restricted in a few areas until after frost to allow time for annuals to release seeds.
- **Noise** – Fort Campbell is located near off-post areas that are growing rapidly. Military noise from Campbell Army Airfield, Sabre Heliport, helicopter flights, and high explosive detonations extend off-post into the community. The potential noise impact on communities as they develop and change could cause negative impacts on training and the community in the future.
- **Encroachment** – As the surrounding communities grow ever closer to the Fort Campbell fence line, land use patterns, zoning requirements, and planning become even more critical to Fort Campbell's on-going mission and the quality of life for the surrounding community.
- **Water Quality** – Military training activities impact water quality in a number of ways. Residue from the detonation of ammunition, high explosives, and other military munitions pose a potential threat to groundwater and surface water quality. Sediment from dirt roads and firebreaks, training land erosion, unprotected stream crossings, and areas denuded of vegetation adversely affect stream water quality. The potential for damage to water resources from fuel spills must also be recognized. Little West Fork Creek, including Piney Creek, and Fletcher's Fork Creek are on the 303(d) list of impaired streams in Tennessee. The state has expressed interest in restoration of these water bodies.
- **Cultural Resources** – Restrictions on digging and maneuver activities are used to protect known and potentially significant archeological sites. These limitations have removed some of the realism and training value associated with free flowing maneuvers, thereby impacting the mission.



Importance to Fort Campbell

Mission – Intense and realistic combat training requires unencumbered access to adequate land. Training constraints, which can degrade readiness, are often imposed to prevent or minimize impacts to threatened and endangered species (TES), cultural resources, people, and water resources. Fort Campbell’s approximate land uses are summarized below:

- Total area: 105,000 acres
- Built-up or cantonment area: 14,000 acres
- Training areas, ranges, and impact areas: 91,000 acres

Quality of Life – By-products of military training include noise, dust, vehicle/aircraft air emissions, smoke, and residue. Residue can be ordinary solid waste, abandoned training material, such as wire, or firing residue and unexploded ordnance (UXO). The quality of life of Fort Campbell’s soldiers and families, as well as the surrounding community, can be affected directly by related by-products and indirectly by degradation of the air, water, and natural environment.

Cost of Operation – Damage to land caused by military training is costly to monitor and repair. Both the Integrated Training Area Management (ITAM) program and the Integrated Natural Resources Management Plan (INRMP) require significant annual funding. In the current INRMP, the estimate for total costs of implementation is \$35.9M, or approximately \$7M per year. Actual funding has averaged approximately \$4.5M per year for the first four years of the INRMP.

Fort Campbell does not routinely buy land. In fact, the installation has only purchased new land once in the past 50 years. In 2000, the installation bought 130 acres as part of the Sabre Airfield expansion project. The land purchase was necessary to prevent an off-post land development project. The project—a subdivision adjacent to the installation boundary at Sabre Heliport—threatened the use of Sabre for night training of helicopter pilots using night vision devices.

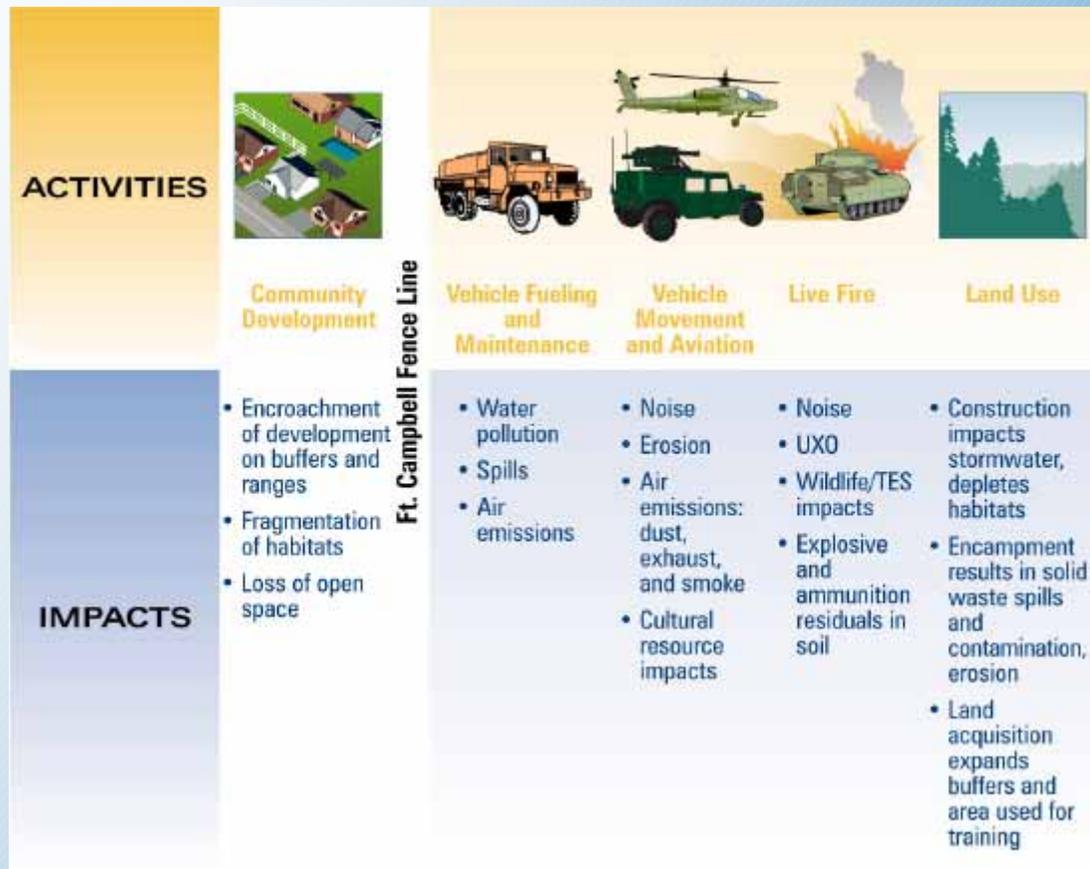
Environment and the Community – Residential and commercial development close to installation boundaries increases the risk that off-post neighbors will be affected by training activities on Fort Campbell. Issues caused by “neighborhood” trespassing and community concerns regarding munitions, smoke, fire, and general safety are magnified as development grows closer to the training area. Training results in residues, air and water impacts, and noise. All of these impacts can cause public concern.



Significant Impacts

Fort Campbell convened a working session the week of 28 July to better define the relationships between Fort Campbell's training support activities and the environment. Participants included representatives from across the Garrison staff, plus several planners from local communities. Figure 1 below summarizes the critical impacts identified during the working session.

Figure 1 – Significant Environmental Impacts for Training Support



Participants determined significance based upon the potential impact to the mission, the surrounding community, current and future costs, compliance considerations, and long-term sustainability. The participants scored noise pollution, water quality, land use and condition, community encroachment, and ordnance residues as the most significant categories of impact associated with training support.



Introduction

Fort Campbell is located in southwestern Kentucky and northwestern Tennessee, within portions of four counties—Christian and Trigg Counties in Kentucky and Montgomery and Stewart Counties in Tennessee. Growth and encroachment are most pronounced in Christian and Montgomery Counties. The land surrounding Fort Campbell consists of farmlands, woodlands, and urban areas that include Clarksville, Oak Grove, Hopkinsville, and development along U.S. Route 41A. Fort Campbell lies within the Western Highland Rim physiographic province, which forms a transition area between Kentucky farmlands to the north, the steeply dissected and wooded rim of the Cumberland River to the south and west, and gently rolling hills of low to moderate relief to the east. Average annual precipitation is approximately 49 inches and is generally well distributed over the year. Prevailing winds are southerly throughout the year, with the exception of February and October when the direction turns northerly.

Fort Campbell is an Army power projection platform. Therefore, intense, realistic military training is critical to Fort Campbell's mission. Fort Campbell's training areas cover about 90,000 acres, and consist of ranges, impact areas, drop zones, and maneuver areas. Approximately 63,525 acres are designated as light maneuver areas. The training mission at Fort Campbell requires intensive land use. Fort Campbell's training areas are used almost every day of the year by active, reserve, and National Guard units.

Regulations At A Glance

Various regulations impact or potentially restrict Fort Campbell's ability to use lands for training activities. These include:

- **National Environmental Policy Act (NEPA)** – This legislation directs federal agencies to evaluate planned land use activities and resolve potential environmental issues before initiating use or activity.
- **National Historic Preservation Act (NHPA)** – This act was enacted in 1986 to protect the nation's historical resources by establishing a comprehensive national historic preservation policy.
- **Endangered Species Act (ESA)** – This legislation establishes a list of species that must be considered in land use decision-making. The goal is to protect struggling species and their habitats.
- **Clean Air Act (CAA)** – This act establishes regional air quality standards and can allow prescriptive restriction of activities in areas where air quality standards are not met.
- **Clean Water Act (CWA)** – This act establishes national water quality standards that are translated into watershed specific requirements. Contamination or disruption of aquifers can result in fines and additional actions to address related issues.
- **Resource Conservation and Recovery Act (RCRA)** – This act requires the proper management of hazardous and solid wastes. Non-adherence can result in mandatory remediation and fines.
- **Sikes Act** – Under the Natural Resource Management on Military Lands Act of 1960, commonly known as the Sikes Act, the Secretary of Defense shall carry out a program to provide for the conservation and rehabilitation of natural resources on military installations.
- **Archaeological Resources Protection Act** – The act provides for the protection of archaeological resources and sites that are on public lands.
- **Native American Graves Protection and Repatriation Act** – This act addresses the rights of lineal descendants, Indian tribes, and Native Hawaiian organizations to Native American human remains, funerary objects, sacred objects, and objects of cultural patrimony. It requires federal agencies and museums (institutions that receive federal funds) to provide information about Native American cultural items to parties with standing, and upon presentation of a valid request, dispose of or repatriate these objects to them.



According to the current Range Development Plan, Fort Campbell has less than one-third of the total maneuver land required for these units to train properly. The military units at Fort Campbell maintain readiness and proficiency through mitigating actions such as using other training areas in the Kentucky/Tennessee area, rotating to the National Training Center and the Joint Readiness Training Center, and using the same terrain at the installation for multiple iterations of training events more often than recommended by Army standards.

Fort Campbell has 29 basic marksmanship ranges, 12 collective live fire ranges, 39 indirect fire ranges, and 6 special/other live fire ranges. Fort Campbell has 22 non-live fire facilities and 52 maneuver training areas.

Proper management and conservation of existing training areas are imperative to the continued level of readiness at Fort Campbell. Rehabilitation and maintenance of the land are on-going requirements and are costly. Programs in both G3/DPTM and the Conservation Branch in Public Works Environmental Division focus on training area features and natural resource management.

Preventing degradation and optimally maintaining existing training areas are imperative. Acquiring additional nearby land suitable for training is not considered likely. In addition, as off-post rural lands become developed, state and local governments look to installation land for needed infrastructure improvements and other requirements. Recent requests for Fort Campbell's Army land have been made for the widening of Highway 79, utility easements, and expansion of the Bi-County landfill. Over the years, Fort Campbell has granted many requests for use of its land for these purposes. However, excessive use of the property to satisfy these requests reduces the buffers for training-related impacts. As buffers decrease and community development moves closer to the installation boundaries, complaints regarding noise and training impacts increase. Community complaints can lead to interruption of training activities.

A perception exists among part of the general public that the Army has a vast quantity of land at Fort Campbell that is not fully utilized. Therefore, the public believes that this open space should be used for unobtrusive activities. Many individuals in pursuit of recreational activities (e.g., driving vehicles off-road, horseback riding, dog-training, and fishing) do not follow the procedures to gain proper access to the installation. Others are engaged in illegal actions (e.g., game poaching, releasing wild hogs, drug manufacturing, disposing of drug paraphernalia, household refuse dumping, and unauthorized discharging of firearms). These activities place the health and safety of both the soldiers and the public at risk and are disruptive to training.

Useful Information

The following information is necessary to determine current and potential impacts on training areas and the community, and to establish sustainable training and management practices:

- How much pollution from off-post sources is moving onto the post in stream and groundwater flow?
- What impact does training have on water resources and wildlife at Fort Campbell?
- How much sediment is delivered into surface waters? What is the source?
- How much particulate matter (PM) do normal training activities contribute to the environment? How will potential non-attainment with the PM_{2.5} standard affect training?



Campbell Army Airfield (CAAF) runway approach and departure zones extend off-post for several thousand feet. Potential for residential and other construction in these zones prompted the Army to seek a costly “avigational” easement to prevent incompatible development, which is currently under way. Other off-post easements have been acquired to restrict land use in the blast danger zones for ammunition loading of aircraft at CAAF. Fort Campbell recently obtained the title to approximately 130 acres to protect night vision flight training at Sabre Heliport from the intense lighting associated with a planned residential development adjacent to installation boundaries.

Activities and Impacts

Training activities can impact local residents, cultural resources, and wildlife, including state and federally listed endangered species. Training can contaminate the soil, surface and ground water, and emit air pollutants. As the surrounding communities grow toward Fort Campbell, training activities may impact the civilian population.

Range Development Plan

The current RDP dated November 2000 considered force modernization for a 5-year period. Listed below are some findings from the RDP on improving Fort Campbell’s ranges:

- Construct a sniper field fire range
- Modernize an existing facility to a standard Military Operations in Urban Terrain (MOUT) assault course (live fire)
- Modify one existing Infantry squad battle course to standard
- Modify one existing platoon battle course to standard
- Modernize Range 28 to a Multi-Purpose Range Complex-Light (MPRC-L) digital
- Acquire additional maneuver training land
- Construct a new aerial gunnery range
- Construct a standard MOUT central training facility

Additional needs and projects identified for training aid devices, simulations, and simulators (TADSS) include:

- Aircraft Survivability Equipment Trainer,
- U.S. Army Operator Driver Simulator, and
- Engagement Skills Trainer.

Wildlife Habitat and Endangered Species

A rare and endangered animal species survey was conducted on the installation from 1 July 1993 through 15 November 1994. Taxa targeted in the survey include mammals, birds, reptiles, amphibians, fish, crustaceans, and mollusks known or suspected to occur on Fort Campbell and in the surrounding area. Twenty-two state-listed species and no federally listed species were recorded from the survey.



Subsequent to this survey, Fort Campbell conducted a bat survey during the summer of 1998 that included cave surveys and mist netting.

Results of the 1998 sampling effort identified the presence of two federally listed endangered species, the gray bat (*Myotis grisescens*) and Indiana bat (*Myotis sodalis*). These bats have been captured in mist nets on the installation. Gray bats have been caught along Saline Creek, Piney Fork Creek, Jordan Creek, Fletcher's Fork Creek, and Noah Spring Branch. Gray bats have also been identified roosting under a bridge on the installation, although no gray bats have been identified in caves on the installation. Thus far, only two Indiana bats have been identified foraging in the riparian areas of the installation as part of the same mist netting program. It is not known to what extent Indiana bats may be using forests as roosting locations. The installation has completed an endangered species management plan for the bats and consults routinely with the U.S. Fish and Wildlife Service (USFWS) on projects that involve bat considerations. So far, only the scheduling of the hardwood timber harvest and timing of bridge maintenance have been affected by the presence of endangered species. Independent of any formal surveys, however, the bald eagle, listed as threatened, has been sighted at Lake Kyle but is not known to breed or regularly forage on-base. The sightings of the bald eagle at Lake Kyle have been infrequent.

Noise

Training activities are the primary sources of noise at Fort Campbell. These sources include fixed- and rotary-wing aircraft operations and heavy weapons firing. Major airfields on the installation include CAAF, Sabre Heliport, and Golden Eagle Assault Airfield. The main runways at CAAF run northeast-southwest. Helicopter corridors run primarily along the perimeter of the installation, as well as through the interior of the installation running east to west. Numerous rotary-winged aircraft are stationed at Fort Campbell and are used extensively throughout the rear area, as well as areas adjacent to the installation, as part of the military operations conducted principally by the 101st Airborne Division and 160th Special Operations Aviation Regiment. Heavy weapons firing is conducted from firing positions throughout the training area with projectiles detonating in the North and South Impact Areas located in the western portion of the installation. Small arms ranges and the associated impact area are located in the eastern portion of the installation near the built-up area. Blast noise emanates from several demolition areas located in the central portion of the installation in the training area.

As part of the Installation Compatible Use Zone (ICUZ) Program, Fort Campbell has mapped noise zones that depict the relationship between noise levels and land use. ICUZ noise zones are generally defined as follows:

- Zone I. This area, considered to have moderate to minimal noise exposure, is acceptable for noise-sensitive land uses.
- Zone II. This area is considered to have significant noise exposure and is "normally unacceptable" for noise-sensitive land uses.



Zone III. This zone is considered an area of severe noise exposure and is unacceptable for noise-sensitive activities.

Results of the noise zone modeling indicated that Noise Zone II and III areas extend beyond the installation boundaries and incompatible development is present within those zones. Noise Zone II contours for Sabre heliport extend beyond the installation boundaries to the east and south approximately 2,000 feet. Noise contours for blast noise indicate that Noise Zone II (normally unacceptable) contours extend beyond the installation boundaries in three places in the vicinity of Lafayette to the north and Big Rock to the southwest. The largest extension off-post is in the vicinity of Lafayette, where the Noise Zone II contour extends approximately 5,000 feet off-post and includes 75 percent of the city. Noise contours associated with aircraft corridors indicate the presence of Zone II contours off-post around the entire periphery of the installation. The Noise Zone II corridors extend into residentially developed areas along U.S. Highway 79 and in the vicinity of Roaring Springs and Big Rock.

Although installation noise is considered to have only a slight impact on surrounding land use, noise complaints related to certain military activities have been received. Fort Campbell maintains records of noise complaints received regarding military operations. By far, the principal noise complaint issues have involved helicopter flights, principally to the southeast around Clarksville, Tennessee. Artillery complaints also have been made from the southeast and southwest. Fort Campbell has completed a Joint Land Use Study (JLUS) to assist in addressing noise abatement issues, land use incompatibility, future land use planning, and noise complaint resolutions.

Also, in November 2000, Fort Campbell completed the current Environmental Noise Management Plan (ENMP), which includes educational elements, complaint management, noise and vibration management, noise abatement procedures, and the ICUZ program. The noise program aims to reduce incompatible land uses around the installation that can severely impact the mission. County and municipal governments are encouraged to support public disclosure of noise zones and noise easements. The ENMP includes recommended actions for both the public and Fort Campbell.

Cultural Resources

Cultural resources at Fort Campbell date from the earliest human occupation of the New World (the Paleo-Indian Period) to the 20th century. As of March 2003, 1,264 archeological sites have been identified within the installation, 10 have been determined eligible for listing on the National Register of Historic Places (NRHP), and 310 of have been determined to be potentially eligible for listing on the NRHP. In addition, a 1971 survey identified 175 cemeteries on the installation.

Settlers moved into the area during the early part of the 19th century, and small communities developed, including Lafayette, Garettsburg, Jordan Springs, Asbury, Weaver's Store, New Providence, Pardertown, Oak Grove, and Legate. The area that is now Fort Campbell remained rural and primarily agricultural until the Army began purchasing property from small farmers in 1941. All civilian families were removed by June 1942, and most of the original premilitary structures were



razed or moved (USACE, 1993). During this time many historic cemeteries and interred remains were also moved off the installation. Fort Campbell was formally commissioned as Camp Campbell on 6 March 1942.

At least 224 historic archeological sites or components of sites have been identified within Fort Campbell. This number includes 73 19th-century sites and 104 20th-century sites. Also, 47 historic sites or components of sites that cannot be dated have been located within the boundaries of the installation.

A Programmatic Agreement (PA) has been executed among the U.S. Army, the Kentucky State Historic Preservation Officers (SHPO), the Tennessee SHPO, the Advisory Council on Historic Preservation, and the Fort Campbell Army Installation. The purpose of the agreement is to stipulate the measures that the U.S. Army will carry out to comply with the requirements of Section 106 of the National Historic Preservation Act (NHPA).

Air Quality

Air emission sources from military training, conservation, and range management activities include vehicle/aircraft engine operation, fueling and transfer of fuel, agricultural harvest and tillage, construction equipment, pesticide application, wildfires, prescribed burning, road dust, aircraft dust during takeoff/landings, graphite/smoke generators, and munitions firing including smoke grenades. Fort Campbell restricts prescribed burning, forest management activities, and smoke obscurant training near post boundaries, public roads, and the cantonment area.

Water Quality

Fort Campbell has documented water quality degradation in some of the streams in the watersheds on the installation. Degradation is almost exclusively due to the high rates of sedimentation caused by erosion. Erosion control efforts under the current Integrated Training Area Management (ITAM) and INRMP programs are reducing the erosion problems on portions of the installation.

Many training activities also create soil compaction, disturb vegetation, and cause general erosion problems within the training area and along stream banks. Very little data is available on chemical contamination of the surface and ground water from range and training operations at Fort Campbell. While the exact impact is unknown, public and regulatory concerns have increased in the past five years concerning the potential effects of munitions in soil, surface water, and groundwater on human health and wildlife.

RDX is a chemical found in many military explosives. It has been found in two areas on the installation—an abandoned quarry that was previously used as an explosive demolitions training area and a groundwater monitoring well near an area that was used in the past for demolitions training and destruction of military munitions by thermal treatment. Fort Campbell continues to monitor the groundwater at these sites, and has begun cleanup and closure of the groundwater monitoring well.



Contamination could affect Fort Campbell's mission. Munitions use and management of training lands could be minimized or altered as a result of regulation or public pressure. Also, in the future, training areas may require special management to prevent contamination of surface waters and groundwater from munitions residue.

Forecast

The predicted average growth rate for the four counties in the Clarksville-Hopkinsville Metropolitan Statistical Area (MSA) is 38 percent over the next 20 years. The four-county population is expected to increase from 230,000 to 315,000 by 2020. Such growth will translate into additional demands and pressures on the natural resources in the region.

Realistic and effective military training requires significant acreage of undeveloped land. The land area of Fort Campbell has not changed substantially since it was established in 1942. It is unlikely that the installation will be able to purchase additional parcels of undeveloped land that are contiguous to existing training areas. The installation will seek cooperative use of other land belonging to conservation organizations, other military installations, and the State National Guard.

Fort Campbell's existing training areas will become increasingly crucial and valuable as the surrounding community develops. The installation has established a policy, in response to community requests for Army land, requiring no "net-loss" of training land and no reduction in installation training capabilities resulting from the request.

As urbanization and development occurs in the region, urban density on the east and southeast from Hopkinsville, Oak Grove, and Clarksville will increase. On the south along Highway 79, which is to be widened to four lanes, growth and development will accelerate.

Fort Campbell may realize additional training impacts because of species potentially headed for listing under the Endangered Species Act (ESA). Several state listed plants are found in unique grassland areas on-post known locally as "barrens." Restrictions may occur in barren type grasslands if the state listed species become federally listed. Listing of any of these species as "threatened" or "endangered" will require the installation to impose training restrictions necessary for recovery purposes.

Ground and surface water quality will be more of a concern as the population on and around Fort Campbell grows in the coming years. It will become imperative that existing surface and groundwater resources are protected for use by the region. In addition, there will be increased regulatory attention placed on potential pollution sources, and chemical contamination from munitions will undoubtedly be included. For example, environmental reporting requirements were expanded in 2001 to include munitions expended on the installation ranges.

RDX contamination can lead to catastrophic impacts on training. As an example, in 1996, the Environmental Protection Agency (EPA) stopped Army National Guard live fire training at the



Massachusetts Military Reservation (MMR) in response to community concerns over potential contamination of the sole source aquifer from munitions residue. The forced cessation of live fire at MMR is dramatic evidence of public concern over the potential effects of munitions and has led to the creation of the Department of Defense (DoD) Operational and Environmental Executive Steering Committee for Munitions (OEESCM) in September 1998. This committee develops recommendations for overarching DoD policies, positions, and action plans related to the lifecycle management of munitions, supporting readiness and balancing operational needs, explosives' safety, and environmental stewardship. Costs of such remediation are unknown, but are expected to be very high and could impact Fort Campbell's mission in the future.

Current Sustainable Activities

- **Land Rehabilitation and Maintenance (LRAM) / ITAM** – LRAM and ITAM projects are designed to achieve sustainable use of training lands by implementing a uniform program that inventories and monitors land conditions, determines carrying capacity of the land for training requirements, and provides for land rehabilitation and maintenance measures. ITAM and LRAM are on-going activities at Fort Campbell.
- **Land Condition Trend Analysis (LCTA)** – LCTA, which was initiated in 1992, is a program that captures all information to develop the carrying capacities and design areas for the sustainment of training lands so that future training missions can be met.
- **Training Requirements Integration (TRI)** – TRI is a part of the ITAM program. Its purpose is to integrate training requirements with land capability, identify ways to improve training via land management, integrate environmental considerations into range operations, and host the installation land management forum to foster integration of range/ITAM projects with other installation activities.
- **Integrated Natural Resource Management Plan (INRMP)** – The INRMP is in the fourth year of execution. A major update to the plan will be done after the fifth year to assess progress and accomplishments and to revise the plan as necessary.
- **Forest Management Plan (FMP)** – The FMP was approved in 2002 and is now being implemented. The FMP integrates military training with habitat management, sustainable timber production, and threatened and endangered species protection. It also incorporates standard operating procedures for prescribed burning and wildfire suppression.
- **Agricultural Outlease** – The Agricultural Outlease program leases approximately 5,000 acres to farmers for crop and hay production. This program provides a no-cost way to maintain large open areas such as dropzones. Revenues are reinvested in the program to protect and improve the land.



- **Integrated Cultural Resources Management Plan (ICRMP)** – Phase I and Phase II surveys continue. Programmatic agreements with the State Historic Preservation Officer are in place and functional. The digging permit process is in effect and is effective in protecting sites.
- **Endangered Species Management Plan (ESMP)** – The ESMP, which was approved by the U.S. Fish and Wildlife Service, describes the actions and measures to be taken to protect the two endangered species found on the installation—the Indiana bat and gray bat—and their habitats.
- **ENMP** – The current ENMP was completed in November of 2000. The ENMP incorporated and replaced the ICUZ program, providing a methodology for analyzing exposure to noise and safety hazards associated with military operations and land use guidance for achieving compatibility between the Army and the surrounding communities.
- **JLUS Participation** – Fort Campbell has completed a JLUS to assist in addressing noise abatement issues, land-use incompatibility, future land use planning, and noise complaint resolutions.

Realm of Possibilities

This section provides a glimpse of what can be accomplished with existing technology and what can be expected from developing sustainability approaches. To become sustainable, Fort Campbell is encouraged to identify and plan for innovations that will support long-term goals.

Training



- **Alternative Obscurants** – The U.S. Army Environmental Center has determined that certain types of signal smoke grenades and smoke pots may be releasing toxic substances that could endanger individuals and the environment. The research indicated that dyes in the hexachlorethane smoke pots could be carcinogenic. As a result, a project is underway to develop and test alternative obscurants with less toxic characteristics. If successful, these new dyes would increase individual safety while decreasing training restrictions implemented to protect surrounding communities. For more information, go to <http://www.estcp.org/projects/pollution/200122o.cfm>.
- **Decision Support Software** – Geographic Information System (GIS) decision support software, specifically designed to address military maneuvers with environmental conditions, is available. A management tool software package includes maps, an impact analysis, training area/range facility



management support, and a scheduling system. Examples of available maps may be found at <http://www.nobility.com/>.

- **Field Photovoltaic System** – The 504th Parachute Infantry Regiment, 82nd Airborne, has developed and tested a mobile photovoltaic system capable of providing up to 80 percent of the power required by a modern tactical operations center. Use of this system would remove the need for dirty diesel generators and improve air quality in and around installations.
- **Green Bullet** – The “Green Bullet” program is a DoD initiative to eliminate the use of hazardous materials in small caliber ammunition and during its manufacture. This fully integrated program, which is spearheaded by the Small Caliber Ammunition Group at the U.S. Army’s Armament Research, Development, and Engineering Center (ARDEC), encompasses all environmental aspects of the small caliber ammunition from 5.56 mm through 0.50 calibers. Specific thrusts include the elimination of ozone-depleting chemicals (ODCs), volatile organic compounds (VOCs), and heavy metals in the manufacture of primers and projectiles in the entire family of small caliber ammunition. For more information, see the Green Ammo web site (<https://www.pica.armby.mil/greenammo/>), which requires a secure channel.
- **Green Missile** – The Green Missile Program, an integrated pollution prevention research effort funded by the Strategic Environmental Research and Development Program (SERDP), is designed to develop alternative materials and technologies for solid rocket motor propulsion systems. The program has team members representing the Army, Navy, Air Force, National Aeronautics and Space Administration (NASA), Department of Energy (DOE), and EPA. The specific objectives of the program are: (1) to develop propellants for both extrudable and castable propellant processes that do not contain lead catalysts; (2) to develop and demonstrate complete and clean hydrochloric acid-free combustion; and (3) to develop and demonstrate the use of liquefied gases and supercritical fluids for environmentally friendly processing of energetic oxidizers and components, resulting in elimination of solvents and reduction of VOCs in the waste stream.
- **Tactical Alternative Fuel Vehicles (AFVs)** – While alternative fuels are not currently approved for use in tactical vehicles, advances in technology may someday allow tanks and armored personnel carriers to run on biodiesel, compressed natural gas, or fuel cells. Beyond the obvious benefit to air quality, moving toward the use of alternative fuels may also have operational benefits. Biodiesel, which is produced from refined vegetable oils, is one of the few truly renewable domestic fuel sources. Vehicles using biodiesel would be immune from variations in foreign oil supply.
- **Virtual Training** – “Virtual training” is the next step in readiness training. While flight simulators and interactive shooting ranges have been in use for years, the next generation of virtual training systems will incorporate unprecedented realism and give soldiers and airmen the ability to experience complex and dangerous combat scenarios in a 100 percent controlled environment.



Land Maintenance

- **Camp Ripley Study** – A two-year study was conducted at Camp Ripley, Minnesota, to determine the effects of tracked and wheeled tactical vehicles on soils and vegetation. The study provided scientific information concerning soil compaction and sensitivity of trees to intense military use (http://www.dma.state.mn.us/cpringley/envir/land_use_management.htm).
- **Tactical Concealment Area Planning** – The Tactical Concealment Area Planning and Design Guidance Document, developed by the Army Environmental Center and ARDEC, is an approach to designing training land that integrates training and environmental requirements to expand and improve training resources. Go to the technology section of the U.S. Army Environmental Center web site for more information: <http://aec.army.mil/usaec/technology/conservation06.html>.
- **Zero Footprint Camp** – The U.S. Army Materiel Command (AMC) recognizes that traditional waste management methods used for base camp operations are resource-intensive and create a substantial burden on the camps. These traditional methods also depend on contracted civilian waste management services, posing potential risk to the physical security of the area from terrorist activities. In response to these concerns, AMC developed the Zero Footprint Camp (ZFC) initiative to reduce the logistics footprint, operations and support costs, and environmental impacts of base camp operations. This initiative minimizes waste by applying “whole-systems” approaches to resource management, thereby finding cost-effective and technically feasible ways to reprocess and/or reutilize trash, grey water, black water, and food garbage within the camp. While the current ZFC initiative focuses primarily on solid waste and wastewater management, it will be expanded to cover other aspects of base camp operations. For more information, go to www.haifire.com/download/zfc.pdf.

Endangered Species



- **Computer Analyses** – Several nongovernmental groups have partnered to develop innovative software programs that allow users to assess habitat parameters such as suitability of areas for certain animals, general health of habitats, restoration potential, and data gaps.
- **GIS Technology** – GIS technology may be heavily used for wildlife studies. GIS enables the collection, retrieval, and storage of spatial information; identification of locations within an area that meet specific criteria; analysis of spatial data about biological resources for management



decisions; assessment of the impact of actions and alternatives; and measurement of the impacts of management decisions over time.

- **Greenbelts/Private Lands Initiative** – The Private Lands Initiative (PLI) is a cooperative effort among the U.S. Army Forces Command (FORSCOM), The Nature Conservancy, the U.S. Fish and Wildlife Service, and private landowners around the borders of an installation. By partnering with landowners and preventing that land from being developed, the PLI creates a “buffer zone” of sorts, which improves wildlife habitat around the edge of an installation. Increased habitat for endangered species outside the fence line decreases training constraints inside the fence line.
- **Satellite Imagery** – A Canadian group uses satellite imagery to determine the effects of environmental changes on migratory paths and patterns of endangered species. For more information, go to <http://www.gisdevelopment.net/aars/acrs/1998/ts11/ts11008pf.htm>.
- **Wildlife Cloning** – Researchers at the American Museum of Natural History and the Zoological Society of San Diego, among other institutions, are working to establish DNA banks for endangered animals. The future use of these DNA banks could include “cryopreservation,” where the frozen embryo of an endangered species could be implanted into a non-endangered host animal, thus preserving the donor species. Another possibility is nuclear replacement cloning where preserved cell lines for endangered animals could be replicated.

Noise and Encroachment



- **Development Planning Tools** – The U.S. Army Engineer Research and Development Center is developing tools to help installations understand the dynamics of urban change and how to develop better installation-community planning policies and forums. Some of this information may be found at <http://www.denix.osd.mil/LMS>.
- **Night Training** – Training between 2200 and 0700 hours has noise impacts that are especially difficult for local residents to cope with because of the lower background noise at night and the probability of being awakened. Much of night training serves to teach proficiency in the dark, which is not necessarily associated with the sensitive 2200 to 0700 period. Spring, fall, and winter months have many hours of darkness before 2200, and in many cases, it is possible to keep the large weapon component of the training in the period between sunset and 2200 hours.



- **Noise Buffers** – Creative solutions for developing noise buffers include building industrial sites, scrap yards, or recycling centers on lands adjacent to installations. Wildlife easements may also prevent development on adjacent lands.
- **Weather and Training** – The rate at which wind speed and temperature change as a function of altitude can have profound effects on the behavior of high-energy sound waves as they propagate off-range and many miles into the surrounding area. As weather conditions change, noise monitoring many miles from the firing point and impact area has shown 30-decibel variations within just a few hours for a single weapon and firing point. For a local resident, this amounts to an eight-fold increase in loudness over a very short time period. Regular sampling of meteorological conditions and good record keeping can help identify adverse conditions and lead to strategies to avoid them. Disclosure of this information and the role that weather can play in noise levels at the point of reception can do a great deal to improve the trust and credibility accorded the leadership at the range.

Water Consumption



- **Water Management Technologies** – Camp Dresser and McKee (CDM) have pioneered a number of water management technologies that help water security during times of drought. Aquifer storage and recovery (ASR) systems store stormwater and treated wastewater in underground “bubbles” where the water can later be removed. It increases water reserves in times of drought and decreases total drain on natural aquifers. CDM also helps design and build stormwater overflow systems and total maximum daily load (TMDL) management programs that help address point and nonpoint source pollution problems.
- **Compost Bioremediation** – Compost bioremediation uses a biological system of microorganisms in mature, cured compost to sequester or break down contaminants in water or soil. Compost bioremediation restores contaminated soil, manages stormwater, controls odors, and degrades VOCs. Seymour Johnson Air Force Base, North Carolina, implemented a compost remediation project, using alternating layers of yard waste compost, petroleum-contaminated soil, and turkey manure. The base saved \$133,000 in the first year of operation because of decreased costs of hauling, incinerating, and purchasing clean soil (www.afcee.brooks.af.mil/pro-act/cross/ed55.asp).
- **Composting Toilets** – Composting toilets eliminate the use of water to transport human waste, reducing indoor water use by 20-30 percent and providing a small amount of high-quality fertilizer. They consume only 1,825 gallons of water per year, compared to 200,000 gallons of water per year



in a traditional toilet, and without the treatment costs. The National Park Service and other outdoor recreation facilities nationwide use them extensively (www.rmi.org/sitepages/pid287.php).

- **Constructed Wetlands** – Fort Knox, KY, is conducting a feasibility study on the construction of a wetland that would link the sewage treatment plant outfall to the drinking water intake. Wetland plants and animals purify the wastewater as it flows through the wetland. Constructed wetlands have the potential for containing and treating nonpoint source pollution from ranges and other natural areas.
- **Drip Irrigation** – A drip irrigation system delivers a small amount of water directly to the root zone of plants as needed. Water use can be decreased by up to 75 percent using these systems in arid regions (www.energy.ca.gov/releases/1996_releases/96-11-19_ag_program.html).
- **Horizontal-Axis Washers** – A Directorate of Environmental Compliance and Management (DECAM) pilot study in 1998 demonstrated that these washers reduced water and saved money for maintenance, but were more costly than traditional washing machines. Laundry facilities account for 23 percent of residential water use as well as a similar proportion of residential sewage production. Horizontal axis washers, also known as front loading washers, use 40-75 percent less water (save 5,000 gallons of water per washer per year); use 50-65 percent less energy; clean clothes better with a less concentrated soap solution; and extend the life of clothes because they are not agitated. From 1996-98, U.S. manufacturers introduced these washers, which are used extensively in Europe. While initial costs are double that of conventional washers, they pay back the additional investment in three to four years through reduced energy, hot water, and soap (<http://www.buildinggreen.com/products/washers.html>).
- **Green Neighborhoods** – John Wesley Miller Company is building Armory Park del Sol, a PATH National demo project and model green community in Tucson, AZ. Each home has a solar hot-water heating system and solar off-peak electric generation, ultra-efficient insulation, and energy-conserving windows. These urban neighborhoods have been designed to use 65 percent less water through xersicaping, grey water recycling, and other methods. In addition, they qualify as affordable housing at \$90,000 (www.pathnet.org and www.aepi.army.mil).
- **Grey Water Recycling** – The future of sustainable water use is *in situ* water recycling and reuse. A large portion of the water we use becomes “grey water” when it is washed down our sinks and showers. This water, with minimal treatment by natural and cost-effective means, can be reused many times over for irrigation, flushing of toilets, and even dishwashing. The home or office of the future could provide up to 70 percent of its daily water needs through simple recycling of bath and laundry water. Treatment systems will be low-tech and cost effective—many times using natural bacteria and plants to clean water. The Rocky Mountain Institute estimates that 50-100 gallons of water per day are available for outdoor use in an average household with a grey water system. A system at the Roseland III office park in New Jersey reduced water use by 60 percent (<http://www.greenbuilder.com/sourcebook/Greywater.html> and <http://www.greywater.com/>).



- **Irrigation Meters** – Irrigation meters, in use in western Texas, save one- to two-thirds of water formerly used for irrigation. A \$1 block of gypsum, buried at the root zone, is connected through two wires to a clip-on meter that reads soil moisture.
- **Low-Flow Fixtures** – Low-flow toilets use a maximum of 1.6 gallons of water per flush compared to about 5-7 gallons of water used by a standard toilet. Low-flow showerheads use about 2.5 gallons of water per minute compared to between 4-5 gallons per minute used by conventional heads. Low-flow faucet aerators can cut the water usage of faucets by as much as 40 percent from 4 to 2.5 gallons per minute (www.dom.com/customer/efficiency/bus/hw_fixtures.jsp and www.water.ci.portland.or.us/waterflow.htm).
- **Xeriscaping** – Xeriscaping, a landscape design method that creates elegant and water-efficient landscapes that require little or no irrigation, uses native plants that are as attractive as traditional ones (<http://www.ciwmb.ca.gov/organics/xeriscaping/default.htm>).

Fort Campbell 25-Year Goals for Training Support

To be determined by Fort Campbell's Command and staff, as advised by members of the local and regulatory community, at the Installation Sustainability Workshop on 9-11 September 2003.

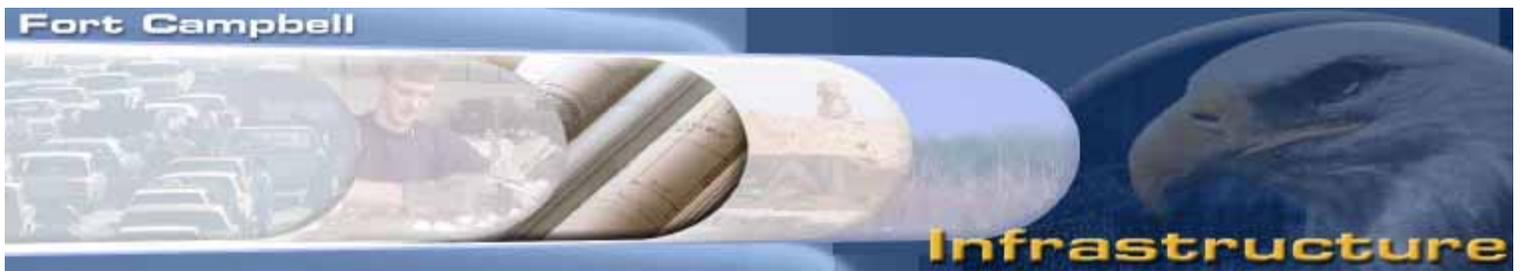


Challenge

Facility construction, operation, maintenance, and demolition at Fort Campbell are costly and produce many environmental impacts, but are vital to providing good quality of life. How can Fort Campbell provide infrastructure that meets the needs of users, and reduces overall costs, environmental impacts, waste, and dependence on non-renewable energy sources?

Key Considerations

- **Design and Construction** – The adoption of sustainable design and development (SDD) principles can significantly reduce the life cycle and operational costs of buildings, while also eliminating associated environmental impacts. The Army uses the Sustainable Project Rating Tool (SPiRiT) to evaluate the relative long-term sustainability of buildings. All Army construction must meet the SPiRiT “gold” standard by the FY06 construction program.
- **Maintenance and Repair** – Inadequately maintained buildings and mechanical systems waste energy and water, and require the constant investment of operations and maintenance (O&M) funds to maintain an unacceptable “status quo.” The ongoing privatization of Fort Campbell’s family housing and utilities may provide a strategic opportunity for reversing the current downward trend in maintenance levels and upward trend in O&M costs.
- **Energy Efficiency** – Energy efficient buildings and proactive energy management can conserve resources, save money, and ensure mission readiness. Future construction and infrastructure revitalization is an opportunity to improve on past design and practice, significantly reducing Fort Campbell’s energy costs.
- **Energy Source** – The Tennessee Valley Authority (TVA) provides electricity to Fort Campbell. The majority of this power is generated from coal-fired plants and hydroelectric turbines. Both sources create different environmental impacts—decreased regional air quality from coal-fired plants and impacts on the river systems from the management and release of waters to produce power. TVA and its business partners are promoting a Green Power Switch (GPS) program, offering power consumers greater opportunity to support renewable power generation in the Tennessee Valley. GPS Generation Partners is a program that provides incentives for the installation of solar and wind-generating facilities, making more “green power” available for any GPS subscribers who buy blocks of green power through their local participating power company. This program also creates a market for small-scale green power generation by homeowners and small businesses.
- **Water Use** – The incorporation of sustainability principles into the design, construction, and operations of the Fort Campbell infrastructure can reduce water demand, enhancing both the availability and quality of regional water resources, and saving associated energy. The reduced demand for water can also significantly decrease the use of treatment chemicals.



- **Water Pollution** – The proper maintenance and necessary upgrades of the stormwater and wastewater systems are necessary to reduce illegal discharges, bypasses, and releases into the environment. Many sustainable building practices maximize the natural ground absorption of rain water, reducing the pollution and costs of treating this runoff prior to final release into streams. On-site biological treatment systems can often reuse and treat building gray water and wastewater, reducing water pollution and associated treatment costs.
- **Construction & Demolition Solid Waste** – Conventional demolition of buildings is a major expense and produces large amounts of construction and demolition (C&D) waste, requiring large landfill volumes and permanently converting productive or training land into nonproductive landfill space. Modern, emerging building deconstruction and reuse techniques can reduce the overall costs of building disposal, enable the beneficial uses of salvaged materials, and drastically reduce landfill space requirements.
- **Air Emissions** – Air emissions on Fort Campbell are regulated by both Tennessee and Kentucky. While Fort Campbell is currently in an area that meets national air quality standards, regional nonattainment could be declared in the future for ozone and particulate emissions.



Importance to Fort Campbell

Mission – Mission accomplishments require adequate, affordable, high-quality facilities for training soldiers.

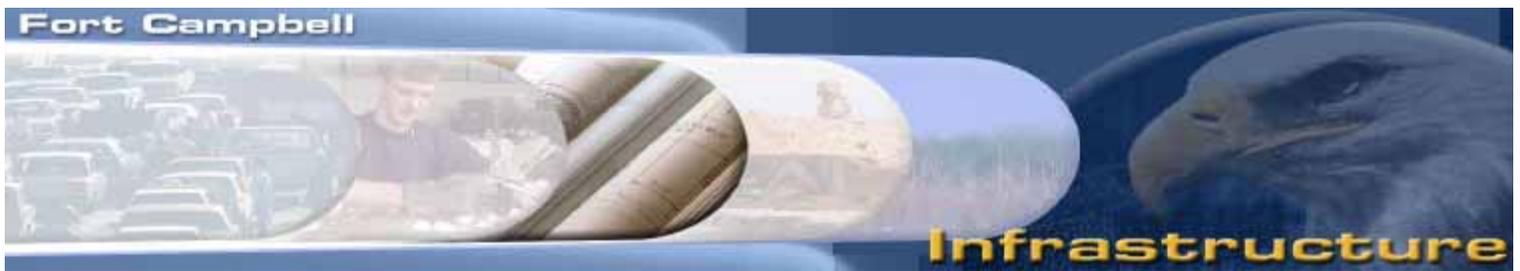
Quality of Life – Comfortable and suitable living, working, and training facilities are necessary to maintain the health and quality of life for soldiers and their families. Clean air, water, and other environmental amenities are essential to sustaining a high quality of life for all personnel who train, live, and work on and near Fort Campbell.

Cost of Operation – Infrastructure sustainment, restoration, and modernization (SRM) requirements for Fort Campbell for FY03 were estimated at \$330.1M. Real Property Services funding (utilities, municipal services, custodial, snow removal, and engineering support) for FY03 were \$41.8M. SRM and Real Property Services costs increase as the condition and efficiency of buildings, appliances, and equipment deteriorates. As of January 2003, ongoing major construction totaled \$346M. None of these costs include the cost of the installation environmental program, which is directly influenced by the impact of the Fort Campbell infrastructure and operations on the local environment. Building energy costs about \$19M/year; the breakdown is shown in Figure 1.

Figure 1 – Energy Use and Costs for FY02

	Consumption	Units	Cost
Fuel Oil	349	Thousand Gallons	\$307,310
Natural Gas	1,124,017	Thousand Cu. Ft.	\$6,000,161
LPG/Propane	157	Thousand Gallons	\$156,660
Electricity	265,721,194	KWh	\$13,163,729
Total			\$19,627,860

Environment and the Community – Facility construction, operation, maintenance, and demolition impact the environment and the surrounding community. Construction activities significantly impact the environment through land disturbance, waste generation, and subsequent effects on off-site water quality. Building use requires energy and water. Energy production impacts regional air quality. Water use impacts regional aquifers. The demolition of infrastructure results in solid waste (currently landfilled) and impacts on water and air. Construction requires building materials and labor, which could be purchased locally to benefit the regional economy and reduce transportation costs.



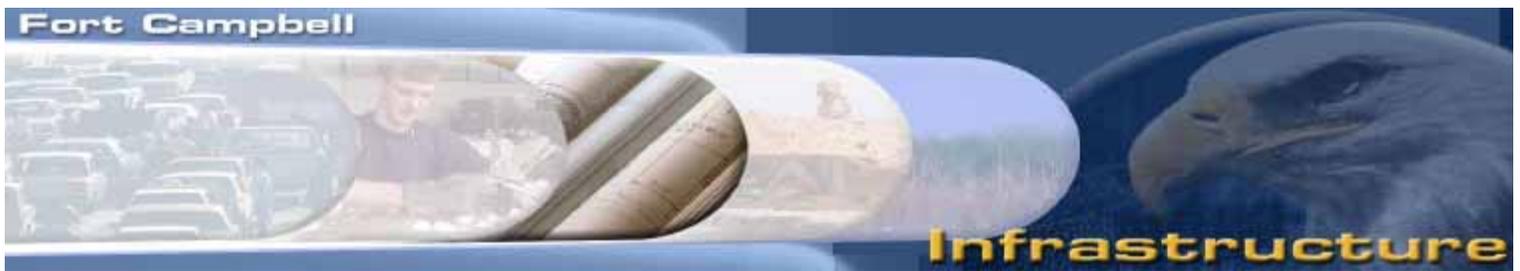
Significant Impacts

Fort Campbell convened a working session the week of 28 July to better define the relationships between Fort Campbell's infrastructure development, maintenance, and use and the environment. Participants included representatives from across the Garrison staff, plus several planners from local communities. Figure 2 below summarizes the critical impacts identified during the working session.

Figure 2 – Significant Environmental Impacts for Infrastructure

ACTIVITIES	 Redesign and Construction	 Facility Operation and Maintenance	 Building Demolition and Deconstruction
Ft. Campbell Fence Line IMPACTS	<ul style="list-style-type: none"> Habitat disturbance and use of open space Water consumption Energy use Regional releases of NO_x, SO_x, and CO₂ to local airshed from energy production Disruption of aquifer recharge with stormwater Stormwater contamination Erosion Building material wastes from construction and demolition (C&D) debris 	<ul style="list-style-type: none"> Noise Water discharge Disposal of hazardous and solid wastes Hazardous materials (solvents, paints, etc.) releases to the air Contamination of stormwater and soils from spills of hazardous materials used in O&M Excessive consumption of water 	<ul style="list-style-type: none"> Erosion Disposal of C&D in landfills

Participants determined significance based upon the potential impact to the mission, the surrounding community, current and future costs, compliance considerations, and long-term sustainability. The participants scored noise pollution, water use and pollution, energy consumption, and solid waste generation as the most significant categories of impact associated with infrastructure.



Introduction

Fort Campbell's infrastructure is large, diverse, and continually evolving in response to current and future requirements. This infrastructure includes—but is not limited to—buildings, utilities, roads, grounds, airfields, and parking areas. Of the 105,000 acres that Fort Campbell encompasses, approximately 11,000 acres make up the built-up areas, which include the Main Cantonment Area (5,213 acres), Campbell Army Airfield (3,385 acres), and Sabre Heliport (110 acres). Figure 3 lists the types of buildings on Fort Campbell and the associated square footage. Infrastructure activities include military construction, SRM, and real property services such as utilities, municipal services, custodial, snow removal, and engineering support to maintain maximum operating capacity of Fort Campbell's infrastructure.

Figure 3 – Key Building and Structure Data

Type	Ft ²
Barracks	2,372,414
Family Housing On-post (10 neighborhoods)	6,166,389
Garage/Carport	179,394
Storage/Depot	2,199,029
Maintenance (total)	1,920,354
Training	487,259
Community Facilities	2,139,006
Administrative	675,149
Medical	676,338
Utilities	115,080
Other	2,122,779
Total	19,053,191

The Installation Public Works Business Center (PWBC) is responsible for the design, construction, operation and maintenance, demolition, and ultimate management and disposal of the installation's infrastructure, including environmental management. The PWBC Master Planner plans and programs the installation's real property management and development through the Real Property Master Plan (RPMP).

The U.S. Army Corps of Engineers (USACE) provides design and construction management, and project oversight. USACE's Sustainable Project Rating Tool (SPiRiT) is an adaptation of the LEED standards to address military-specific design considerations. Achieving a SPiRiT rating standard will require that a design establish the minimum level of energy efficiency for the base buildings and systems. Building orientation and massing, natural ventilation, day-lighting, shading, and other passive strategies can lower a building's energy demand and increase the quality of the interior environment and the comfort and productivity of occupants. The efficiency of required systems can be maximized through the use of advanced computer modeling and life cycle cost analysis. In guidance dated April 11, 2003, USACE has directed all FY06 and future Army Military Construction projects to achieve a gold level SPiRiT rating and, to the extent possible, to achieve a gold level rating in ongoing designs.

Fort Campbell's family housing is being privatized. All future construction and maintenance of family housing will be through the Army's Residential Communities Initiative (RCI).

The installation is a major source of air emissions under Title V and will eventually have major source operating permits from both Tennessee and Kentucky.



Fort Campbell is served by one drinking water treatment plant and distribution system with a capacity of 7.6 million gallons per day (MGD). Raw water is drawn from Boiling Springs, which is not classified as a sole source aquifer.

Fort Campbell operates a municipal wastewater treatment plant (WWTP). The system, which services the entire installation, was originally built in 1942 but modified and/or expanded on several occasions. The system consists of a four million gallon per day (4 MGD) trickling filter wastewater treatment plant. The plant provides primary and secondary treatment, discharging effluent into Little West Fork Creek, a tributary of Ringgold Creek and the Red River. The age of the 450,000 linear foot collection system ranges from one year to fifty years, with the majority of the system between 35-50 years old. Biosolids, after anaerobic digestion, are used in the training areas as a soil amendment and conditioner.

PWBC currently operates the water and wastewater plants and systems. Privatization of both systems has been proposed and may occur in calendar year 2003. Fort Campbell has an industrial stormwater permit from Tennessee and is covered under a general stormwater discharge permit for Kentucky. Phase II stormwater permitting is currently underway.

Activities and Impacts

Construction, operation, maintenance, renovation, and demolition of facilities produce environmental impacts. The design of a building defines the materials, equipment, and appliances to be used over the life of the facility, and therefore defines the operation and maintenance impacts and costs. The siting of the facility impacts the surrounding habitat. In addition, the design, placement, and construction of buildings and roads affect the quantity and quality of stormwater during and after construction. Operation, maintenance, and repair of buildings result in energy and water use, air emissions, hazardous materials usage, and the generation of various wastes.

Energy Consumption

The energy provision and conservation program for Fort Campbell is under the direction of the PWBC. Installation facility operations consume approximately 2,100 billion BTUs of energy in the form of electricity, natural gas, propane gas, and heating oil at a cost of approximately \$19.6M/year. The installation reports a usage rate of 109.12 MBTU per 1,000 building square feet.

TVA generates all electricity for the post. The electrical distribution system is operated by PWBC, except for a small part of Army Family Housing in Kentucky that is operated by Pennyrite Electric. Consumption is currently measured through 138 meters, resulting in two total bills for the installation. Most point usage is not metered. Under the Residential Communities Initiative, all family housing units—once privatized—will eventually be individually metered for electricity and natural gas. Fort Campbell predominantly uses energy for facility and residential lighting, air conditioning, heating, and industrial operations. Facility energy use by building type is shown in Figure 4. The chart illustrates where the most improvement can be made in energy conservation and awareness programs—the housing areas.

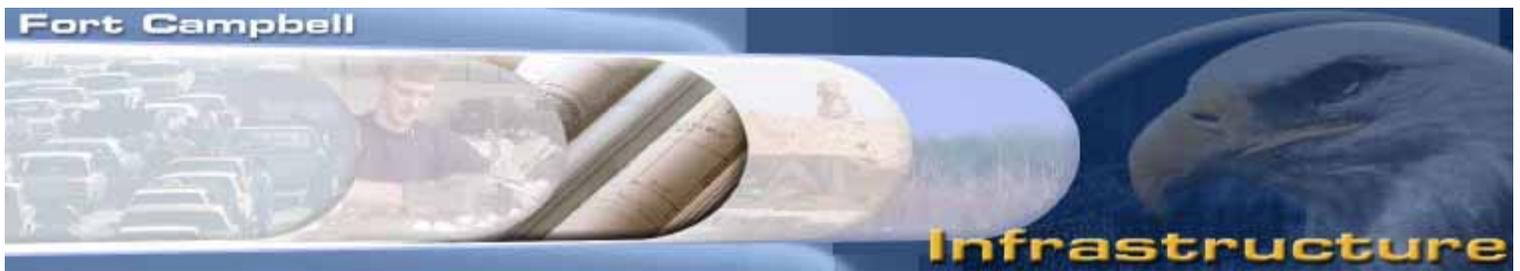
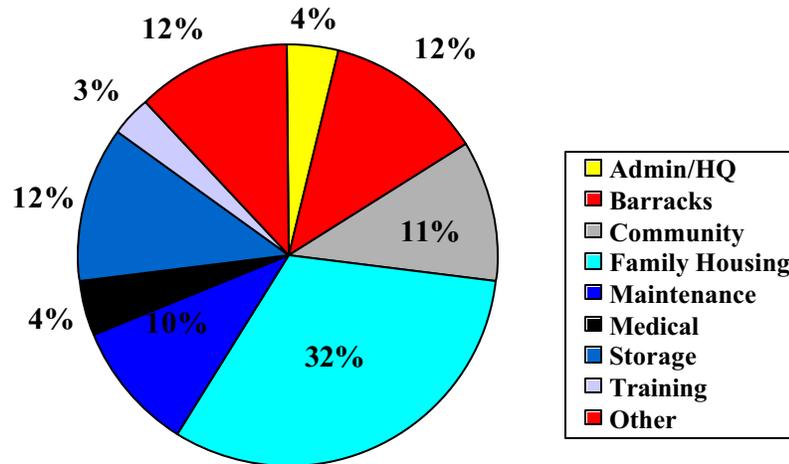


Figure 4 – Facility Energy Use By Building Type



Water Consumption

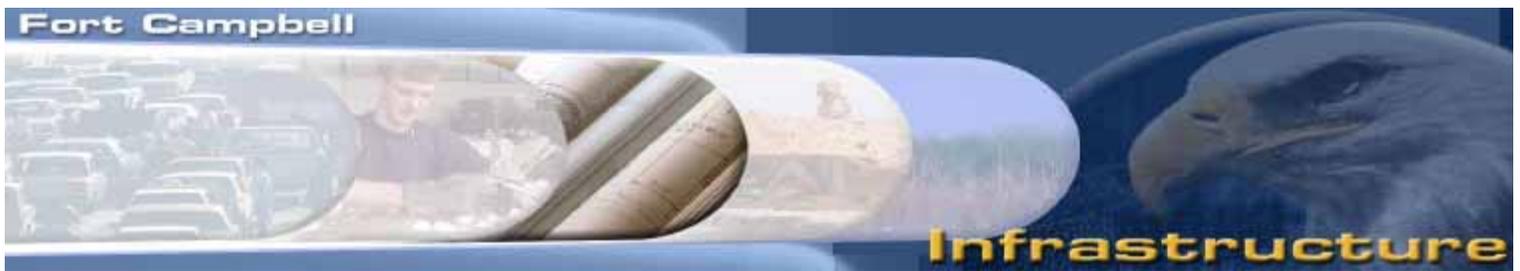
Boiling Springs serves as the primary source of drinking water for Fort Campbell. This source is not a sole source aquifer, but is classified by the State of Tennessee as a “groundwater under the influence of a surface water.” This spring has an average discharge of approximately five million gallons a day. As a backup source of water, Fort Campbell can draw 3.2 million gallons a day from the Red River. The Red River intake and pumping station are located in Clarksville, Tennessee, approximately 10 miles from the water treatment plant. The alternate system is regularly tested to make sure that it remains functional and can provide high quality water. During emergencies, Blanchfield Community Hospital can be supplied with treated water via a six-inch pipe from Clarksville.

Drinking water regulations require Fort Campbell to prepare and implement a Wellhead Protection Plan. The Wellhead area for Boiling Springs consists of approximately 126 square miles of land in parts of Montgomery and Stewart Counties in Tennessee, and Christian and Trigg Counties in Kentucky. Approximately 75 percent of the Wellhead area lies within the confines of the installation boundary. Most of the off-post portion of the wellhead area is used for agriculture.

There has been little change in water usage at Fort Campbell for several years. Average finished water production is approximately 4.44 MGD (FY95 through FY00) and remains that today. The drinking water treatment plant processes consist of aeration, rapid mixing, flocculation, sedimentation, filtration, disinfection, and fluoridation. The plant has a design capacity of 7.6 MGD. The plant was constructed in the early 1940s and enlarged in the mid-1950s.

The potential problems with this system include:

- Vulnerability to source water contamination due to its direct influence of surface water.
- Inadequate raw water supply during periods of extreme drought.



- The yield of raw water from Boiling Springs is fixed and cannot be increased if the installation population grows.
- Pressure and flow problems can develop as the post builds additional infrastructure if the distribution system is not altered to accommodate the growth.
- Systems of this age can lose up to 40 percent through losses.

There are two golf courses on Fort Campbell that are irrigated during warm weather. Most of the irrigation water is supplied directly from the Little West Fork of the Red River. The course uses approximately 50M gallons of water a year from Little West Fork Creek, as well as approximately 2.5M gallons from Fort Campbell's treated water supply.

Water Pollution

Due to the interconnected nature of water resources (see Figure 5), human activities can affect water supply and quality in a number of ways. Pollutants can travel in rainwater over the surface of the ground to waterways, or they can filter into groundwater. Pollutants that leach into the ground can travel many miles in unexpected directions and contaminate connected surface water systems. Therefore, pollutants from land use activities and discharges that occur within watersheds or aquifer recharge areas can impact surface water and groundwater resources adjacent to—and far away from—the activity.

There are two types of water pollution—nonpoint and point. Nonpoint source pollution occurs at Fort Campbell when water runs over land or through the ground, picks up pollutants, and deposits them into drainageways, streams, wetlands, rivers, and lakes or introduces them into groundwater. Point source pollution on Fort Campbell can originate from a discrete conveyance or discharge point, such as the permitted wastewater treatment plant discharge, sewage bypasses, or sewage overflows resulting from system failures.

Fort Campbell is located in an area of karst geology, characterized by sinkholes, surface depressions, caves, and underground solution channels in limestone. This geology allows rapid and direct flow of surface water to the groundwater, making this groundwater extremely susceptible to contamination from nonpoint and point sources. Currently at Fort Campbell, there are no test results or data linking groundwater contamination to nonpoint source pollution via sinkholes or other karst features.

Many infrastructure components can become nonpoint pollution sources on Fort Campbell: training ranges and maneuver areas, construction sites, paved areas, industrial facilities, roads, and grounds. Each source has the potential for different discharges, pollutants, and impacts. Rooftops, asphalt, and compacted gravel areas are impervious to rainwater infiltration and are a significant source of nonpoint source pollution. Oil, grease, sediment, heavy metals, nutrients, and other contaminants settle on these surfaces and are washed into waterways with every rain. Proper infrastructure design can reduce impacts through reduced building footprints, sustainable landscaping, porous pavements, and smaller parking lots.

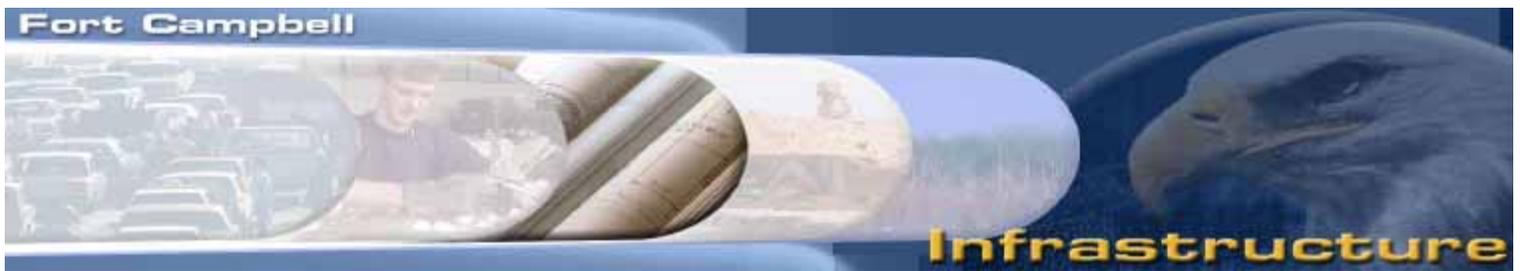
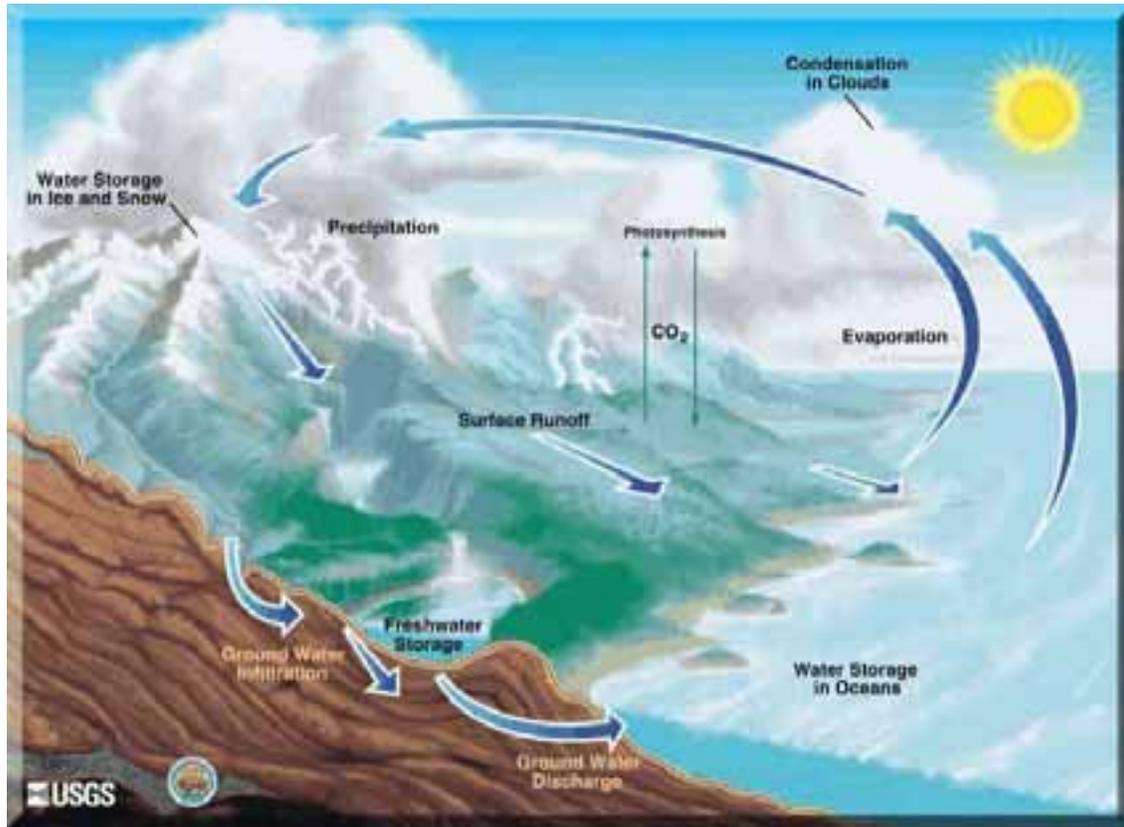


Figure 5 – The Water Cycle



Proper “housekeeping” in industrial areas is essential, as industrial activities often use petroleum-based products, antifreeze, or other hazardous materials, which can potentially enter stormwater runoff.

Large petroleum spills are another significant threat to groundwater and surface water on Fort Campbell. Military operations require the storage, loading, and transportation of vast quantities of JP-8 fuel. Ground and air training activities on Fort Campbell consume millions of gallons of fuel each year. Commercial highway tankers deliver the fuel to bulk storage facilities at Campbell Army Airfield (CAAF) and Sabre Heliport. The fuel system at CAAF has leaked in past years and caused significant groundwater contamination beneath the airfield. The installation has also experienced truck tanker accidents and spills in past years. Since these accidents and spills, the installation has repaired and modernized its hydrant fuel system and has updated its Spill Prevention Control and Countermeasures Plan (SPCCP).

Old landfills also threaten groundwater. These sites require long-term monitoring of the soil and groundwater to ensure that control measures are maintained and contamination does not migrate to the groundwater in the future.



Pesticides and nutrients from agricultural activities adjacent to the installation can also contaminate groundwater. The installation currently leases 5,500 acres of land to farmers each year to grow corn, soybeans, and tobacco.

Currently, the only permitted point source discharge at Fort Campbell is the WWTP located at Old Clarksville Base, which discharges into Little West Fork Creek. The plant serves a population of 40,000 people at Fort Campbell. Sewage treatment facilities can adversely impact water quality in a number of ways including: discharges that exceed permit limitations, overflows or bypasses caused by inadequate capacity, failed system components, or inadequate maintenance. All of these potential sources can be eliminated or minimized through proper operations and maintenance and system upgrades.

Fort Campbell's WWTP treats biosolids or sewage sludge via anaerobic digestion. The digested sludge is then land applied to selected permitted sites in the training area. There can be adverse water quality impacts from land application of sludge if it is mishandled, or applied incorrectly or at the wrong time. Excess nutrients, suspended solids, metals, and other contaminants present in the sludge can be picked up in stormwater and carried to streams. When applied properly, sludge is a valuable soil amendment that builds and maintains the fertility and organic matter in the soil. Land application also keeps sludge out of sanitary landfills.

C&D Solid Waste

C&D debris generated from the demolition of WWII-era wood buildings and Korean War-era barracks represents a significant percentage of the solid waste at Fort Campbell. In FY02 Fort Campbell initiated the sale of WWII-era wooden buildings with the provision that at least 51 percent of the wood and other building materials be recovered and reused. A mechanism is also in place in FY03 to grind all concrete and masonry from demolished barracks to be used as aggregate.

Air Emissions

Fort Campbell operates eight significant boilers each in excess of 10 million BTU/hr and numerous other small residential and commercial boilers to heat buildings on the installation. All of the boilers operate on natural gas, some with fuel oil backup during periods of natural gas curtailment. Other air emission sources include emergency generators, surface coating operations, woodworking shops, aggregate storage, and degreasers. Fort Campbell has HVAC, fire suppression, and other equipment that use ozone depleting substances (ODS). The installation has replaced some Class I ODSs with equipment that uses Class II or III ODSs. The bulk of the Class I ODSs remain in halon fire extinguishing systems at the flight simulator buildings.



Forecast

Over the next several years Fort Campbell will continue a construction program that includes new and renovated barracks, administrative, and maintenance facilities. Most of the WWII-era wooden structures will be taken down as new or renovated administrative and maintenance space is completed and available. Korean War-era concrete/masonry barracks will be demolished or remodeled for administrative office space. Energy consumption is expected to continue to trend downward primarily due to efficiencies of new facilities. C&D from concrete/masonry barracks and WWII-era wood waste will be diverted from the C&D landfill through the expansion of the building deconstruction and sale program and the processing of concrete/masonry into usable aggregate for pavement bases and surfaces.

Tennessee and Kentucky have indicated a constant concern about ozone and other air pollutants within this region. Recently, Kentucky preliminarily declared Christian County in nonattainment for ozone. More information will be needed before the effects of this designation can be ascertained, but the entire cantonment area of the installation will apparently be affected.

Privatization of housing is on schedule for September of 2003. The housing privatization partner has agreed to incorporate sustainable design and development principles and practices into the design, construction, and operation of family housing on Fort Campbell. Natural gas and electricity will be metered at each housing unit.

Privatization of the installation gas distribution system is complete, and the drinking water and wastewater systems should be privatized by mid- or late 2003. The water and wastewater privatization contract began on 1 July 2003, with a 60-day transition period. Under this contract, the 50-year life cycle cost for both water and wastewater is estimated to be \$2.26 per thousand gallons. The actual reimbursable rates under privatization have not been determined.

Drinking water demand and wastewater volume are expected to remain relatively steady. The post population will increase slightly due to the construction of approximately 700 new family housing units, but no military stationing changes have been identified.

Most current water pollution comes from stormwater runoff due to construction site erosion, training and maneuver damage, forest access roads, fuel spills, and nonpoint urban pollution. This year Fort Campbell will apply for Phase II stormwater permits, which will address many of these issues. The new permit application includes provisions for low impact development principles and practices, and addresses urban nonpoint pollution. The forestry and natural resources programs have ongoing efforts to reduce erosion from access roads, firebreaks, and activities in the training areas.



Current Sustainable Activities

Energy Projects

- An \$8M upgrade to the electrical distribution system has begun this year to improve efficiency and reduce energy losses. The current five percent line losses will be reduced to two percent. The work includes a new 69 KVA backbone loop and ability to balance substation loads.
- Nine aircraft hangars are being fitted with infrared heat. This project will be completed in late 2003. Savings of 50 to 70 percent in natural gas usage are expected for heating these facilities.
- Under an Energy Savings Performance Contract, a \$1M project was recently completed to replace lights in the hangars with energy saving metal halide lights. In 2003-2004, a \$3.4M project has been approved to replace 1200 street and security lights and 12 traffic signals with energy efficient units. The expected energy savings are 25 percent.
- A \$1.1M project, currently underway, will add 25 buildings and power monitoring at 4 electrical substations to the Energy Monitoring and Control System (EMCS). In 2004, another \$1.5M project will add 25 additional buildings and 3 more substations to the system. Under the Energy Conservation Investment Program (ECIP), in 2005 all gymnasiums will be added to the EMCS. In 2006 all administrative facilities will be added, and in 2007 all aircraft hangars will be added. When in place, these five systems will provide an estimated 1.5 to 2 percent energy savings per system, or 7.5 to 10 percent overall.
- In 2002, a \$30M upgrade to the central energy facility (boiler plant) was completed. This project converted the system to low temperature hot water. With a projected energy savings of 25 percent, the new system is expected to save \$12M over the next 25 years.
- The natural gas distribution system has been privatized, and, in time, promises to provide better maintenance of the systems and to reduce gas leaks and losses.

Green Buildings

- Under the Army's Military Construction program (MCA), the new Corps Support Group Barracks Project has been designed to meet a gold standard under the SPiRiT rating tool.
- Fort Campbell participates in the Residential Communities Initiative (RCI), an Army program designed to enhance quality housing by transferring ownership, construction, maintenance, and operation of military family housing to large housing contractors through 50-year contracts. Approximately 90 percent of the Army's Family Housing (AFH) units will be renovated or replaced in the first ten years of the RCI partnership. The transfer of ownership is projected to be accomplished by the fall of FY03. As noted above, the housing privatization partner will be incorporating sustainable design and development principles and practices into the design,



construction, and operation of family housing. Natural gas and electricity will be metered at each housing unit, which will help to pinpoint possibilities for energy conservation.

Construction & Demolition Solid Waste

- Last year Fort Campbell sold several WWII-era wood buildings with the provision that at least 51 percent of the structure be reclaimed and recycled. The new owner has the option of deconstructing or moving the entire building off-post.
- The installation also partnered with the Army's Construction Engineering Research Laboratory (CERL) on a building deconstruction project to study and document material recovery potential of WWII-era wood and to identify the market for such materials. This successful project involved several types of WWII-era wood structures and warehouses. (See the Procurement section for additional information.)
- Grinding of concrete and masonry rubble for aggregate is now being done routinely at the installation. In 2002, approximately 40,000 tons of concrete rubble from an airfield pavement project was ground on-site and reused in the project as base aggregate material. Currently concrete and masonry are segregated from the C&D waste stream and stockpiled at the landfill on-post. The rubble is periodically processed by contract. The resulting aggregate or gravel is "free issue" for installation roads, ranges, and other projects.

Stormwater and Wastewater

- The installation has a Stormwater Pollution Prevention Plan (SWPPP) that provides guidance to control contamination in runoff from transportation and maintenance facilities; reuse, recycling, and disposal activities; and other regulated industrial activities that may be exposed to stormwater. It describes and promotes best management practices to reduce stormwater pollution. The SWPPP also provides guidance regarding site erosion and sediment control. The installation will file and apply for a Phase II stormwater permit in 2003 that will address the non-industrial aspects of stormwater. The permit will include the use of low impact development (LID) stormwater management practices for installation development, construction, and retrofit projects.
- On June 23, 2003, the Army issued a notice to proceed on a 50-year contract with CH2M-Hill to privatize the installation water and wastewater systems. CH2M-Hill will be fully responsible for operation of the systems on August 29, 2003. Privatization of these systems will ensure adequate resources for maintenance and capital improvements to the systems.



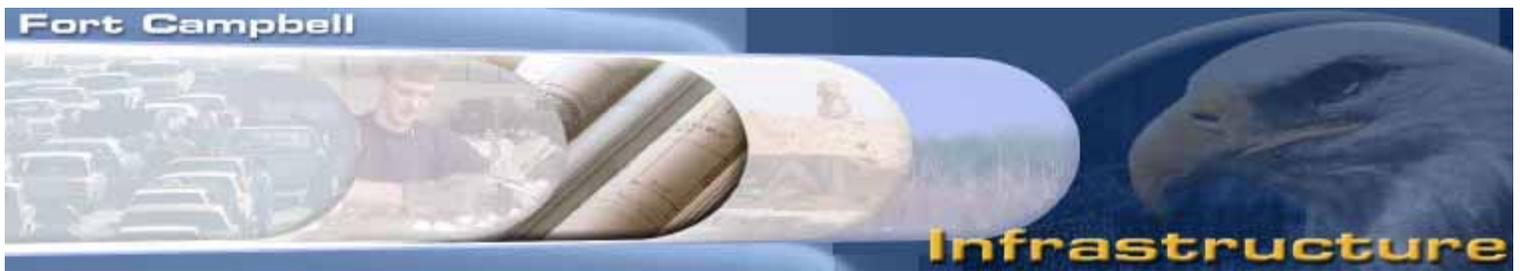
Realm of Possibilities

This section provides a glimpse of what can be accomplished with existing technology and what can be expected from developing sustainability approaches. To become sustainable, Fort Campbell is encouraged to identify and plan for innovations that will support long-term goals.

Energy Efficient Buildings



- **Continuous Commissioning** – This is a process of improving building performance through independent hourly metering, monitoring, analysis, and system fine-tuning to maximize energy conservation. This approach, which involves comparing design intent with actual building operation, has yielded an additional 15 to 45 percent savings beyond traditional conservation measures. For additional information, visit <http://esl.tamu.edu/cc/>.
- **Microscopic Systems** – Scientists at the Pacific Northwest National Laboratory (PNNL) and other research laboratories are developing a family of micro-sized energy systems that are manufactured in a manner similar to computer chips. Microscopic heat exchangers, evaporators, condensers, gas absorbers, turbines, bioreactors, chemical reactors, chemical separators, pumps, and valves exhibit extraordinary rates of heat and mass transfer. When combined into HVAC or process equipment, this translates into very high efficiencies and minimal pollution generation. These miniature components can be combined to create small heat pumps that can be integrated into window frames, with the simple plug-in of replacement units should the originals fail. Small bio-fueled fuel cells will be developed that can be located wherever heat and electricity are needed. Miniature chemical separation units will be developed for on-site cleanup of tanks, wells, aquifers, and other polluted systems—imagine a pen-sized device that can be dropped into a drum of waste to eliminate PCBs.
- **Drain Water Heat Recovery** – It is estimated that up to 80 percent of water-heating bills come from shower/bath water. An innovative technology called drain water heat recovery uses the latent heat in drain water to preheat cold water before it is sent through a conventional water heater. Drain water is typically 90 to 95°F when it is piped away from the shower or bath; 100 percent of that potential energy is wasted. These systems take warm drain water and run it through tiny spiraling pipes to preheat cold water to a higher temperature, thus reducing the total amount of energy a water heater must expend to heat fresh water. Installing a drain water heat recovery unit can reduce overall heating bills by as much as 40 percent. EPA estimates that, if 6 million hot



water systems were outfitted with drain water heat recovery systems, carbon dioxide emissions could be reduced by 20 million tons every year (<http://gfxtechnology.com/>).

- **Superconductivity** – Superconductivity, the ability of a material to conduct electricity with zero resistance and almost no loss of power, is a cutting-edge technology that may some day revolutionize the way we think about electricity (<http://www.eren.doe.gov/superconductivity/>). Today, almost 10 percent of all electricity generated is lost in transmission, radiated as heat from inefficient copper and aluminum wires. Superconductors will lead to the development of a number of new technologies:
 - Transmission wires will carry 100 times more current on a wire no larger than those we use now.
 - Super-efficient mass transit systems (similar to the MagLev train in Japan) will transport people at enormous speeds using a fraction of the energy required by current commuter trains.
 - Electric motors using superconductor wiring will operate at a fraction of the cost, improving industrial and residential energy efficiency while saving money.
 - Electric generators will be smaller and lighter and require less fuel to generate power.
- **Compact Fluorescent Lights (CFLs)** – A number of alternatives to traditional incandescent lights are commercially available. Compact fluorescent lights (CFLs) use between 50 and 70 percent less power than incandescent lights of the same intensity. EPA maintains a comprehensive list of CFLs at <http://www.energystar.gov/products/cfls/>.
- **Energy Star** – EPA maintains a database of high-efficiency appliances and office equipment. By simply investing in these readily available alternatives, businesses and homes can save hundreds of dollars in energy bills every year (<http://www.energystar.gov/>).
- **Desiccant Cooling Systems** – In the next few years, desiccant cooling systems could be saving offices and large commercial buildings thousands of dollars each month in electricity bills. Desiccant coolers, which are used in conjunction with traditional HVAC units, remove moisture from the outside air, cooling the air and enabling the primary unit to operate much more efficiently. For more information, see <http://www.nrel.gov/desiccantcool/tech.html>.
- **Spectrally Selective Windows** – Spectrally selective and chromogenic windows represent the next generation of window technology. Spectrally selective windows have advanced coatings that filter certain wavelengths of radiation from incident sunlight, lowering overall solar heat gain significantly. Chromogenic windows are more advanced, with coatings that change their reflective properties based on ambient temperature or light conditions. Some estimates place the potential energy savings at 40 to 70 percent for electrically heated spaces.
- **Ground Source Heat Pumps** – This technology has been around for 70 years, emits no CO₂, and produces fewer emissions than all other fossil fuels. Ground source heat pumps use the constant



subsurface temperature to regulate building temperatures by passing air through the ground and then into the building. This type of system costs twice as much as a conventional system, but saves 50 to 75 percent in energy costs.

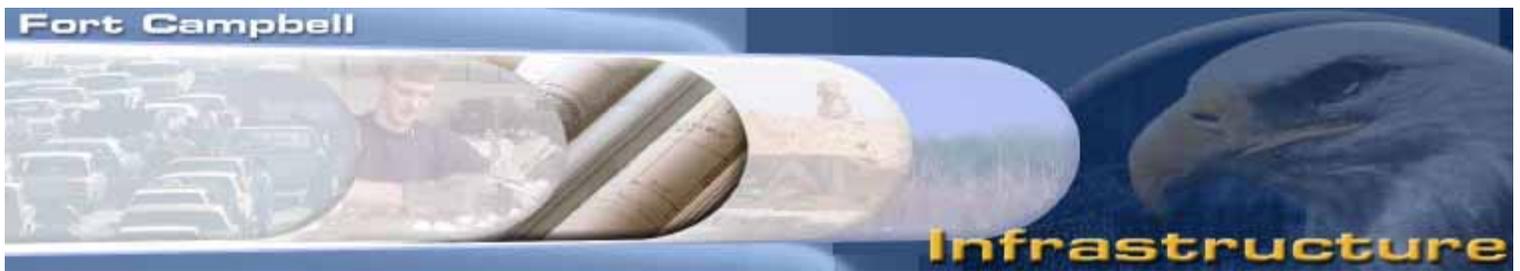
- **Energy Plus** – The Department of Energy developed this free software, which incorporates all the design features of a building into a model to simulate building energy use and then outputs the results as a text file (<http://www.eere.energy.gov/buildings/energyplus>).
- **Energy Supply and Management** – The City of Chicago estimates that it will save more than \$260 million by 2010 through the use of renewable energy, distributed energy sources, and better energy management (<http://www.ci.chi.il.us/environment/>).
- **LEED System** – USGBC’s release in 2000 of the LEED rating system provides a national standard for evaluating and comparing green building performance. The LEED standards (version 2.0) can be downloaded from <http://www.usgbc.org>.
- **SPiRiT Guidelines** – The Army has developed its own version of the LEED standards that takes into account military-unique aspects of building design. The SPiRiT guidelines are an adaptation of the LEED standards used by industry. The SPiRiT includes additional rating factors appropriate to military projects and facilities. Projects are rated for sustainability in eight facility categories: sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, facility delivery process, current mission, and future missions. More information on the SPiRiT standards can be found at <http://www.cecer.army.mil/sustdesign/SPiRiT.cfm>.
- **Green Renovation** – The current renovation of the Pentagon is being done according to green design principles. The first project was a separate \$10M central receiving facility. Given the security requirements for the building, it was designed as an earth-sheltered building with a park on top for Pentagon employees to enjoy. The \$1.1B renovation of the Pentagon itself is harnessing market forces to determine how to “green” the historic structure. The contractor has been given a list of performance criteria for the building, some of which address environmental impacts. Some are mandatory and some are not; however, if the contractor can suggest a way to meet the criteria that will save money over the expected lifetime of the building, and the government accepts the suggestion, then the contractor shares in the anticipated savings by increasing the percentage of the profit.
- **Army Demonstrations** – Forts Hood, Carson, and Polk all have green building demonstrations in the planning and design stages. Fort Bragg is currently designing a low impact parking lot for its environmental education building.



Water Consumption

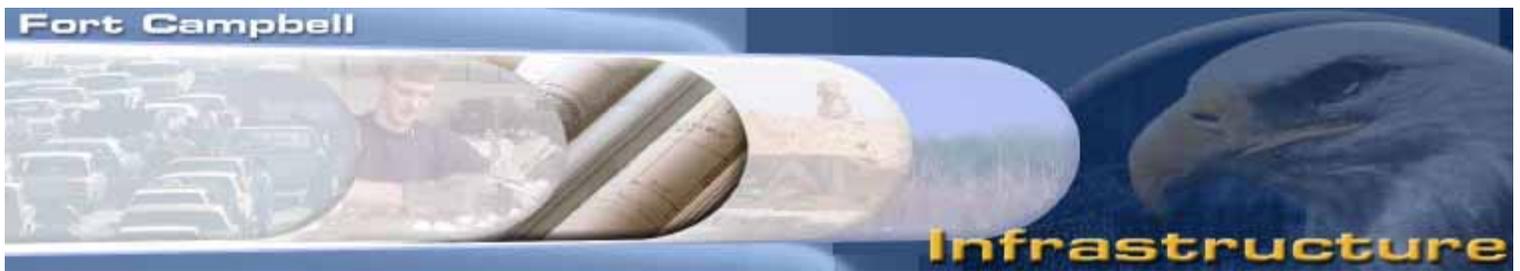


- Water Management Technologies** – Camp Dresser and McKee (CDM) have pioneered a number of water management technologies that reduce the impact on local water resources. Aquifer storage and recovery (ASR) systems store stormwater and treated wastewater in underground “bubbles” where the water can later be removed. It increases water reserves in times of drought and decreases total drain on natural aquifers. CDM also helps design and build stormwater overflow systems and total maximum daily load (TMDL) management programs that help address point and nonpoint source pollution problems.
- Compost Bioremediation** – Compost bioremediation uses a biological system of microorganisms in mature, cured compost to sequester or break down contaminants in water or soil. Compost bioremediation restores contaminated soil, manages stormwater, controls odors, and degrades VOCs. Seymour Johnson Air Force Base, North Carolina, implemented a compost remediation project, using alternating layers of yard waste compost, petroleum-contaminated soil, and turkey manure. The project saved \$133,000 in the first year of operation because of decreased costs of hauling, incinerating, and purchasing clean soil (www.afcee.brooks.af.mil/pro-act/cross/ed55.asp).
- Composting Toilets** – Composting toilets eliminate the use of water to transport human waste, reducing indoor water use by 20-30 percent and providing a small amount of high-quality fertilizer. They consume only 1,825 gallons of water per year, compared to 200,000 gallons of water per year in a traditional toilet, and without the treatment costs. The National Park Service and other outdoor recreation facilities nationwide use them extensively (www.rmi.org/sitepages/pid287.php).
- Constructed Wetland** – Fort Knox, KY, is conducting a feasibility study on construction of a wetland that would link the sewage treatment plant outfall to the drinking water intake. Wetland plants and animals purify the wastewater as it flows through the wetland. Constructed wetlands have the potential for containing and treating nonpoint source pollution from ranges and other natural areas.
- Drip Irrigation** – A drip irrigation system delivers a small amount of water directly to the root zone of plants as needed. Water use can be decreased by up to 75 percent using these systems in arid regions (www.energy.ca.gov/releases/1996_releases/96-11-19_ag_program.html).
- Horizontal-Axis Washers** – A DECAM pilot study in 1998 demonstrated that these washers reduced water and saved money for maintenance, but were more costly than traditional washing

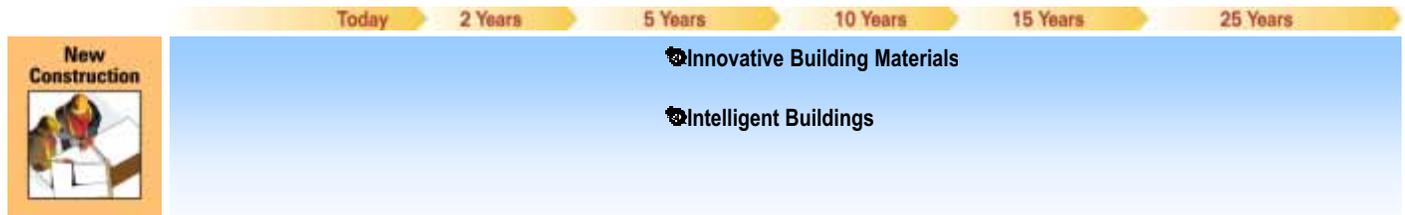


machines. Laundry facilities account for 23 percent of residential water use as well as a similar proportion of residential sewage production. Horizontal axis washers, also known as front loading washers, use 40-75 percent less water (save 5,000 gallons of water per washer per year); use 50-65 percent less energy; clean clothes better with a less concentrated soap solution; and extend the life of clothes because they are not agitated. In 1996-98, U.S. manufacturers introduced these washers, which are used extensively in Europe. While initial costs are double that of conventional washers, they pay back the additional investment in three to four years through reduced energy, hot water, and soap (<http://www.buildinggreen.com/products/washers.html>).

- **Grey Water Recycling** – The future of sustainable water use is *in situ* water recycling and reuse. A large portion of the water we use becomes “grey water” when it is washed down our sinks and showers. This water, with minimal treatment by natural and cost-effective means, can be reused many times over for irrigation, flushing of toilets, and even dishwashing. The home or office of the future could provide up to 70 percent of its daily water needs through simple recycling of bath and laundry water. Treatment systems will be low-tech and cost effective—many times using natural bacteria and plants to clean water. The Rocky Mountain Institute estimates that 50-100 gallons of water per day are available for outdoor use in an average household with a grey water system. A system at the Roseland III office park in New Jersey reduced water use by 60 percent (<http://www.greenbuilder.com/sourcebook/Greywater.html> and <http://www.greywater.com/>).
- **Irrigation Meters** – Irrigation meters, in use in western Texas, save one- to two-thirds of water formerly used for irrigation. A \$1 block of gypsum, buried at the root zone, is connected through two wires to a clip-on meter that reads soil moisture.
- **Low-Flow Fixtures** – Low-flow toilets use a maximum of 1.6 gallons of water per flush compared to about 5-7 gallons of water used by a standard toilet. Low-flow showerheads use about 2.5 gallons of water per minute compared to between 4-5 gallons per minute used by conventional heads. Low-flow faucet aerators can cut the water usage of faucets by as much as 40 percent from 4 to 2.5 gallons per minute (www.dom.com/customer/efficiency/bus/hw_fixtures.jsp and www.water.ci.portland.or.us/waterflow.htm).
- **Xeriscaping** – Xeriscaping, a landscape design method that creates elegant and water-efficient landscapes that require little or no irrigation, uses native plants that are as attractive as traditional ones (<http://www.ciwmb.ca.gov/organics/xeriscaping/default.htm>).



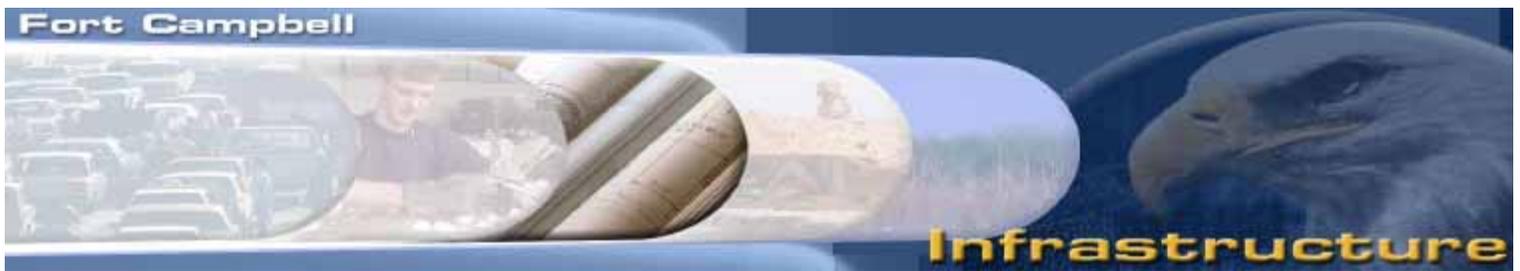
Design



- **Innovative Building Materials** – The building industry and the building products manufacturing industry have aggressive research activities that are providing a host of environmentally friendly and sustainable products. These include soy-based adhesives and foam insulators, shellfish-derived coatings, gas-filled wall panels, and ceramic insulators. For additional information, go to <http://www.nahbrc.org/> and click “Green Building” on the navigation bar.
 - The Home Builders Association provides a “Built Green Checklist” on its web site at <http://www.builtgreen.org/>. While developed for single-family housing use, the checklist is comprehensive and easy to understand, and may be used as a starting point for administrative buildings and barracks.
 - In collaboration with the General Services Administration, EPA successfully modernized a 1.2-million square foot office complex in Washington, D.C. For more details, go to: http://www.edcmag.com/edc/cda/articleinformation/features/bnp_features_item/0,4120,19197,00.html. (Note: each “gap” in the URL represents two consecutive underscore characters.)
 - The Assistant Chief of Staff for Installation Management requires Army activities to evaluate all facility construction and repair projects using the SPiRiT tool, which is the Army’s version of the LEED system developed by USGBC.
- **Intelligent Buildings** – The intelligent building is the future of architecture. It looks like any other building from the outside, but employs sophisticated control systems to make building systems (heating, cooling, ventilation, lights, windows, and appliances) more convenient and efficient. Commercial office buildings are being designed wherein lighting, temperature, and humidity in the space occupied by each worker are regulated according to his/her preferences, and windows automatically darken to provide appropriate ambient lighting for the task. This technology is also appropriate for homes. In Bill Gates’ private home, occupants wear an electronic pin that keeps track of them, so the house can adjust lighting, temperature, music, and/or television shows as they move about. Investors are pumping vast amounts of money into intelligent building research. Intelligent buildings make good financial sense. For example, by turning off unnecessary lights and not heating unoccupied rooms, these buildings can reduce utility bills by 20 to 30 percent.

Historic Buildings Preservation

- **Geophysical Techniques** – The U.S. Army Construction Engineering Research Laboratory is conducting tests using geophysical techniques to make determinations on materials commonly



buried at archaeological sites. Location, depth, dimension, and position of historical objects are recorded and mapped using geophysical techniques and equipment. More information can be found at the following website: <http://www.cecer.army.mil/td/tips/product/details.cfm?ID=424>.

- **Historic Preservation** – Historic preservation of buildings and sustainable design complement each other in many places. Window replacement, paint, and replacement of heating, ventilation, and air conditioning systems may allow for the incorporation of sustainable principles. For an example and more information, go to <http://www.saptek.com/sp/general/21-2-4.pdf>.
- **Modeling Probability of Cultural Sites** – To guide archaeological investigations, the Center for Ecological Management of Military Lands (CEMML) at Colorado State University has developed a GIS-based model to identify areas of high, high-medium, medium, low-medium, and low probability for archaeological sites. Using remote sensing equipment, aerial photography technology, and modeling increases the likelihood of releasing and expanding land for military use (<http://www.cemml.colostate.edu>).

Deconstruction

- **Salvage Rights** – Fort Knox sells the “salvage rights” to buildings that are on the demolition schedule. The purchaser of the rights can remove windows, doors, flooring, siding, plumbing, and copper wire—but must remove at least 50 percent of the volume of the building. The installation makes about \$100,000/year on the sale of the salvage rights, and saves hundreds of thousands on reduced demolition costs and disposal costs. Fort McCoy has a similar program.
- **Local Industry Partnerships** – Redstone Arsenal has paid a local house mover and developer to move 89, two-story brick duplexes off the installation and into the local community, where they will be sold and reused. The cost was about \$9,000 per house versus the \$12,000 it would have cost to demolish them, resulting in a cost savings of \$267,000.

The Army has signed a Memorandum of Agreement with Habitat for Humanity to allow them to “deconstruct” buildings on the demolition schedule and sell the salvaged items to support Habitat home-building activities. A pilot project is being developed at Fort Hood with the Austin, Texas Habitat affiliate.

Fort Campbell 25-Year Goals for Infrastructure

To be determined by Fort Campbell’s Command and staff, as advised by members of the local and regulatory community, at the Installation Sustainability Workshop on 9-11 September 2003.



Challenge

Fort Campbell's procurement of products and services significantly contributes to costs, waste, and exposures to health and environmental hazards. How can Fort Campbell purchase products and services that will reduce life cycle costs, impacts from waste disposal, and exposures to hazards, while promoting sustainable manufacturing and stimulating local/national markets for environmentally preferable products?

Key Considerations

- **Clean Products** – The use of materials that are non-toxic, made of renewable resources, produced in an environmentally friendly manner, and easily reused or recycled is critical to sustainability and in controlling future costs and liabilities.
- **Product Leasing** – Fort Campbell purchases many products such as carpeting, furniture, and appliances. At the time of purchase, little or no consideration is given to the ultimate disposal of the product. Several companies now lease products in which the supplier takes away and reuses/recycles the product when the user is finished with it.
- **Local Manufacture** – The purchase of locally manufactured products stimulates the regional economy, reduces transportation costs and environmental impacts, and helps to sustain the community.
- **Use Reduction** – Sustainability depends on the ability to use the smallest quantities of products and materials needed to meet minimum requirements—in other words, not wasting resources. This includes reducing amounts used, spilled, and leaked to the environment.
- **Reuse and Recycling** – Material reuse and recycling reduces the costs and environmental impacts associated with processing virgin materials, transporting new products, and properly disposing of waste materials.
- **Waste** – Ordinary refuse and hazardous waste are expensive to manage and dispose of. Changes in purchasing and use of materials and products can reduce waste generation.



Importance to Fort Campbell

Mission – Fort Campbell requires many types of products, materials, energy, water, and services to accomplish its mission. Procurement represents a significant portion of the operating budget of Fort Campbell and consumes thousands of hours of personnel time for negotiating contracts; selecting, buying, managing, and disposing of products and materials; and obtaining services to support the mission.

Quality of Life – The use of materials can impact the health and safety of Fort Campbell’s soldiers, families, and workers. The release of hazardous materials and waste and the disposal of “non-hazardous” municipal refuse can contaminate the air and the water supply. The selection of materials in construction impacts the quality of working and living space.

Cost of Operation – The total life cycle cost of a material or product is never expressed in the purchase price. Life cycle costs include the following hidden costs:

- Refuse/garbage collection and transport
- Construction, operation, and post-closure care of landfills
- Landfill tipping fees and operating costs
- Building demolition and disposal
- Hazardous material and waste management
- Environmental Compliance programs
- Environmental tracking and reporting
- Environmental cleanup cost for improperly managed products
- Health and related costs to workers
- Increased operational costs for inefficient buildings

Environment and the Community – In FY02, the Directorate of Contracting (DOC) spent \$93M on local purchases, which included products and materials, as well as labor and services. In addition, other offices such as the Corps of Engineers, tenant units and agencies, and reserve units made significant purchases of products and materials that were not processed through the DOC. Through this purchasing power, Fort Campbell has the potential to stimulate growth with local manufacturers and producers, which can support sustainability while improving quality of life for the community and its residents.

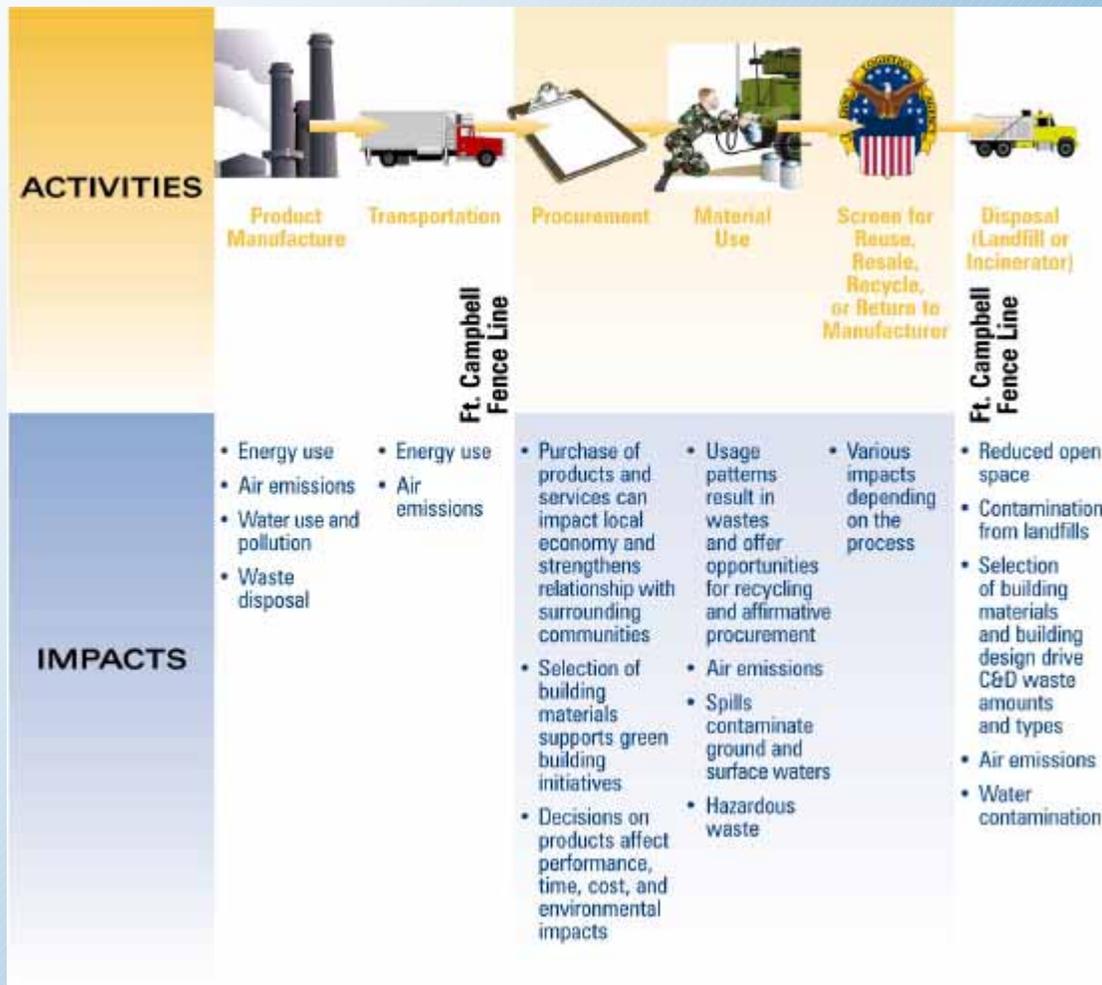
Fort Campbell does not currently monitor the purchase of environmentally preferable products on the installation. Hazardous materials are effectively managed since 99+ percent of the activities and units on-post use the Pollution Prevention Operations Center for hazardous material (HAZMAT) supply. Ordinary solid waste is collected and transported to the Bi-County landfill just off-post on Highway 79. Bi-County and Fort Campbell have agreed on a land swap to enable Bi-County to expand the landfill. With this expansion, it appears that Bi-County will continue to have the capacity to receive the installation’s ordinary solid waste at the current rate for the next 25 years.



Significant Impacts

Fort Campbell convened a working session the week of 28 July to better define the relationships between Fort Campbell's procurement, purchasing, and materials use patterns and the environment. Participants included representatives from across the Garrison staff, plus several planners from local communities. Figure 1 below summarizes the critical impacts identified during the working session.

Figure 1 – Significant Environmental Impacts for Procurement



Participants determined significance based upon the potential impact to the mission, the surrounding community, current and future costs, compliance considerations, and long-term sustainability. The participants scored material purchase and use, energy consumption, and waste generation and disposal as the most significant categories of impact associated with procurement.



Introduction

The purchase and use of products and materials creates some of the most significant impacts on the environment. The extraction and harvesting of raw materials, the use of energy in manufacturing, the transport of finished products, and the ultimate use and disposal of these products present a great challenge to environmental quality. Changing wasteful and damaging material usage patterns can help to ensure the high quality of life now and in the future.

The decision of what product to buy drives the future costs of use, management, and disposal of a product. Indirect costs and environmental impacts associated with waste disposal include air, water, and soil contamination, and undesirable land use. In addition, manufacturing, transportation, storage, and use of products and materials also cause negative environmental impacts both on- and off-post. The Federal government is committed to encouraging markets for environmentally preferable products (EPPs) by requiring installations to purchase items such as recycled paper, re-refined oil, and retread tires. EPPs are those products that contain or require less hazardous materials to produce or use, have fewer environmental impacts compared to similar products, and/or contain recycled materials.

Activities and Impact

The purchase of products, materials, and services impacts the local economy, influences the performance of buildings, and defines the resource consumption patterns of Fort Campbell. The buying decisions of Fort Campbell's users and procurement officials can greatly limit environmental impacts and reduce life cycle costs. Today, understanding of the environmental and cost impacts associated with product and material use is fragmented. Waste generation rates and volumes are known, but little is known about the production, distribution, or content of the products that also create wastes. The long-term environmental impacts associated with the use of hazardous and non-hazardous

Requirements At A Glance

The following environmental regulations and requirements impact the purchase and disposition of materials and wastes at Fort Campbell:

Resource Conservation and Recovery Act (RCRA) – This federal legislation's primary goals are to protect human health and the environment from the potential hazards of waste disposal, to conserve energy and natural resources, to reduce the amount of waste generated, and to ensure that wastes are managed in an environmentally sound manner. RCRA regulates the management of solid waste (e.g., garbage), hazardous waste, and underground storage tanks holding petroleum products or certain chemicals.

Executive Order (EO) 13101 – *Greening the Government Through Waste Prevention, Recycling, and Federal Acquisition* (1998) – This Executive Order requires federal agencies to minimize negative environmental impacts caused by the whole life cycle of products, rather than focusing only on better waste management through recycling and reuse programs.

Emergency Planning and Community Right-to-Know Act (EPCRA) – This act requires reporting the storage and release of EPA-identified chemicals above threshold quantities.

Clean Air Act (CAA) – This federal legislation aims to protect air quality by limiting emissions from stationary and mobile sources. States implement many provisions of the CAA. For example, a state air pollution agency holds a hearing on a permit application by a power or chemical plant or fines a company for violating air pollution limits. In addition, states are responsible for preparing State Implementation Plans that contain strategies for meeting ambient air quality standards.



products and materials are largely unknown by users. Some environmental impacts associated with the purchase, use, reuse, and disposal of materials are discussed in the following sections.

Purchase

The DOC purchases services and products for customers throughout the installation. Other entities on the installation also purchase materials for specific projects. For example, the Corps of Engineers purchases materials for construction projects. The International Merchant Purchase Authorization Card (IMPAC) credit card program has decentralized most small purchases of products. Currently, Fort Campbell has no data on the amounts of locally manufactured products that Fort Campbell uses.

Fort Campbell is implementing an Affirmative Procurement Plan (APP) and has provided information and training on affirmative procurement concepts. Fort Campbell will have difficulty tracking individual purchases because of the numerous procurement outlets available to organizations at the installation. In addition, many purchases are made through Federal agencies that continue to offer products that do not meet APP guidelines. Fort Campbell has no method of tracking its purchase of materials/products that contain recycled materials.

Hazardous Materials Use

Hazardous materials are strictly controlled at Fort Campbell. The Fort Campbell Pollution Prevention Operations Center (PPOC), established in 1996, serves as the installation's central hazardous material management center. This facility provides centralized hazardous material ordering, issuing, and storing; distribution to authorized users in quantities limited to immediate needs; tracking of hazardous materials; and collection and reissue of unused serviceable hazardous material on a free-issue basis. The Public Works Business Center (PWBC) Environmental Division operates this facility. The PPOC currently serves 99 percent of the installation's units and appropriated fund activities.

In addition to controlling the purchase, management, distribution, use, and reuse of hazardous materials, Fort Campbell continues to reduce the consumption of hazardous materials/products through traditional pollution prevention initiatives. Fort Campbell's reduction in hazardous material use can be attributed to increased user awareness, responsiveness by manufacturers, and numerous pollution prevention initiatives on Fort Campbell that support waste minimization through material management and recycling.

Reuse

The Department of Defense (DoD) is one of the original "recyclers" in the nation. Through the Defense Reutilization and Marketing Office (DRMO), almost every product and material that is no longer needed on a military installation is screened for reuse within DoD and other federal and state agencies. Items not claimed are then offered for sale to the general public. Through this system, the vast amount of material that Fort Campbell no longer needs—office furniture, tires, computers, scrap



metal—is kept out of the solid waste stream and reused by someone else. Items that are not claimed or sold for use become solid or hazardous waste.

The Fort Campbell DRMO services the installation and all military activities in the State of Tennessee and part of Kentucky. DRMO officials estimate that 50 to 60 percent of the items handled by the local DRMO come from units and activities on Fort Campbell. The local DRMO tracks activity by number of line items or turn-in documents handled. As a measure of activity, in May 2002, the DRMO processed over 1900 turn-in items that had a total original acquisition cost of \$10.1M. The DRMO then issued 544 line items for reuse—items that had an original acquisition cost of \$2.2M—and sold 399 line items to the public for \$1.7M. In FY02 DRMO sales of these items contributed \$27,000 to the Qualified Recycling Program (QRP) account. In addition, during the first eight months of FY03, DRMO sales of used oil and scrap metal contributed \$42,000 to the QRP account. Figure 2 shows the materials that were processed as scrap from October 2002 to May 2003.

Disposal

The term “solid waste” includes household garbage, also known as municipal solid waste (MSW); construction and demolition debris (C&D); yard waste, also known as “land clearing and inert debris” (LCID); and hazardous waste. In CY01, Fort Campbell generated a total of 113,786 tons of MSW and C&D waste (see Figure 3). Of this amount, Fort Campbell recycled approximately 10,830 tons, or 10 percent. The remaining waste was landfilled.

Figure 2 – DRMO Scrap From October 2002 to May 2003

Scrap	Amount
Ferrous Metals	635,799 lbs
Non-Ferrous Metals	54,519 lbs
Non-Metals	211,020 lbs
Precious Metals	3,810 grams
Fine Precious Metals	43,846 grams

Landfilling results in various environmental impacts including irretrievable conversion of open lands, habitat destruction, release of chemicals to the air and water, odor, and various health impacts associated with all of these.

Figure 3 –Solid Waste Stream at Fort Campbell for CY01

Waste	Amount Generated	Amount Landfilled	Amount Diverted	Diversion Rate
MSW	23,826 tons	18,221 tons	5,605 tons	23.5%
C&D	89,960 tons	84,735 tons	5,225 tons	7.4%
LCID	NA	0 tons	NA	100%
Total	113,786 tons	102,956 tons	10,830 tons	9.5%

Municipal Solid Waste (MSW) – Historically all solid waste generated from activities at Fort Campbell was landfilled on-site until 1994. Since then, MSW has been transported off-site to the Bi-County landfill for disposal. PWBC contracts for the pick-up of MSW from the cantonment areas, which includes residential housing areas.



Recycling of paper and cardboard is mandatory for administrative offices and military units. All other recycling including family housing is voluntary. Two convenience centers are operated by contract for recyclable and refuse drop-off. Troop units may turn in recyclables at the convenience centers or at the DRMO. The recycling center receives, processes, and markets the recyclables. An installation recycle committee chaired by the Deputy Garrison Commander provides oversight for the recycling program.

C&D Debris – The on-post government-operated C&D landfill accepts debris and special waste from construction and demolition contractors. Starting in 2003, concrete and masonry waste will be crushed for use as aggregate for road base and surfacing. Recycling of metal, wood, and other items is encouraged. DRMO is currently streamlining the turn-in procedures for scrap metal. DRMO recently implemented a procedure for turn-in of scrap concertina wire. Usable wood pallets are accepted by DRMO; broken pallets are ground into mulch at the wood yard.

LCID Waste – Fort Campbell collects LCID wastes separately from its MSW. Yard waste and leaves are composted along with bedding from the horse stables. Tree limbs, trunks, and stumps are collected and periodically processed into mulch. The compost and wood mulch is used throughout the cantonment and range areas. Schools can pay a portion of the wood grinding cost in exchange for mulch for playgrounds. Fort Campbell does not track the amount of LCID waste collected; all of the LCID waste is processed and reused.

Hazardous Waste – The use of various products results in the generation of hazardous (regulated) wastes and the release of chemicals to the environment (air and water). Fort Campbell ensures that waste is correctly managed and tracked according to all state and Federal requirements. Several toxic materials are recycled through the PPOC (also referred to as the pharmacy).

Air Emissions

The selection of products and materials has a tremendous impact on air quality. Transporting products to the post and hauling waste off-post produces vehicle air emissions. Storage and use of hazardous materials result in the release of pollutants to the air. Release of these materials to the air can result in local air pollution, regional air pollution, or even degrade stratospheric ozone. While air emissions are addressed in greater detail in the Infrastructure section of this baseline document, it is important to link air emissions to the sources—material purchase and use.



Water Quality

Water is contaminated in a variety of ways by products and materials. Water is combined with solvents and soaps to wash vehicles, facilities, and equipment such as paint guns. Water runs over the surface of the ground and picks up metals, organics, oil, fuel, dirt, and whatever else is in its path. Hazardous materials spilled into drains or streams contaminate surface and ground water. Water is also contaminated by the chemical stew called “leachate” that is created when solid waste landfills leak—and most eventually do. Products that are bought and the manner in which they are disposed of have serious impacts on water quality. The Infrastructure section of this baseline document provides additional information about the water-related issues facing Fort Campbell.

Forecast

Environmental compliance requirements and costs have increased over time and are expected to continue to do so. Materials and product activity has, and will continue to have, a direct impact on waste generation. The cost for solid and hazardous waste disposal has increased over time and will continue to rise as regulations become more stringent and the type and quantity of materials requiring regulated disposal increase. Fort Campbell is currently evaluating proposals for its next solid waste contract. Provisions in the new contract require that each container of refuse or recyclables be weighed. Analysis of this data will provide information to the recycling manager on the effectiveness of the program and will allow targeting of assistance to increase participation.

To date, Fort Campbell’s emphasis on pollution prevention has been on controlling hazardous materials/wastes, assisting units with compliance issues, and specific pollution prevention opportunities at motorpools and industrial sites. Fort Campbell has had tremendous success in these areas. Expanding these efforts to include all materials and products that are currently thrown away would have the following potential benefits to Fort Campbell and the surrounding community:

- Decreased total life-cycle management costs of the products and materials that Fort Campbell buys. Paying to buy something—and then paying again to throw it away—is often more costly than entering into manufacturer take-back and/or leasing arrangements.

Useful Information

The following information would be useful in determining where Fort Campbell could begin to establish sustainable purchasing and use practices:

- **Sources of materials and products** – Where are the products used at Fort Campbell manufactured?
- **Quantities** – How many commonly discarded materials/products are used each year?
- **Composition** – What products contain hazardous components? What products contain recycled materials?
- **Releases** – Which products result in the release of chemicals to the environment or generation of hazardous waste?
- **Markets** – Various organizations manage the sale and recycling of materials and wastes. The nature of markets and the value of materials are not easily quantified or tracked.
- **Treatment and disposal** – What is the long-term availability of capacity to dispose of garbage and hazardous waste? What are the projected costs for treatment and disposal in the short-, mid-, and long-term?



- Decreased current costs of waste management and disposal.
- Increased revenues from the sale of used commodities.
- Decreased legal liabilities and potential for regulatory enforcement actions.
- Decreased potential to contaminate the environment, which will decrease future costs associated with clean up and/or fines.
- Preserved local landfill capacity to meet state goals and control future costs.
- Creation of a market for recycled products. The intent of EO 13101 is to use the enormous buying power of the federal government to make the recycling of products cost-effective. By buying environmentally preferable products, Fort Campbell's purchases will support the market for recycled content products. This will also support Fort Campbell by creating markets for some of the wastes that it currently landfills.
- Reduced toxic releases and wastes through material substitutions and more efficient use. This will provide additional cost reductions for hazardous waste management and disposal, as well as reduced air pollution and water contamination.

Current Sustainable Activities

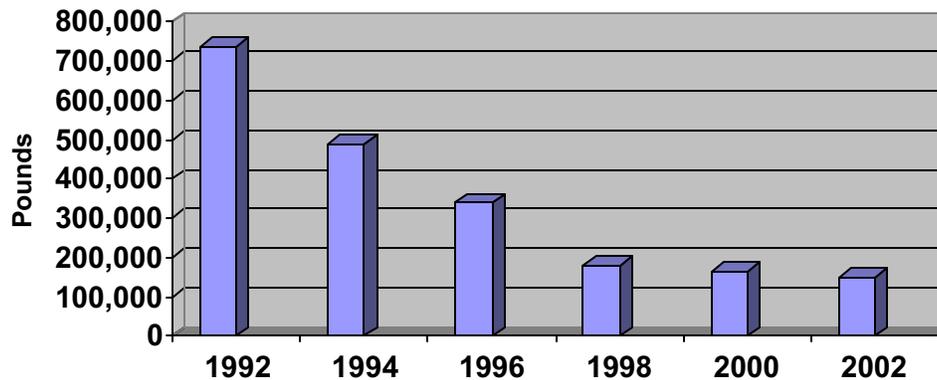
Purchase of Environmentally Preferable Products

Fort Campbell has taken some initial steps toward encouraging the purchase and use of environmentally preferable products, including products with recycled content. The general environmental specification that is included in all of Fort Campbell's contracts refers to the provisions of the Affirmative Procurement program. In addition, the DOC has included provisions of the Affirmative Procurement program in its IMPAC training class. Directorate heads and their staff have been provided with Affirmative Procurement information in briefings and brochures.

Through a series of programs, Fort Campbell prevents waste by properly managing the Army's hazardous materials both at a centralized location and at each unit and garrison activity location. Many of the materials that were once disposed of, like antifreeze, parts washer solvents, refrigerants, and batteries, are now recycled on-site. Rigorous source reduction techniques coupled with other environmentally sound solutions including buying environmentally preferred products, utilizing affirmative procurement, and employing a strong shelf life rotation program, result in drastically reduced material usage, less toxic products, and ultimately less waste. Figure 4 shows Fort Campbell's reduction in hazardous waste disposal over the past decade.



Figure 4 - Hazardous Waste Disposal Reduction



Hazardous Waste Reduction

Hazardous wastes are managed through the model 90-day hazardous waste storage area, which combines chemical analysis, containerizing, labeling, and tracking. Hazardous wastes are processed through DRMO and shipped off-site to an EPA permitted treatment storage disposal (TSD) facility. TSDs can treat and destroy some wastes while others must be processed and stored for the foreseeable future.

Since 1992 Fort Campbell has reduced hazardous waste disposal by over 592,000 pounds, which is a reduction of 80 percent. This notable reduction was achieved through reduced hazardous material use and other pollution prevention and recycling efforts. Recycling programs for antifreeze, parts washer solvent, refrigerants, and batteries contributed to the reduction in hazardous waste disposal. The use of a pharmacy process and other inventory control programs also helped to reduce the amount of hazardous waste generation.

Recycling Activities

- **Antifreeze** – Before on-site recycling began, over 137,000 pounds of antifreeze were disposed of each year as hazardous waste. In FY02 the installation recycled and reused 12,000 gallons of antifreeze. The annual avoided disposal cost of the fully implemented system is \$20K. In FY02 the total annual cost savings was \$96K.
- **Solvent Recycling** – The PPOC provides on-site solvent recycling for parts washers and weapons cleaners to 192 installation customers and 319 parts washer/weapon cleaner machines located throughout the installation. Dirty solvent is periodically cleaned by filtration at the customer location or removed to the PPOC for distillation. Only the solids trapped on the filter or sludge in the distillation unit require disposal as hazardous waste. The system has increased productivity by



25 percent (hours previously used to manually clean parts/weapons), and the recycle system saves \$236K per year in avoided disposal costs.

- **Used Oil and Fuels** – During FY02, 128,600 gallons of used oil and recyclable fuels were collected on Fort Campbell and processed for off-site recycling.
- **Refrigerant Recycling** – Since FY01, refrigerant has been recovered, reclaimed on-site, tested for quality assurance, and reissued to units. Recent equipment upgrades enable the PPOC to handle 20 types of refrigerants, versus only four in FY01. Each 30-pound cylinder issued provides a cost avoidance of \$149.
- **Oil Can and Filter Processing** – Fort Campbell collects all “empty” oil containers and filters, which are then drained and crushed to be recycled as scrap metal. As much as 30 gallons of oil per day are captured from these “empty” containers and filters by this operation. A metal shredder is being added to the process to enhance the metal recycling value. During FY02, 110,620 gallons of used oil and recyclable fuels were collected on Fort Campbell and sold to an off-site recycling company. The sale of used petroleum, oils, and lubricants (POLs) in FY02 generated over \$20K in revenues for the installation’s Qualified Recycling Program.
- **Concrete Grinding** – Fort Campbell is recycling concrete from both obsolete buildings and road construction projects through the new concrete grinding program. Waste concrete and masonry debris is turned into valuable gravel for road surfacing and base courses. This has a tremendous beneficial impact on life of the C&D landfill. In a runway reconstruction project during the summer of 2002, Fort Campbell diverted and reused over 37,000 tons of concrete through concrete grinding. This material was enough to gravel a two-lane road approximately 13 miles long. Plans to continue this trend are underway with additional obsolete buildings, including 10 barracks and 10 administration buildings with an estimated 21,500-ton concrete diversion.
- **Wood Debris** – Fort Campbell’s wood debris is ground into mulch and utilized on the installation’s playgrounds, parks, training areas, and daycare grounds. Waste from horseback riding stables, leaves, yard waste, and cross-shredded documents are composted. In 2002, 816 tons were composted. The rich compost is used as a soil amendment and fertilizer in training area restoration and landfill cover.
- **Demolition Waste Diversion** – C&D waste accounted for 85 percent of landfilled materials at Fort Campbell in FY01. Over the next few years, between 300 and 400 obsolete World War II-era wooden buildings will be replaced or removed from post. This material represents millions of pounds of debris. To keep this material out of landfills, a building deconstruction program and a whole building sale program has been introduced through the partnerships of many organizations (see Figure 5).



- **The First Five Deconstructions** – Fort Campbell hosted a building deconstruction/waste diversion study conducted by the Engineering Research Development Center (ERDC) and CERL to reduce demolition and construction debris. Within the first five building deconstructions, Fort Campbell achieved an impressive 151.8-ton diversion while earning \$25,000 for Habitat for Humanity in the resale of salvaged materials.

Through continued process development, similar buildings have been sold and are currently being deconstructed.

Realm of Possibilities

This section provides a glimpse of what can be accomplished with existing technology and what can be expected from developing sustainability approaches. To become sustainable, Fort Campbell is encouraged to identify and plan for innovations that will support long-term goals.

Figure 5 – Building Deconstruction Project

The Building Deconstruction project has been made possible through strong partnerships with:

- Corps of Engineers Construction Engineering Research Laboratory (CERL)
- Fort Campbell Public Works Business Center Environmental Division
- Environmental Protection Agency (EPA)
- U.S. Army Environmental Policy Institute (AEPI)
- Habitat for Humanity (HfH)
- National Civilian Community Corps (NCCC)/AmeriCorps
- University of Florida Center for Construction and Environment
- U.S. Forest Service Forest Products Laboratory

Clean Products



- **Clean Products Guide** – The General Services Administration (GSA) maintains an extensive “Environmental Products and Services Guide” which lists all available “green” products. The guide can be found on the following websites:
http://www.gsa.gov/attachments/GSA_PUBLICATIONS/pub/EPSPG2001.pdf
<http://pub.fss.gsa.gov/environ>
- **Biomimicry** – Biomimicry stems from the belief that the design of the natural world around us can inspire the future of material design and use. Abundant evidence indicates that nature has long ago mastered the problems that we still grapple with today. The silk from a spider’s web is *three times* stronger than Kevlar, the material used in bulletproof vests. Slug mucous can withstand pressure up to 1500 times its weight without losing any of its fluid or lubricating properties. Termite mounds are marvels of design ingenuity, using passive cooling systems and venting to maintain



constant interior temperatures regardless of exterior temperatures. See this website for more information: <http://www.natick.army.mil/warrior/97/nov/silk.htm>.

Local Manufacture



- **Locally Manufactured Products** – The use of locally manufactured products reduces harmful air emissions by reducing the transportation distance to their final destination. In addition, the purchase of these products stimulates the local economies of the communities around the installation.

Product Leasing



- **Take Back Programs** – One of the new business models taking hold in Europe and Asia is “manufacturer take back” programs. In such a program, the original manufacturer retains ownership and disposal responsibility for products. Several examples include recyclable BMWs and Nike shoes. Interface, Inc., is the American manufacturer pioneering this concept. Interface’s “Evergreen Lease” on commercial carpet provides a service in which worn carpet tiles are checked and replaced each month. The worn tiles are 100 percent recyclable into new carpet. For more information on efforts worldwide, see Chapter 3, *Waste Not*, and Chapter 4, *Making the World*, in the book Natural Capitalism.
- **Paperboard and Food Composting** – Shredded paperboard can be used as a bulking agent for food composting. A food composting program, which may include pre-consumer (i.e., kitchen waste) and/or post-consumer (e.g., food service waste from lunchrooms) waste, typically needs a bulking agent to absorb the excess water from food waste.
- **Heating and Power Supply** – Today, almost every home and business owns a hot water heater and heating, ventilation, and air conditioning (HVAC) unit. When these units fall out of service or need to be replaced, they are almost always disposed of in a local landfill. There is an alternative; Trane is starting to offer full-service leases to commercial clients at competitive monthly rates. In



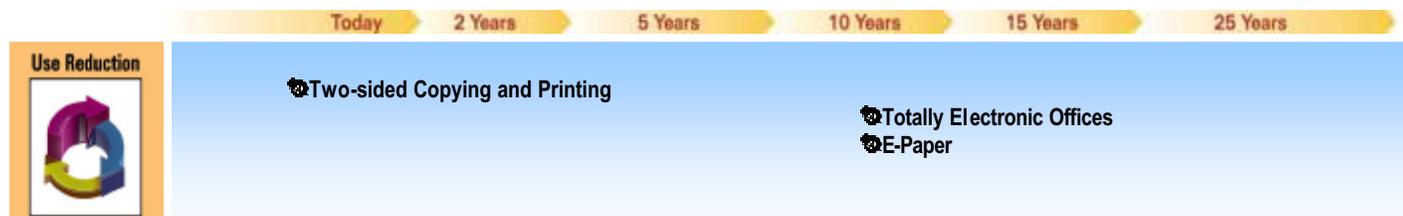
these arrangements, the customer provides the location for installation and Trane takes care of the rest. When the customer desires a new unit, the old unit is returned to the manufacturer and a new one is provided. In the future, home heating and electricity may be bundled in a fuel cell, further simplifying the process (<http://www.trane.com/commercial/financing/leasing.asp>).

Reuse and Recycling



- **Recycled Asphalt** – DoD and EPA conducted a joint parking lot repaving project for the Pentagon. The \$1M project used 25 percent recycled asphalt. McClellan AFB avoided paying \$3.8 million to haul 144,000 tons of construction debris by recycling concrete in a rock crusher (www.afcee.brooks.af.mil/pro-act/success/mcclellan/mcclellan.asp#7).

Use Reduction



- **Two-sided Copying and Printing** – Printing and copying on both sides of a sheet of paper is a fast and easy way to immediately reduce paper use by 50 percent. Printers can be used with little or no modification and overall printing speed is preserved.
- **Totally Electronic Offices** – In the next 10 years, offices will use less and less paper as workers become more dependent upon email, web pages, and other electronic means of doing business. This will reduce the overall flow of material into an office, and there will be fewer pens, staplers, tape, and plastic binders as well.
- **E-paper** – Lucent Technologies and E Ink Corporation of Cambridge, MA, are developing e-paper. This paper may be used repeatedly to download daily newspapers and books. As compared to LCD technology, it is 5 times brighter, uses 99 percent less power, has more portability, and has a longer battery life. For more information, go to the following web site: www.sciencentral.com/articles/view.php3?language=english&type=article&article_id=218392010.



Waste



- **Innovative Deconstruction** – Fort Knox sells the salvage rights to buildings that are on the demolition schedule. The purchaser of the rights can remove windows, doors, flooring, siding, plumbing, and copper wire, but must remove at least 50 percent of the volume of the building. The installation makes about \$100K/year on the sale of the salvage rights, but saves hundreds of thousands of dollars on reduced demolition and disposal costs.
- **Landfill Fluff** – Fort Campbell and the Army's Construction Engineering Research Lab are testing a new waste-reduction technology in partnership with its inventor, Bouldin-Lawson, Inc. Unsorted household garbage is fed into a grinder, hydrolyzed, and then flash-heated to kill germs. The resulting dry “fluff,” which looks like cellulose insulation, passes all toxicity tests and appears to pose no environmental hazard. The process reduces waste volume and weight by 90 percent. The entire process costs \$30/ton—comparable to landfill disposal fees in most areas of the country. Testing at Fort Campbell will determine if the “fluff” is useful as a soil amendment and with building materials (i.e., plastic lumber). This technology has the potential to eliminate the need for landfilling household garbage.

Fort Campbell 25-Year Goals for Procurement

To be determined by Fort Campbell’s Command and staff, as advised by members of the local and regulatory community, at the Installation Sustainability Workshop on 9-11 September 2003.



THIS PAGE INTENTIONALLY LEFT BLANK



Challenge

The Clarksville-Hopkinsville Metropolitan Statistical Area (MSA) is among the fastest growing in the region and part of the most rapidly growing area in the United States. How can Fort Campbell and its regional partners ensure sustainable regional development that protects and enhances the mission of Fort Campbell, the regional environment, and the regional quality of life?

Key Considerations

- **Regional Planning** – State, regional, and local planning agencies are in place for the region and surrounding communities. A Joint Land Use Study (JLUS) with the surrounding communities, which addresses incompatible land uses around the installation, has been completed, and a JLUS Partnership committee—comprised of Garrison leadership, local elected officials, and community planning staff—meet periodically to discuss land use issues and review progress in meeting JLUS recommendations. The fact that the region around Fort Campbell is divided into two states complicates area-wide planning. Tennessee state law mandates a planning process for cities and counties that addresses public service needs of growing residential areas and maintenance of the character of rural areas. The Kentucky Legislature is currently considering a bill that would require planning units to have comprehensive plans that take into account and accommodate military installations in their planning area.
- **Plan Implementation** – Studies have shown that regional development also occurs via individual requests for zoning variances, not only according to plan. Fort Campbell and the surrounding communities must work together to ensure that critical resources and areas are maintained in compatible land uses.
- **Clean Air** – The State of Kentucky has nominated Christian County as being a nonattainment area for ozone under the Clean Air Act based on exceeding the eight-hour standard. At this time, the U.S. Environmental Protection Agency (USEPA) has not approved the designation of Christian County as a nonattainment area. If nonattainment is declared, air quality controls and measures resulting from this situation may apply to the entire Metropolitan Statistical Area (MSA). As of June 6, 2003, the MSA, which is defined by the U.S. Office of Management and Budget, included all four counties surrounding Fort Campbell: Stewart and Trigg Counties, as well as Montgomery and Christian Counties.
- **Clean Water** – According to the Source Water Protection Program, the quality of source water could be affected due to human activities. Cumberland River/Lake Barkley, which is the source water for Clarksville, Dover, and Cunningham East Montgomery and the backup source for Fort Campbell, has been rated as highly susceptible to contamination from agriculture, urban runoff, and transportation and industrial activities.



- **Population Growth** – The Clarksville-Hopkinsville MSA ranked 47th in population growth nationally during the 1990s. Stewart and Trigg Counties experienced double-digit growth for the decade. These growth trends are predicted to continue.

Importance to Fort Campbell

Mission – The sustainability of Fort Campbell is linked to the sustainability of the surrounding communities and region. That is, Fort Campbell relies upon the surrounding communities for services, materials, energy, and compatible land use. The surrounding communities benefit from the jobs, purchasing, and community support provided by Fort Campbell. Participation by the installation in community planning for sustainable development will help avoid conflicts that have arisen in the past and could arise in the future between community and military objectives.

Quality of Life – Fort Campbell relies upon the surrounding communities for resources, services, energy, and housing. The successful accomplishment of the installation mission will continue to depend on the civilian workforce provided by the communities, transportation networks, local suppliers, off-post housing, and mutual aid/support. The installation will benefit from a robust community dedicated to environmental principles and sustainability where economic, social, educational, recreational, and cultural opportunities abound.

Cost of Operation – Without a regional sustainability approach, the installation will continue to be faced with increasing costs to accomplish the mission. Some costs already apparent are easements and land acquisitions to protect the ability to operate and train. In 2000, the installation bought 130 acres for \$1.8M to protect aircraft approaches to Sabre Heliport. A \$7.3M project was funded in FY03 to purchase avigational easements on approximately 4,000 acres of private property in the approach zone to the runway at Campbell Army Airfield (CAAF). The easements will prevent housing and commercial developments in the approach zones to CAAF. Other costs will result from environmental degradation such as regional ozone nonattainment and impaired water quality.

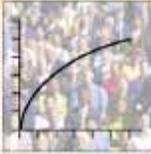
Environment and the Community – We live in the environment, and as such, we impact it. Regional development will demand that the community pay attention to the environmental impacts created by this development. Current regional growth has resulted in air and water quality issues. Future growth may erode open space and farmland, reducing habitats and productive farmland. Increasing populations will demand energy that can result in additional air pollution and higher energy costs. The rising population will also result in additional solid waste that will consume landfill capacity. Growth will also demand investments in infrastructure like roads and schools, or the community quality of life will slip. The environment, regional quality of life, and growth are inexorably linked.



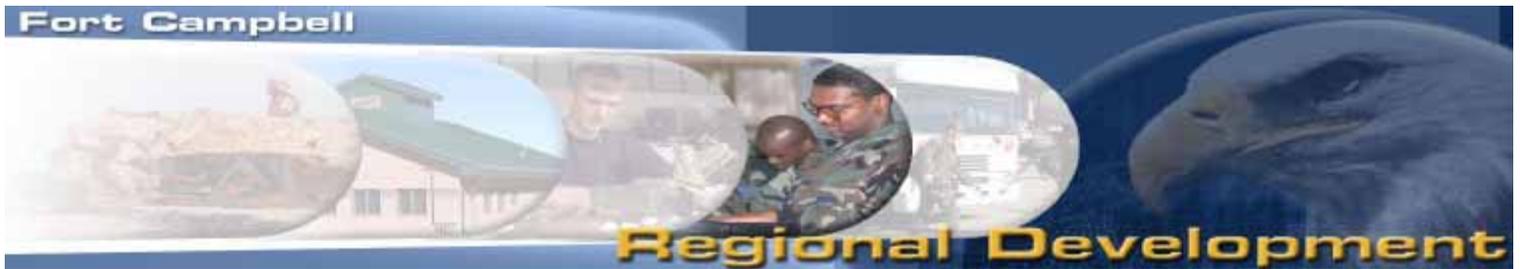
Significant Impacts

Fort Campbell convened a working session the week of 28 July to better define the relationships between Fort Campbell’s mission and regional development. Participants included representatives from across the Garrison staff, plus several planners from local communities. Figure 1 below summarizes the critical impacts identified during the working session.

Figure 1 – Significant Environmental Impacts for Regional Development

ACTIVITIES	 Construction of Buildings and Communities	 Population Growth	 Road Construction
IMPACTS	<ul style="list-style-type: none"> • Encroachment of buildings on buffers • Loss of habitat and open space • Storm water pollution and runoff • Erosion • Use of raw materials • Increased energy consumption 	<ul style="list-style-type: none"> • Encroachment of population on training areas. Noise impacts on population. • Loss of space for training • Increased energy usage • Air pollution • Water pollution • Consumption of natural resources • Solid waste generation • Transportation congestion 	<ul style="list-style-type: none"> • Segmentation of habitats • Loss of open space • Air pollution • Water pollution

Participants determined significance based upon the potential impact to the mission, the surrounding community, current and future costs, compliance considerations, and long-term sustainability. The participants scored land use, water quality and availability, solid waste disposal, air quality, and energy cost and availability as the most significant issues pertaining to regional development.



Introduction

The Fort Campbell area is rich with natural beauty, scenic landscapes, tremendous recreational opportunities, productive farms and forest lands, and vibrant communities that range from historic small towns to a thriving city. These resources make the area an attractive place to live, work, and visit. Yet parts of the area are being transformed. For the past decade, the Clarksville-Hopkinsville MSA has been among the fastest growing in the region, and a part of the most rapidly growing area in the country. Unprecedented population growth, land development, and economic prosperity are redefining the area. Many of the changes brought by this rapid growth are positive, including jobs, businesses, and higher property values. However, growth and development are also resulting in negative consequences, including conversion of open space and farmland, longer commutes, more traffic congestion, air and water pollution, and conflicts with the mission of Fort Campbell.

When Fort Campbell was first built in 1941, it was located approximately ten miles northwest of the City of Clarksville, Tennessee, in largely rural, undeveloped portions of Tennessee and Kentucky. During the past fifty years, development has surrounded the installation, intensifying to a point that the cantonment area of Fort Campbell is now considered a portion of the Clarksville urbanized area. The City of Hopkinsville, KY, also continues to grow and has extended its city limits to the I-24 area just north of the post boundary. In turn, this growth has caused neighboring landowners to consider developing their lands and farms into subdivisions and commercial areas in order to benefit from the area's growth.

Citizens, policymakers, and business leaders are increasingly concerned about the impacts of growth and development. These impacts include schools, roads, water, and sewer; traffic and commuting; health and environmental impacts from air and water pollution; loss of farmlands and open space; and

Planning and Development Organizations

- The **Cadiz-Trigg County Joint Planning Commission** has six members and meets as needed. A comprehensive plan and subdivision regulations were adopted in March 1989.
- The **Clarksville/Montgomery County Regional Planning Commission** is a joint city-county agency to direct comprehensive planning efforts for the local governments of Clarksville and Montgomery County. A 20-year growth plan was completed in February 2000.
- The **Hopkinsville-Christian County Planning Commission** is a joint city-county regulatory planning commission tasked with planning, zoning, local code enforcement, and community development. The goals and objectives portion of their comprehensive plan were updated in 1999. The City of Oak Grove is in the process of updating their Future Land Use Plan.
- The **Greater Nashville Regional Council (GNRC)** is a voluntary association of local governments in the 13 counties of upper middle Tennessee including Montgomery and Stewart Counties. This council is the vehicle for regional planning in the 13-county region.
- The **Pennyrile Area Planning Commission (PADD)** is a regional association of local governments working together to promote local development, facilitate strong local planning efforts, and resolve common problems. The PADD serves nine counties, including Christian and Trigg Counties, in an advisory capacity.



the loss or impairment of natural and historic resources that attract tourist spending. Decision makers and citizens are increasingly realizing that growth needs to be guided and based on sustainable principles in order to have a strong economy, society, and environment. There is growing awareness of the many regional effects of growth and development, the need to develop sustainable solutions at both a regional and a local level, and the limitations of current approaches to land use and transportation.

Activities and Impacts

Many factors affect the growth and development of the area surrounding Fort Campbell. Growth consumes open space and requires additional community infrastructure. Regional development may impact or influence the mission of Fort Campbell. As communities move closer to Fort Campbell, there is a higher probability that residents may be impacted by training and deployment activities. Without understanding, the community may come to object mission-critical activities.

Population Growth and Distribution

From 1990 to 2000, the population of Clarksville-Hopkinsville and other MSAs in Tennessee grew between 10 and 25 percent. Figure 2 shows the rank of these areas according to the growth of other MSAs in the United States and the percent increase in growth over the past decade.

Figure 2 – Population Growth for Tennessee Metro Areas from 1990 to 2000

Rank	Metropolitan Statistical Area	Population on April 1, 1990	Population on April 1, 2000	Growth Amount	Percent Increase
37	Nashville	985,026	1,231,311	246,285	25%
47	Clarksville-Hopkinsville, (TN-KY)	169,439	207,033	37,594	22%
80	Knoxville	585,960	687,249	101,289	17%
134	Memphis, (TN-AR-MS)	1,007,306	1,135,614	128,308	13%
160	Johnson City-Kingsport-Bristol, (TN-VA)	436,047	480,091	44,044	10%
165	Chattanooga (TN-GA)	424,347	465,161	40,814	10%

As shown in Figure 3, the tremendous population growth in Middle Tennessee and the Fort Campbell area is expected to continue. The predicted average growth rate for the four counties in the Clarksville-Hopkinsville MSA is 38 percent over the next 20 years. The four-county population is expected to increase from 230,000 to 315,000 by 2020.



Figure 3 – Past and Projected Growth for the Fort Campbell Area

County	1990	2000	2010	2020	20-Year Change
Montgomery	101,605	132,536	163,927	202,680	53%
Stewart	9,489	12,068	14,595	16,960	41%
Christian	68,941	72,265	74,791	75,404	4%
Trigg	10,361	12,597	15,740	19,345	54%

* Source – U.S. Census Bureau 2000.

Land Use

Land use in the four-county region varies from urbanized to natural woodlands and farms. Urban development is concentrated in Clarksville and Hopkinsville and along U.S. Highway 41A, which connects these two cities. The only other urban developments are Cadiz in Trigg County and Dover in Stewart County. These communities are approximately 10 miles from Fort Campbell and have populations less than 2,500.

Christian County’s 404,640 acres is about 60 percent agricultural, with most in row crops. Forest and woods make up 30 percent of the acreage, 4 percent is wildlife or water, and the remaining 6 percent includes Fort Campbell and the urban areas of Hopkinsville and Oak Grove.

The Trigg and Stewart County area is mostly forest. About 33 percent of Trigg County’s 292,480 acres is pasture and cropland. The State and Federal government own almost 40 percent of the land in Stewart County. The government-owned land, plus the agricultural/forest/open/undeveloped land, in Stewart County totals 261,532 acres, or 89 percent of all land within the county.

Montgomery County has a total area of 345,046 acres with 101,879 classified as developed and 243,167 classified as agricultural and undeveloped.

Economic Activity

Fort Campbell is the largest single employer in the four-county region. There are about 5,000 civilian jobs in addition to approximately 25,000 military on-post. The four counties around Fort Campbell have diversified economies. Major sectors include agriculture, manufacturing, government, and retail/wholesale trade. Most of the labor force lives in Christian and Montgomery Counties, where the majority of the jobs are located. Tourism is a primary focus in Stewart County for economic development, but manufacturing, farming, and Fort Campbell are the dominant sectors today. A large industrial and military payroll, strong retail trade, and a robust agricultural sector support the economy of Clarksville. Clarksville serves the surrounding area as a shopping and medical center. Hopkinsville and Christian Counties have a strong mix of agriculture, industry, and trade. The Cadiz and Trigg County area is more rural but has some industry. Trigg County borders Lake Barkley and thus has a significant tourism and recreational component.



Land Development

Population surges—coupled with land use and transportation policies that tend to favor sprawling development—are having tremendous impacts. Statewide in Tennessee, the U.S. Department of Agriculture estimated that 401,000 acres of open space were developed between 1992 and 1997 for projects such as new homes, businesses, roads, and parking lots. This was the seventh highest amount of land development of open space in the nation during this period.

Sprawl

The land use and transportation trends shaping this region are not simply the result of consumer choice or a necessary by-product of economic growth. A host of government subsidies, regulations, and decisions are a primary factor promoting scattered development by making it cheaper and easier to develop farther from existing communities. For example, taxpayers often subsidize the costs of providing roads, schools, water, and sewer facilities for new development. As long as taxpayers cover these costs, there is little incentive to build where infrastructure already exists. In addition, planning and zoning policies requiring large lots and the geographic separation of commercial and residential uses encourage scattered development and driving. Other regulations, such as building code requirements, frequently increase the cost of redeveloping existing structures. Plus, state and local transportation spending often subsidizes roads that open new areas to development or make it easier to live farther from existing communities. Recognizing the role that governmental policies and decisions can play in fostering sprawl highlights the fact that sprawl is not inevitable, and suggests some of the opportunities for growth management.

Farmland Loss

Of the 401,000 acres in Tennessee developed between 1992 and 1997, 124,000 acres were prime farmland. On average, this means that the state has been losing 24,000 acres of prime farmland each year, or 65 acres each day. In the 10-county Middle Tennessee region, an estimated 18,100 of the 110,000 acres developed between 1992 and 1997 were prime farmland. On average, this means that 3,620 acres of prime farmland are being developed each year, or 10 acres per day.

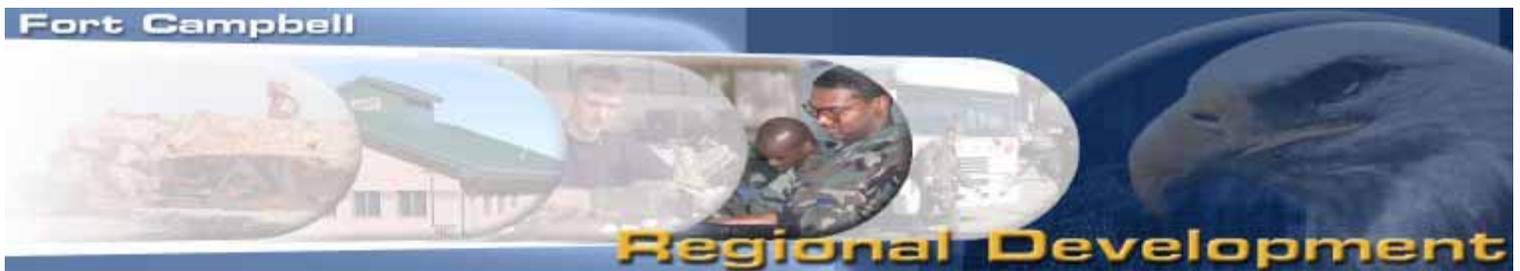
Forest Loss

The rate of forest land loss in the region is also accelerating. Between 1992 and 1997, an estimated 40,000 of the 110,000 acres of developed open space had been forest lands. This is the same amount that was consumed over the entire previous 10-year period. The current rate of forest land development translates into an average loss of 8,100 acres per year, or 22 acres per day.

Requirements At A Glance

The following planning/land use regulations and requirements impact regional development:

- **Kentucky Revised Statutes Chapter 100, Planning and Zoning** – State-enabling regulations pertaining to planning and zoning throughout the State of Kentucky.
- **Tennessee Code Annotated Title 13, Public Planning and Housing** – State-enabling regulations pertaining to regional and local community planning and zoning.
- **Tennessee Code Annotated Title 6, Chapter 58, Section 107** – State-enabling regulations requiring each county to have a growth plan to guide land use decisions.



Loss of open space, agricultural land, and forests can be detrimental to both individuals and the community as a whole. Open space enhances economic viability, sense of community, and environmental health. In turn, a vibrant community will enhance accomplishment of the mission and military readiness.

Protected open space provides ecosystem services such as water purification, water temperature and turbidity control, groundwater and wellwater recharge, and stormwater and sediment control that are vastly more expensive to provide through traditional sewerage and drinking water treatment plants by themselves. In addition, a common misperception is that new water and sewer users bring new disposable revenue to municipal authorities. This is typically true for redevelopment of urban areas because the shorter distances between users reduce infrastructure capital outlays. However, for the same reason, it is typically not true for converting outlying farmland into sprawling residential or commercial uses. According to an International City/County Management Association report, "Economic Benefits of Parks and Open Space," dispersed development of open space typically requires community expenditure for new infrastructure and services at costs that are never fully recovered from the new service recipients.

Useful Information

The following information would be useful to consider in determining where to begin to establish sustainable regional development practices:

- **Air Quality**
- **Ecosystem Health**
- **Energy Use**
- **Land Consumption**
- **Waste and Recycling**
- **Water Quality**

Driving, Congestion, and Road Building

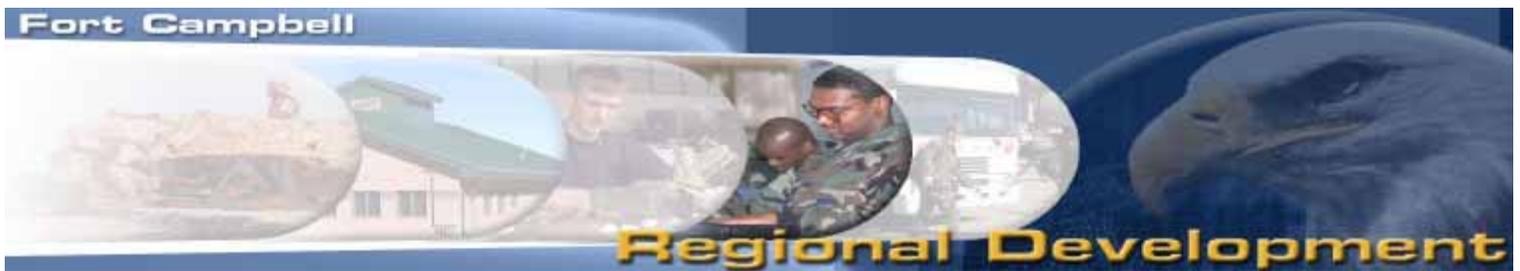
Motor vehicles are the dominant mode of personal transportation throughout virtually all of the United States. In Middle Tennessee, a recent survey of travel behavior showed that over 90 percent of all trips are taken by automobile. Transportation and land use are intertwined. One of the factors accounting for the dramatic increase in driving in this region is the trend toward more scattered land development. As development spreads farther and farther out, people have little choice but to drive—and to drive longer distances—to work, buy groceries, see a movie, or take children to school. Commuting patterns also underlie some of the increase in driving in the region.

Environmental Quality

From air and water pollution to the loss of wildlife habitat and open space, the region's land use and transportation patterns are having substantial environmental impacts.

Transportation is a major source of air pollution. The bulk of this pollution, which contributes to problems such as acid rain, visibility impairment, and ground-level ozone, originates from motor vehicles. Transportation also produces a significant amount of particulate matter, lead, rubber, and other hazardous pollutants. Christian County recently failed to meet the Clean Air Act's new, eight-hour standards for ground-level ozone, which is directly attributable to the handling and burning of gasoline and other fuels.

Development and transportation are also a primary source of water pollution. Buildings, roads, and paved areas are replacing thousands of acres of forests and farms—the areas that would otherwise filter



water. Development dramatically increases the amount of impervious surfaces, which in turn can increase the volume of runoff of pollutants, increase erosion, and slow groundwater replenishment, thereby depleting water supplies. A one-acre parking lot, for example, creates 16 times more runoff than a meadow of the same size.

Historic Resources

The rich heritage of historic and cultural resources offers a wide range of benefits, including helping to define a sense of community, educating the public about the past, and strengthening the economy. The National Register of Historic Places currently lists 121 places in the four-county Fort Campbell area. Insensitive land use and transportation decisions may threaten many historic resources in the future.

The loss of open space, farmland, and forests and the rise in traffic congestion have brought growth issues to the forefront of public debate in parts of the region. Awareness of the causes and consequences of growth is rising among citizens and decision makers, as are the efforts to find innovative approaches that will protect quality of life without limiting economic growth.

Forecast

The existence of the Clarksville-Montgomery County Growth Plan and the Stewart County Growth Plan are positive and encouraging indicators that the region may be starting to consider all of the effects of growth and development—both positive and negative.

There is strong public concern over growth issues. A poll conducted for the Tennessee Conservation Voters Education Fund found that 9 out of 10 voters ranked environmental issues as an important factor when deciding how to vote. When asked which environmental issues were of greatest concern, 89 percent of voters identified water quality and 84 percent identified air quality. In addition, 78 percent expressed concern about growth and sprawl.

As of June 6, 2003, the Clarksville-Hopkinsville MSA has been expanded to include Stewart and Trigg Counties. This change will allow and promote regional community and economic planning in the four-county area and provide for better communication and cooperation regarding issues of regional sustainable development (OMB Bulletin 03-04, June 6, 2003).

Current Sustainable Activities

- **JLUS** – The current JLUS study for Fort Campbell was completed in 1996, and a JLUS Partnership committee—comprised of Garrison leadership, local officials, and community planning staff—was formed in 1998. The JLUS committee remains active and continues to meet and assess progress toward implementation of the JLUS study recommendations. The JLUS process provides for maintaining private property land values and community development options, while supporting continued installation military missions and operations.



Installation planning cannot be insular; the concerns and interests of local communities must be considered. No installation can consider itself isolated, nor can planners ignore the surrounding communities. Evolving Army missions, equipment, and operations create annoyances to these communities. Disregarding those concerns can ultimately lead to unwanted limitations on future installation operations, such as changes in flight patterns, range uses, or levels of military activities that adversely affect private property. The JLUS can remedy some of these problems.

- **On-site Community Planner** – Fort Campbell has a full-time community planner on staff. This position was added a few years ago to interface and communicate with local governments, agencies, and planning offices. The community planner is responsible for monitoring off-post actions such as zoning, development, or transportation system changes that may impact the installation and its ability to perform the mission.
- **Environmental Noise Management Plan (ENMP)** – In November 2000, Fort Campbell completed the current ENMP, which includes educational elements, complaint management, noise and vibration management, noise abatement procedures, and the ICUZ program. The noise program aims to reduce incompatible land uses around the installation that can severely impact the mission. County and Municipal governments are encouraged to support public disclosure of noise zones and noise easements. The ENMP includes recommended actions for both the public and Fort Campbell.

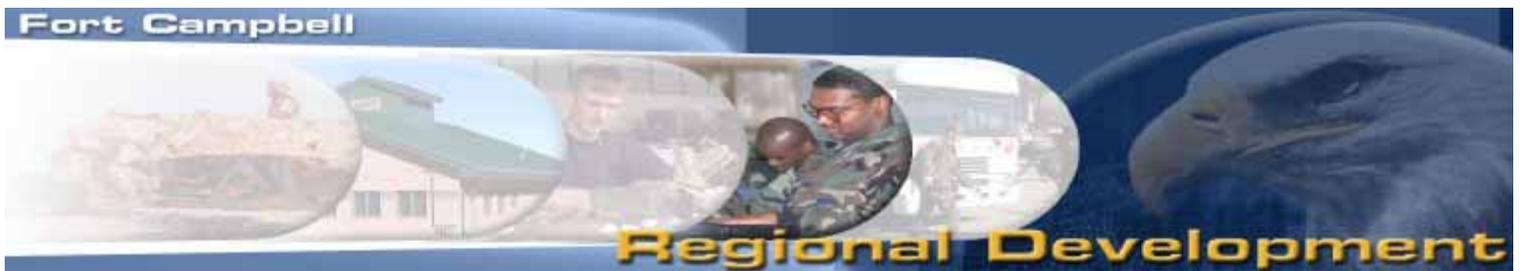
Realm of Possibilities

This section provides a glimpse of what can be accomplished with existing technology and what can be expected from developing sustainability approaches. To become sustainable, Fort Campbell is encouraged to identify and plan for innovations that will support long-term goals.

Sustainable Communities



- **Private Lands Initiative** – The Private Lands Initiative (PLI) is a cooperative effort between the Army, The Nature Conservancy, U.S. Fish and Wildlife Service, and private landowners around the borders of an installation. By annexing land around the fenceline and preventing that land from being developed, the PLI creates a “buffer zone” of sorts, allowing for better wildlife habitat around the edge of an installation. Increased habitat for endangered species outside the fenceline decreases training constraints inside the fenceline. The PLI has been active at Fort Bragg since



1995 and is currently reviewing 10,000 to 20,000 acres of prime habitat of the red-cockaded woodpecker.

- **Noise Buffers** – Creative solutions for developing noise buffers include building industrial sites, scrap yards, or recycling centers on lands adjacent to installations. Wildlife easements may also prevent development on adjacent lands.
- **Weather and Training** – The rate at which wind speed and temperature change as a function of altitude can have profound effects on the behavior of high-energy sound waves as they propagate off-range and many miles into the surrounding area. As weather conditions change, noise monitoring many miles from the firing point and impact area has shown 30-decibel variations within just a few hours for a single weapon and firing point. For a local resident, this amounts to an eight-fold increase in loudness over a very short time period. Regular sampling of meteorological conditions and good recordkeeping can help identify adverse conditions and lead to strategies to avoid them. Disclosure of this information and the role that weather can play in noise levels at the point of reception can do a great deal to improve community understanding and tolerance of the noise related to military training.
- **Smart Growth** – The Smart Growth Network (SGN), formed in 1996, is a coalition of planners and businesses looking for ways to promote growth and development without causing sprawl (www.smartgrowth.org). The Network was formed in response to increasing community concerns about the need for new ways to grow that boost the economy, protect the environment, and enhance community vitality. Chattanooga, TN, Seattle, WA, and Jacksonville, FL, are just a few of the cities pursuing Smart Growth and sustainable development. The SGN works to encourage development that serves the economy, community, and environment by:
 - Raising public awareness of how growth can improve community quality of life;
 - Promoting smart growth best practices;
 - Developing and sharing information, innovative policies, tools, and ideas; and
 - Cultivating strategies to address barriers to and advance opportunities for smart growth.

Getting to Smart Growth: 100 Policies for Implementation is back in print! This primer from the Smart Growth Network and International City/County Management Association (ICMA) serves as a roadmap for states and communities that have recognized the need for smart growth, but are unclear on how to achieve it. It can be downloaded from www.smartgrowth.org.

Fort Campbell 25-Year Goals for Regional Development

To be determined by Fort Campbell's Command and staff, as advised by members of the local and regulatory community, at the Installation Sustainability Workshop on 9-11 September 2003.



THIS PAGE INTENTIONALLY LEFT BLANK



Challenge

Traffic congestion, dependence on oil, and vehicle emissions contribute to a growing regional air quality problem. How does Fort Campbell support its rapid deployment mission and ensure cost-effective, reliable, safe, secure, and pollution-free transportation systems in partnership with the local communities and states?

Key Considerations

- **Deployment Support** – Fort Campbell deploys troops, equipment, and supplies by air, highway, rail, and water. These transportation modes must have adequate capacity, flexibility, and be safe, timely, and adaptable.
- **Transportation Patterns** – The installation population, as well as the off-post population, is almost totally dependent on the automobile for transportation. The distances between buildings and activities on the installation make walking impractical. No on-post bus service or mass transportation exists. Fleets of government and contractor vehicles are used to transport soldiers, workers, equipment, and materials in support of Garrison and unit operations. Soldiers, workers, visitors, and military families overwhelmingly rely on internal combustion, fossil-fueled automobiles for personal transportation. Currently only a few useful alternatives exist.
- **Air Pollution** – The ozone levels in the air around Fort Campbell and surrounding counties are failing to meet national air quality limits for ozone. This is primarily due to vehicle emissions.
- **Energy Used in Transportation** – Currently all locally used modes of transportation for troop and material movement, tactical training, strategic deployment, and administrative and personal use depend exclusively on nonrenewable gasoline, diesel, or jet fuel.



Importance to Fort Campbell

Mission – Multimode, rapid deployment capability and safe, efficient transportation are essential to Fort Campbell's mission.

Quality of Life – Good quality of life depends on having safe, convenient modes of transportation and clean air for the soldiers, their families, and people in the community.

Cost of Operation – On average, Fort Campbell consumes about \$60,000 of gasoline, \$40,000 of diesel distillate, and \$12M of tactical fuels (11M gallons of JP-8) per year. During 2002, the Army and Air Force Exchange Service (AAFES) sold roughly \$10M of gasoline and diesel (over 7.5M gallons) for private vehicles and the General Services Administration (GSA) administrative fleet.

Environment and the Community – While Fort Campbell is currently in an attainment area for national ambient air quality standards, the State of Kentucky has preliminarily declared Christian County as exceeding the eight-hour ozone standard. If the area is declared as non-attainment by USEPA, then as a minimum, the entire cantonment area will be affected. The actual consequences and restrictions on activities will not be known until the states and USEPA have decided on programs to be implemented.

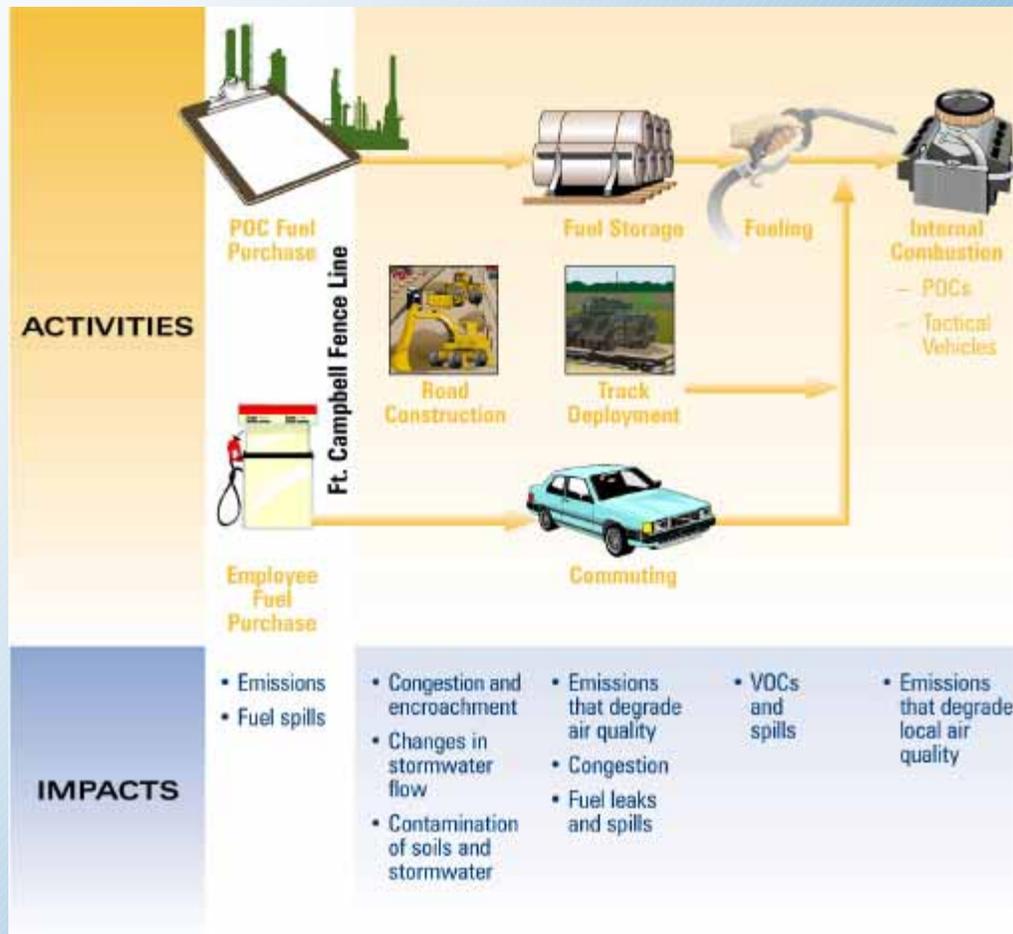
Based on the national average that commuters travel—24 miles per day—the commuters to Fort Campbell—civilians, contractors, and off-post military personnel—travel approximately 460,000 miles per day. This translates into an estimated annual release of 50,158 tons of carbon dioxide (CO₂), 168 tons of nitrogen oxide (NO_x), and 2,521 tons of carbon monoxide (CO).



Significant Impacts

Fort Campbell convened a working session the week of 28 July to better define the relationships between Fort Campbell's transportation systems and the environment. Participants included representatives from across the Garrison staff, plus several planners from local communities. Figure 1 below summarizes the critical impacts identified during the working session.

Figure 1 – Significant Environmental Impacts for Transportation



Participants determined significance based upon the potential impact to the mission, the surrounding community, current and future costs, compliance considerations, and long-term sustainability. The participants scored air, water, and noise pollution; congestion; and erosion as the most significant categories of impact associated with transportation.



Introduction

Fort Campbell is located between Clarksville, TN, and Hopkinsville, KY, near I-24. The nearest large city, Nashville, TN, is 55 miles to the southeast. Fort Campbell supports the third largest military population in the Army and the seventh largest in the Department of Defense. At 164 square miles, the installation is one of the largest in the world.

Fort Campbell exists to advance the combat readiness of the 101st Airborne Division (Air Assault) and the non-divisional units posted at the installation through support of training, mobilization, and deployment. The installation serves as a Premier Power Projection Platform for the Division and for major Special Operations Command units.

Fort Campbell is a city unto itself. In addition to barracks for thousands of single soldiers, there are over 4000 family housing units on the installation for married officers, enlisted soldiers, and their families. The post has seven schools including a high school, a major hospital, child care facilities, numerous chapels, banks, restaurants, post exchanges, service stations, campgrounds, swimming pools, and most other types of facilities found in a civilian city of equivalent size.

As of the end of FY02, Fort Campbell had a supported population of 209,747. Below is a breakdown of that population:

- Military – 24,916
- Family – 42,149
- Civilians – 4,317
- Retirees and family members – 123, 665
- Reserve Components – 14,700

Fort Campbell is a power projection platform with strategic deployment capabilities (see Figure 2). Strategic deployment assets include Campbell Army Airfield (CAAF), the Rail Marshalling Area, the off-post rail connector, and Interstate 24.

Requirements At A Glance

The following environmental regulations and requirements impact the transportation activities at Fort Campbell:

Executive Order 13149 – *Greening the Government Through Federal Fleet and Transportation Efficiency* – Against a 1999 baseline, this Executive Order requires federal agencies to increase fleet fuel efficiency by 3 miles per gallon and reduce vehicle petroleum consumption by 20 percent by 2005. Also, it requires federal agencies to ensure that alternative fuels account for 50 percent of fuels used in dual-fueled vehicles by 2005.

Clean Air Act (CAA) – This federal legislation aims to protect air quality by limiting emissions from stationary and mobile sources. States implement many provisions of the CAA.



Figure 2 – Fort Campbell's Strategic Deployment Capability



CAAF is the largest airfield in the Army. CAAF airspace starts at 500 feet above ground level and extends to 10,000 feet above sea level. The main runway is 11,800 feet long and capable of handling the Air Force's C5 and C17, the NASA space shuttle and its 747 carrier aircraft, and all commercial passenger jets.

The railroad marshalling yard (facility for loading military vehicles onto railroad cars) was completed in 1999. This facility greatly expanded the rail deployment capability of the post by adding 10 rail spurs for upload, 620,000 square feet of paved area, and the ability to handle 300 rail cars.

CSX Transportation System provides regional rail service to the north of Fort Campbell near Hopkinsville. Fort Campbell owns a spur from the CSX line at Hopkinsville that connects to the on-post rail marshalling area. Rail movement is accomplished on- and off-post by diesel-locomotive power. Rail transportation is the chief mode of deployment for vehicles and equipment. For example, in the recent deployment in January to Iraq, approximately 75 percent of the vehicles and equipment to be deployed were sent via rail to the port of Jacksonville, Florida. The remaining 25 percent was sent via overland truck to Jacksonville because the rail system could not accommodate the demand within the time limits ordered. Troops are typically deployed via Air Force aircraft or chartered commercial flights.



There is no rail passenger service to Fort Campbell or Clarksville. The closest passenger rail service is through western Tennessee and western Kentucky on the Chicago to New Orleans route.

Fort Campbell has no water transportation facilities on the installation. The Corps of Engineers owns a facility on the Cumberland River downstream from Clarksville that is used by Fort Campbell for equipment movement by river barge. This provides access to the nation's inland waterway system where navigable channels provide year round access to the Cumberland, Ohio, Tennessee, and lower Mississippi rivers for goods moving to and from the Gulf of Mexico.

The primary highway arteries serving Fort Campbell include Interstate 24 (I-24); U.S. Route 41A, which runs along the east side of the post; and U.S. Route 79, which runs along the southern border of the installation. Most of the access points between the internal and external roadways are located along the eastern border and connect to U.S. Route 41A. The internal roadway system at Fort Campbell is set up in a grid pattern. The internal roadway network consists of arteries, collectors, and local roadways.

Clarksville is served regionally by Greyhound bus lines and is served locally by Clarksville Transit System (CTS). CTS has two routes connecting to Fort Campbell, but the buses no longer enter the post due to access point time delays.

In the Clarksville urbanized area, which includes Oak Grove, Kentucky, the Metropolitan Planning Organization (MPO) coordinates comprehensive regional transportation planning. A local MPO coordinator works with the local planning commission and conducts studies, develops plans and programs, and chairs all MPO subcommittees. The coordinator serves as liaison between the MPO and the Federal Highway Administration, the Federal Transit Administration, the Tennessee Department of Transportation, local governments, and other groups or individuals interested in transportation issues. In Kentucky, the Pennyriple Area Development District coordinates transportation planning. There currently is no mass transit plan for the regional area. For the most part, transportation studies for this area have been used to document the need for additional roads to accommodate the traffic load.

Activities and Impacts

Transportation activities include commuting by soldiers, the civilian workforce, and visitors, as well as military vehicle use by units for training and administration. Other transportation activities include garrison support activities, commercial activities, and contractor use. Transportation activities are integral to the mission of training, mobilizing, and deploying combat-ready forces. Transportation also mandates construction and maintenance that also result in environmental impacts.

Thousands of military ground vehicles and hundreds of helicopters equip the units assigned to Fort Campbell. JP-8 fuel is used in almost all Army vehicles, aircraft, and equipment. A very small amount of gasoline is still used in some equipment. In addition to assigned aircraft, Campbell Army Airfield services approximately 4,300 transient aircraft annually. The 4,500,000 gallons of JP-8 fuel



provided for transient aircraft is approximately 40 percent of the 11,000,000 gallons handled annually on the installation.

Fort Campbell provides commissary, recreation, educational, exchange, and medical services to the supported community. While no hard data is available on number of trips, miles, traffic, and environmental impacts, clearly this is a significant activity in the transportation arena. The estimated population supported by these services is over 200,000 active duty soldiers, military families, reservists, and retiree families. In 2002, AAFES reported dispensing over 600,000 gallons of gasoline per month.

Garrison transportation activities involve the use of vehicles for maintenance of the facility; movement of soldiers, school children, materials, and equipment; administrative transportation for staff; and recreation support activities. The total number of administrative GSA vehicles, Army-owned commercial vehicles and equipment, and vehicles used for service and construction contracts are substantial. Practically all of these vehicles are conventional, gasoline- or diesel-fueled, commercial trucks, cars, buses, construction equipment, or locomotives.

Ozone pollution is one critical concern related to transportation systems. Ground-level ozone is not emitted directly into the air, but instead is formed as the result of a chemical reaction involving volatile organic compounds (VOCs), and nitrogen oxides (NO_x) in the presence of sunlight, especially during hot weather. Ozone is very chemically reactive and can be an irritant to eyes and respiratory tissues. Ground-level ozone is the chief component of smog. Ground-level ozone can be a health hazard, affecting the throat, respiratory tract, and lungs. Ozone also can reduce crop and forest yields; damage the appearance of trees and plants; and limit plants' ability to withstand disease, insects, other pollutants, and harsh weather.

The only way to lower ground-level ozone levels is to reduce the amount of VOCs and NO_x released into the air. VOCs and NO_x are emitted from daily activities such as driving a car or truck, filling a gas tank, and mowing the grass. Individuals create 60 percent of the ozone pollution, primarily from vehicle operation. Business and industry account for the other 40 percent. For businesses, the largest sources of ozone-forming chemicals are industrial and utility boilers that use fossil fuels, like coal and oil. Transportation control measures for ozone include coordinating traffic signals to reduce engine idling, using mass transportation, car pooling, using alternative fuels and transportation, and implementing stage II vapor recovery at gasoline dispensing stations. Industrial controls might include process changes or emissions control devices on stacks.

On September 16, 1997, the federal government adopted a new eight-hour ozone standard. The new standard is calculated by averaging data over a three-year time period. To calculate this average, the four highest daily eight-hour averages for three years are averaged together. A one-hour standard of 125 ppb also exists for ozone. If there are four one-hour averages greater than 125 ppb at one site during a given three-year time frame, the site has exceeded the federal standard.



The State of Kentucky has preliminarily listed Christian County as exceeding the eight-hour standard for ozone. If USEPA declares Christian County as a nonattainment area, this would affect the entire metropolitan statistical area, which includes Montgomery County, TN. It is not known if Trigg, KY, or Stewart, TN, would be included. This nonattainment status will likely prompt local authorities to focus more attention on reducing emissions from vehicles, perhaps providing mass transit options. The area's nonattainment status may lead to the withholding of federal funding for highways.

Forecast

The United States is the world's largest emitter of carbon dioxide, the most significant greenhouse gas. The World Health Organization points to respiratory disease as the leading cause of death among children worldwide. Many developing nations do not use even rudimentary emission controls on vehicle engines. Fossil fuel use damages the environment in several ways beyond vehicle emissions. The heavy equipment used to explore for, extract, and transport fossil fuels damages ecosystems. Transportation of fossil fuels adds to air pollution and spills, which also damage the environment, and pipelines disrupt ecosystems during construction and use. Additionally, demand for reliable, inexpensive sources of oil has led to wars and tensions between countries. Clearly, reduced dependence on fossil fuels is highly desirable.

The goals of Army After Next—the force envisioned for the year 2020 and beyond—require a 75-percent reduction of fuel usage by the year 2020. The Army's National Automotive Center has been working to expand use of hybrid propulsion systems in military ground vehicles. Dual-power source vehicles, also known as hybrids, most likely will provide the bulk of land transport needs for the Army After Next.

Better fuel economy also means savings on the logistics "tail," which include fuel haulers, pipelines, and ships that are used to move the fuel forward to combat line units. Vehicles with better mileage provide increased operational capability and security during wartime because of a reduced footprint for the fuel resupply logistics support. Smaller supply lines are less vulnerable to attacks.

Almost all, if not all, of the administrative vehicles on the installation are standard commercial fossil fuel automobiles. Some are Army-owned vehicles that have been retained long past the time when most consumers would have traded them in for newer vehicles. GSA owns several flexible fuel vehicles (FFV) that are capable of running on blends of gasoline and methanol or ethanol, but no on-post blended fuel is available. As the largest fleet operator in the nation, the Federal government has the greatest opportunity to provide market incentives for the development and manufacture of alternatively fueled vehicles and the infrastructure to support them. Executive Order 12844, entitled "Federal Use of Alternative Fueled Vehicles," requires the use of alternatively fueled vehicles for areas that have GSA service centers providing alternative fuels. Because the Clarksville area is somewhat remote and does not have a GSA service center, Fort Campbell is not subject to the provisions of EO 12844. There is little incentive to push for alternatively-fueled vehicles.



Over the next 20 years, the population of the four-county region surrounding Fort Campbell is expected to grow at a rate of 38 percent on average (see the Regional Development chapter for more information). This growth rate will increase the number of daily commuter vehicles, causing congestion and delays, and ultimately will affect the air quality of the region due to vehicle emissions. This potential decreased air quality will worsen the health risks associated with living and working in the Fort Campbell area.

Current Sustainable Activities

- **Purchase of Alternately Fueled Vehicles (AFVs)** – Several of the GSA-provided vehicles on-post are flexible fueled vehicles, which can burn gasoline/ethanol/methanol mixtures. However, all vehicles are routinely fueled with only gasoline; no blended fuels are available on-post. There are no AFVs, such as hybrid or natural gas, being used on-post. Sources for alternative fuels are a problem.
- **Carpools** – No organized effort exists to promote or create carpools. Some carpooling exists, but no data is available on the level of activity; it does not appear to be widespread. Current fuel prices do not provide sufficient incentives to soldiers and civilians to carpool to the installation. In addition, many people want the convenience afforded by driving their own vehicles. The distribution of personnel off-post may, however, support more carpooling if there were sufficient incentives to change.
- **Electric Golf Carts** – Cole Park Golf Course will be almost completely converted to electric golf carts by the fall of 2003. Approximately 80 carts will be affected.
- **City Buses** – City bus use by soldiers, families, and civilians to and from Fort Campbell is very limited. Since 9/11, city buses do not enter onto Fort Campbell due to the time it takes to check the ID of each passenger.



Realm of Possibilities

This section provides a glimpse of what can be accomplished with existing technology and what can be expected from developing sustainability approaches. To become sustainable, Fort Campbell is encouraged to identify and plan for innovations that will support long-term goals.

Community Pattern Transportation



- **Trees for Travel** – Trees for the Future is a nonprofit organization that will plant trees to offset the pollutants caused by air and vehicle travel. Organizations can keep track of their mileage and send donations to Trees for the Future. Large land-owning organizations can start their own program to offset the vehicle emissions caused by transportation activities (<http://www.treesfff.org/travel.htm>).
- **CIVIS Optically Guided Buses** – Most recently implemented in Las Vegas, hybrid buses use optical tracking and light synchronizers to create a very efficient mass transit system. These buses are less costly than light rail systems (1/10 the cost) mainly because the buses do not require a track (<http://www.commuterpage.com/civis/>).
- **Rideshare** – McClellan Air Force Base's Rideshare program has reduced the percentage of single occupancy vehicles (SOVs) from 77 percent to 62 percent since 1997. The program targets employee education, carpooling, vanpooling, bicycling, public transportation, clean-fueled vehicles, and other transportation modes. The efforts have included free public transportation, vanpool subsidies, bicycle-only gates, and preferential carpool parking. For every McClellan AFB employee that uses a non-motorized mode of transportation, approximately 200 pounds of air pollutants are avoided per year. The 1,000-rideshare participants are equal to an avoidance of 200,000 pounds per year of air pollutants (www.afcee.brooks.af.mil/project/success/mcclellan/mcclellan.asp#7).
- **Car Sharing** – Car sharing is an automobile community cooperative, or a subscription-based transportation service with cars available to its members. The average car sharer spends only \$1900 per year on automobile expenses, as compared to the average individual car owner's costs of \$7600 per year. In addition, after one joins a car-sharing operation, they reduce their car use by over 70 percent per year and consume 55 percent less fuel energy.



Fuel Efficiency



- **LEV/SuLEV** – Low-emission vehicles (LEV), super-low emission vehicles (SuLEV), and no-emission vehicles are on the market, in response to new laws in California.
- **Hybrid Vehicles** – A hybrid is an automobile that runs on a combination of technologies with the traditional internal combustion engine. The Honda Civic and Toyota Prius are both hybrid electric vehicles and are presently on the market. They normally get twice the miles per gallon as a conventional automobile.

In addition, the Department of Energy now offers a \$2,000 rebate on the purchase of hybrids, making them more affordable. This technology does not have the refueling problems that other technologies may have because it fundamentally depends on the same combustion engine mechanism.

Alternative Technologies



- **Biofuels** – Biofuels are alcohols, ethers, and other chemicals made from renewable resources (e.g., fast-growing trees, grasses, and algae) and waste products (e.g., agricultural and forestry residues, and municipal and industrial wastes). It is estimated that domestically produced biomass resources could eventually provide at least half of the U.S. light duty vehicle (LDV) fuel requirement. In the not-too-distant future, biomass will be consumed in fuel cells in vehicles and stationary equipment to produce heat and electricity very efficiently, with virtually no pollution and no net increase in carbon emissions. Eventually, high-efficiency biomass power plants will allow any facility to generate its electricity on-site.

According to the Department of Energy, America’s fastest growing alternative fuel is bio-diesel. Fuel generated from surplus soybean crops can replace diesel in many applications. Bio-diesel reduces diesel exhaust by 80 to 90 percent. The Defense Energy Support Center recently issued a



long-term contract to purchase bio-diesel for fleet vehicles including those of the Marines, Air Force, and Department of the Interior.

In 2001, Scott Air Force Base became the first base to use bio-diesel in all 270 diesel vehicles on-base. The base uses B20, a commonly used blend of 20 percent soybean oil and 80 percent petroleum diesel.

- **Hydrogen/Fuel Cells** – Hydrogen currently is not a viable energy source since little free hydrogen is available. Instead, many view it as the ultimate energy storage and transmission medium. It will be extracted from hydrocarbons, bio-fuels, and even water, and shipped/piped to another location where it will be directly burned, or indirectly consumed in a fuel cell, producing only energy and water vapor. Iceland, which has rich geothermal and hydrologic resources to extract hydrogen from seawater, recently set a goal of becoming the first hydrogen economy. Iceland New Energy—a consortium that includes Daimler Chrysler AG, Norsk Hydro AS of Norway, Royal Dutch Shell Group, and a Reykjavik-based venture capital fund—has launched projects aimed at promoting the hydrogen economy in Iceland. Three buses powered by hydrogen fuel cells were introduced into Reykjavik’s city transport fleet at the end of 2002. A second project will begin replacing conventional chemical batteries with fuel cells in stationary power structures that are not currently on the regular electric grid.

Fuel cells convert fuel to power three times more efficiently than internal combustion engines; they also allow for a greater range of travel than electric vehicles and do not pollute at the point of use. Every major automobile manufacturer in the world is investing in fuel cell technology, and the Department of Energy supports fuel cell research and development.

- **Alternative Fuel Vehicles (AFVs)** – AFVs are available on a limited basis now, but it will be a few more years before they truly begin to capture market share in the public and private sectors. Honda is working on a zero-emission vehicle that uses fuel cells for power. The state of California will now give up to \$9,000 in rebates to people who buy SuLEVs. With lower per-mile costs associated with fueling larger fleets, city bus fleets and commercial fleets are prime candidates for alternative fuels such as compressed natural gas.

Luke Air Force Base in Arizona has an extensive AFV fleet, including 10 propane, 253 LEVs, and 7 solar-powered carts. This AFV fleet travels 325,000 miles per year, saving the Air Force \$86,000 in costs. These costs equal a reduction of six tons of air pollutants per year

http://www.eere.energy.gov/femp/newsevents/femp_focus/fempfocus_archive/dec98_mobil_organ.html. GSA can provide a number of AFV options. For more information, go to the following websites:

<http://www.afdc.doe.gov/afvehicles.html> and
<http://www.csu.org/environment/energy/page2582.html>



- **Electric Vehicles** – The Advance Research Projects Agency established the Hawaii Electric Vehicle Demonstration Project to facilitate further applications of electrical vehicle technologies for commercial and military applications. The potential for creating jobs, broadening the use of electric and other alternatively fueled vehicles, developing infrastructures to support those vehicles, and maximizing the number of alternatively fueled vehicles on the road increases with partnerships of this type.
- **Segways** – These personal machines are self-balancing, personal transportation devices designed to operate in any pedestrian environment. Segways use a process called dynamic stabilization, which works in much the same way your own sense of balance does. This machine can carry heavy loads for localized, on-post transportation without any harmful air emissions. For more information, go to the following website: www.segway.com.
- **Air-powered Automobiles** – Based upon isotherm dynamics with a lightweight body and under-belly mounted engine, this vehicle has no harmful emissions and no fuel costs. It is very small and does not go very fast, but is very useful for urban environment and urban fleets, or on a military installation. For more information on these automobiles, go to the following website: www.technologyreview.com and search for “air-powered automobiles.”

Fort Campbell 25-Year Goals for Transportation

To be determined by Fort Campbell’s Command and staff, as advised by members of the local and regulatory community, at the Installation Sustainability Workshop on 9-11 September 2003.



THIS PAGE INTENTIONALLY LEFT BLANK

Appendix A

Acronyms and Abbreviations

AAFES	Army and Air Force Exchange Service
AEPI	U.S. Army Environmental Policy Institute
AFB	Air Force Base
AFH	Army's Family Housing
AFVs	Alternative Fuel Vehicles
AMC	Army Materiel Command (U.S. Army)
APP	Affirmative Procurement Plan
ARDEC	Armament Research, Development, and Engineering Center (U.S. Army)
ASR	Aquifer Storage and Recovery
BBTU	Billions of British Thermal Units
C&D	Construction and Demolition
CAA	Clean Air Act
CAAF	Campbell Army Airfield
CDM	Camp Dresser and McKee
CEMML	Center for Ecological Management of Military Lands
CERL	Construction Engineering Research Laboratory (USACE)
CFLs	Compact Fluorescent Lights
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
CTS	Clarksville Transit System
CWA	Clean Water Act
CY	Calendar Year
DA	Department of the Army
DECAM	Directorate of Environmental Compliance and Management
DfD	Design for Deconstruction
DOC	Directorate of Contracting
DOD	Department of Defense
DOE	Department of Energy
DRMO	Defense Reutilization Marketing Office
ECIP	Energy Conservation Investment Program
EMCS	Energy Monitoring and Control System
ENMP	Environmental Noise Management Plan
EO	Executive Order
EPA	Environmental Protection Agency (U.S.)
EPCRA	Emergency Planning and Community Right-to-Know Act
EPPs	Environmentally Preferable Products
ERDC	Engineering Research Development Center
ESA	Endangered Species Act
ESMP	Endangered Species Management Plan
FFV	Flexible Fuel Vehicles
FMP	Forest Management Plan
FORSCOM	U.S. Army Forces Command
FY	Fiscal Year

GIS	Geographic Information System
GNRC	Greater Nashville Regional Council
GSA	General Services Administration
HAZMAT	Hazardous Material
HQ	Headquarters
HVAC	Heating, Ventilation, and Air Conditioning
ICMA	International City/County Management Association
ICRMP	Integrated Cultural Resources Management Plan
ICUZ	Installation Compatible Use Zone
IMPAC	International Merchant Purchase Authorization Card
INRMP	Integrated Natural Resources Management Plan
ITAM	Integrated Training Area Management
JLUS	Joint Land Use Study
JP-8	Jet Fuel
KWH	Kilowatt-Hour
LCID	Land Clearing and Inert Debris
LCTA	Land Condition Trend Analysis
LDV	Light Duty Vehicle
LEED	Leadership in Energy and Environmental Design (USGBC)
LEV	Low-Emission Vehicle
LID	Low Impact Development
LRAM	Land Rehabilitation and Maintenance [Program]
MBTU	Millions of British Thermal Units
MCA	Military Construction – Army
MGD	Million Gallons Per Day
MMR	Massachusetts Military Reservation
MOUT	Military Operations in Urban Terrain
MPO	Metropolitan Planning Organization
MPRC-L	Multi-Purpose Range Complex-Light
MSA	Metropolitan Statistical Area
MSW	Municipal Solid Waste
NASA	National Aeronautics and Space Administration
NCCC	National Civilian Community Corps
NEPA	National Environmental Policy Act
NESHAPs	National Emissions Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act
NO _x	Nitrogen Oxides
NRHP	National Register of Historic Places
O&M	Operations and Maintenance
ODC	Ozone-Depleting Chemical
ODS	Ozone Depleting Substance
OEESCM	Operational and Environmental Executive Steering Committee for Munitions
PA	Programmatic Agreement
PADD	Pennyrile Area Planning Commission
PLI	Private Lands Initiative
PM	Particulate Matter
PNNL	Pacific Northwest National Laboratory

POL	Petroleum, Oils, and Lubricants
PPOC	Pollution Prevention Operations Center
PV	Photovoltaic
PWBC	Public Works Business Center
QRP	Qualified Recycling Program
RCI	Residential Communities Initiative
RCRA	Resource Conservation and Recovery Act
RDP	Range Development Plan
RPMP	Real Property Master Plan
SDD	Sustainable Design and Development
SDWA	Safe Drinking Water Act
SERDP	Strategic Environmental Research and Development Program
SGN	Smart Growth Network
SHPO	State Historic Preservation Officer
SOV	Single Occupancy Vehicle
SO _x	Sulfur Oxides
SPCCP	Spill Prevention Control and Countermeasures Plan
SPiRiT	Sustainable Project Rating Tool (military adaptation of USGBC's LEED)
SRM	Sustainment, Restoration, and Modernization
SuLEVs	Super-Low Emission Vehicles
SWPPP	Stormwater Pollution Prevention Plan
TADSS	Training Aid Devices, Simulations, and Simulators
TES	Threatened and Endangered Species
TMDL	Total Maximum Daily Load
TRI	Training Requirements Integration
TSD	Treatment, Storage, and Disposal
TVA	Tennessee Valley Authority
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGBC	U.S. Green Building Council
USGS	U.S. Geological Survey
UXO	Unexploded Ordnance
VOCs	Volatile Organic Compounds
WWTP	Wastewater Treatment Plant
ZFC	Zero Footprint Camp