FORT CARSON NET ZERO
WASTE, WATER, AND ENERGY
IMPLEMENTATION
FINAL ENVIRONMENTAL ASSESSMENT
AND
FINDING OF NO SIGNIFICANT IMPACT

September 2012

Prepared for:

Fort Carson

and

U.S. Army Environmental Command

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FINDING ON NO SIGNIFICANT IMPACT (FNSI)

Fort Carson Net Zero Waste, Water, and Energy Implementation

Introduction

Fort Carson has long been at the forefront of implementing sustainability practices within the Army. In April, 2011, Fort Carson's proposal to begin planning and to implement "Net Zero" waste, water, and energy was approved by the Assistant Secretary of the Army for Installations, Energy and Environment. Fort Carson has prepared an Environmental Assessment (EA) to identify and evaluate potential adverse environmental effects associated with implementing Net Zero waste, water, and energy goals by 2020. In accordance with both Council on Environmental Quality (CEQ) and Army National Environmental Policy Act (NEPA) regulations (40 Code of Federal Regulations [CFR] 1508.13 and 32 CFR 651.21 respectively), this FNSI hereby incorporates the entire EA by reference.

1. Purpose and Need

The purpose of the Proposed Action is to implement the Army's Net Zero waste, water, and energy goals at Fort Carson to secure the Installation's mission moving into the future. In implementing Net Zero at Fort Carson, the Installation would exceed Federal and state waste, water, and energy mandates while achieving enhanced security, increased efficiency, and operating cost reductions, all while improving Installation sustainability.

Implementation of Net Zero at Fort Carson would ensure that a holistic and long-term approach is in place to support an enduring mission at Fort Carson that supports Department of Defense, Army, and other Federal government goals and objectives for increasing use of renewable energy, lowering greenhouse gas (GHG) emissions, and reducing the Army's reliance on fossil fuels. The implementation of the Proposed Action would enhance the overall sustainability and security of Fort Carson.

2. Description of the Proposed Action and Alternatives

Proposed Action: The Proposed Action is to implement Net Zero waste, water, and energy goals by 2020 at Fort Carson. Fort Carson's Proposed Action includes evaluation of efforts to (1) produce as much renewable energy on the Installation as it uses annually; (2) limit the consumption of freshwater resources and return water back to the region so as not to deplete the groundwater and surface water resources of that region in quantity or quality; and (3) reduce, reuse, and recover waste streams by converting them to resource value with zero solid waste landfilling.

Alternatives Considered and Evaluated: Chapter 2 of the EA presents a discussion of the alternatives evaluated. A variety of technologies and locations were initially considered for achieving Net Zero at Fort Carson. Based on the screening criteria analysis presented in Section 2.3 of the EA, seven Proposed Action Alternatives met the ten required screening elements and are carried forward for evaluation in the EA and include:

- **Alternative 1: Construction and Operation of a Waste-to-Energy Plant.** Under this alternative, Fort Carson would pursue the construction and operation of an up to 40 megawatt (MW) waste-to-energy (WTE) plant within the Gate 19 area.
- **Alternative 2: Construction and Operation of a Biomass Plant.** Under this alternative, Fort Carson would pursue the construction and operation of a biomass plant. Three sites are being considered for a biomass plant: an up to 13MW biomass plant in the Gate 19 area (Alternative 2a); an up to 13MW biomass plant in Bravo North Sites 1 and 2 (Alternative 2b); and an upgrade of the proposed Combat Aviation Brigade (CAB) Central Energy Plant into a 2.5MW biomass plant (Alternative 2c).

- **Alternative 3: Use of Photovoltaic Technology.** Under this alternative, Fort Carson would pursue the construction, operation, and maintenance of photovoltaic (PV) systems for energy generation on Fort Carson. Up to 13 sites throughout Fort Carson are being considered for this alternative (see Table 2-1 of the EA).
- **Alternative 4: Expansion of the Existing Reclaimed Water System.** Under this alternative, Fort Carson would expand the existing reclaimed water system to include new reclaimed water distribution lines (piping) from the golf course pond to the Sports Complex, and other locations requiring irrigation in the Main Post area.
- **Alternative 5: Construction and Operation of Wind Turbines.** Under this alternative, Fort Carson would pursue the construction, operation, and maintenance of up to eight utility-scale wind turbines in the southeastern corner of the Installation in Training Area 48.
- **Alternative 6: Implement Future Renewable Energy Development within Net Zero Footprints Identified by the Army.** Under this alternative, Fort Carson would consider the installment and operation of ground-source heat pumps and solar energy technologies on existing buildings or future construction, or on compatible development sites on the Installation. Environmental screening criteria have been developed and considered within the EA to assess and capture future impacts as specific projects are identified and sited in the future and tiered off this programmatic alternative (see Fort Carson Net Zero Project Checklist, Appendix B).
- **Alternative 7: Maximum Conservation and Re-use:** Alternative 7 includes maximizing the conservation, re-use, and recovery of resources on a programmatic level. As part of Alternative 7, Fort Carson may implement all policies, procedures, best management practices (BMPs), and actions described in Sections 2.1.1 through 2.1.3 of the EA which are not already covered under Alternatives 1 through 6. These actions support the conservation of water and energy and seek to limit the production of waste.

In addition, Fort Carson also considered the No Action Alternative where the decision-maker would elect not to leverage the Net Zero Initiatives to accelerate reduction of waste, water, and energy consumption beyond those policies and procedures that are currently in place.

3. Environmental Analysis

Environmental Consequences and Comparison of Alternatives: Chapter 3 of the EA discusses the affected environment and potential environmental consequences for the Proposed Action Alternatives. Chapter 4 summarizes these findings. An overview of the potential level of adverse effects is presented in Table 1. The table indicates which valued environmental components (VECs) have potentially significant but mitigable impacts by alternative. Unless indicated, all other VECs are anticipated to have less than significant impacts. As shown in Table 1, implementation of the Proposed Action Alternatives is not anticipated to result in adverse significant environmental impacts. Table 2 (page 4 of this FNSI) summarizes the mitigation measures which are detailed in the EA. These would be implemented by VEC and by alternative to avoid significant impacts.

Cumulative Impacts: Cumulative effects are the combination of impacts of the Proposed Action, when added to other past, present, and reasonably foreseeable future actions, regardless of who undertakes those other actions (CEQ Regulation 1508.7). Cumulative effects can result from actions occurring over a period of time that are minor when each is considered individually, but that are significant when viewed collectively.

Fort Carson has numerous construction projects recently constructed or currently planned that are included in the cumulative effects analysis of this EA. A majority of these projects are Soldier and Family support facilities (e.g., commissary, physical fitness center, housing, child development center). Range support projects include garrison support facilities for the CAB, a Battle Command Training Center, Convoy Skill Trainer, Tactical Unmanned Aerial Vehicle Facility, and two Infantry Squad Battle Courses. In addition, two major projects are being evaluated which consider the redevelopment of Iron

Horse Park and the Banana Belt, which is the area containing the greatest concentration of Soldier unaccompanied housing, motorpools, and unit administrative offices on Fort Carson.

Reasonably foreseeable projects within Fort Carson included within the cumulative effects analysis in the EA were not determined to pose a significant adverse cumulative impact to the resources analyzed within the EA.

Table 1. Summary of Potential Environmental Effects from Baseline Conditions

Alternative	Level of Impact	Cumulative Impact
No Action	Less than significant	Less than significant
1	**Potentially significant but mitigable** (air quality[1], noise[2], airspace[3], and hazardous and toxic substances[4])	Less than significant
2a	**Potentially significant but mitigable** (air quality[1], noise[2], and airspace[3])	Less than significant
2b	**Potentially significant but mitigable** (air[1] quality and noise[2])	Less than significant
2c	**Potentially significant but mitigable** (noise[2] and airspace[3])	Less than significant
3	**Potentially significant but mitigable** (biological[5] and cultural[6])	Less than significant
4	Less than significant	Less than significant
5	**Potentially significant but mitigable** (airspace[3], biological[5], and cultural[6])	Less than significant
6	**Potentially significant but mitigable** (biological[5] and cultural[6])	Less than significant
7	**Potentially significant but mitigable** (cultural[6])	Less than significant

[1]Emissions from operations of the WTE or biomass plants (Alternatives 1 and 2) could exceed Title V permit thresholds. In addition, Alternative 2b operational emissions of carbon monoxide (CO) would likely exceed the applicability thresholds as the proposed biomass plant location of Alternative 2b is within the CO maintenance area.

[2]Noise generated during the operations of the WTE or biomass plants (Alternatives 1 and 2) from plant equipment (i.e., turbines, engine intakes and exhausts) could cause significant adverse impacts to noise sensitive areas.

[3]Obstruction and interference with existing airspace from smokestacks (Alternatives 1 and 2) and wind turbines (Alternative 5) could adversely impact military and commercial airspace operations. In addition, the wind turbines associated with Alternative 5 have the potential to create a wake turbulence effect that could cause an adverse significant impact to air traffic operating in their vicinity.

[4] Potentially hazardous ash waste and air emissions could occur from the combustion of residual hazardous material not removed from the municipal waste in the combustion stream during operations of the WTE plant (Alternative 1).

[5]Adverse impacts to species protected under the Bald and Golden Eagle Protection Act could occur from the potential construction of powelines to transmit power from the Wildhorse, Fremont, and Highway 114 sites. In addition, significant impacts to species protected under the Migratory Bird Treaty Act and to species protected under the Bald and Golden Eagle Protection Act could occur from potential turbine strike during operations (Alternative 5).

[6]The potential exists for adverse significant impacts to cultural resources from implementation of Alternatives 3, 5 or 6; Net Zero sites (Wildhorse, Ray Nixon, and Fremont) have not been surveyed for cultural resources. In addition, implementation of Alternative 7 has the potential to adversely affect historic structures.

<u>Proposed Impact Reduction Measures:</u> Table 2 summarizes the mitigation measures which are detailed in the EA, which I adopt and incorporate by reference. These would be implemented by VEC and by alternative to avoid significant impacts. In addition Chapter 4 of the EA contains a summary of various permits, plans, and measures identified within the EA analysis that would be undertaken by Fort Carson, as necessary, to further minimize adverse effects.

Table 2. Summary of Identified Mitigation Measures

Alternative	Activity	Level of Impact	Mitigation Measure
Air Quality and Greenhouse Gases			
Alts. 1, 2a, &2b	Operations	Potentially significant but mitigable	Mitigation measures for air quality may be required to reduce impacts to less than significant in compliance with existing regulations, necessary permits, and plans. The project would be accomplished in full compliance with Colorado regulatory requirements, through the use of compliant practices or products per 5 CCR 1001-1, AQCC Regulations.
Noise			
Alts. 1 & 2	Operations	Potentially significant but mitigable	To avoid the potential for significant adverse noise impacts from operations, as necessary, Fort Carson would: • Perform a preconstruction noise study to determine a baseline noise level at the closest property line and adjacent buildings. • Design the plant, through building and other equipment specifications (such as silencers, mufflers, engineered sound enclosures, etc.), to reduce noise levels as measured at the property line adjacent to residential neighbors or at facilities which house patients, to less than 65 dBA between the hours of 6 a.m. and 9 p.m., or 55 dBA between the hours of 9 p.m. to 6 a.m. • Perform a post-construction sound survey at the site. If the noise attributable to the operation of the facility is not less than 65 dBA between the hours of 6 a.m. and 9 p.m., or 55 dBA between the hours of 9 p.m. to 6 a.m. for locations identified, additional noise controls shall be installed within one-year of the in-service date to meet this level.
Biological Resources			
Alts. 3, 5, & 6	Construction (Alts. 3, 5, & 6)	Potentially significant but mitigable	If an overhead powerline is required, a raptor-proof system would be installed to avoid adverse impacts to raptors including eagles protected by the Bald and Golden Eagle Protection Act (Wildhorse, Freemont, and Highway 115 sites).
	Construction & Operations (Alt. 5)	Potentially significant but mitigable	In order to avoid or minimize "take" of migratory birds and raptors, Fort Carson would consult USFWS on operational and bird deterrent measures. As necessary, a project-specific Avian and Bat Protection Plan would be prepared to avoid and minimize adverse effects to birds and bats, incorporate adaptive management, and (if applicable) document compensation measures that would be taken.

Table 2. Summary of Identified Mitigation Measures

Alternative	Activity	Level of Impact	Mitigation Measure
Cultural Resources			
Alts. 3, 5 & 6	Construction	Potentially significant but mitigable	A cultural resource survey would be completed following the guidance of the ICRMP if unsurveyed sites within this alternative are selected (Wildhorse, Ray Nixon and Fremont sites only). If surveys determine there would be impacts to cultural resources, the mitigation measures presented in the ICRMP would be implemented to avoid or reduce the impacts to less than significant levels.
Alt. 7	Construction	Potentially significant but mitigable	As projects associated with this alternative could involve modifications to existing buildings, the Fort Carson CRM Program personnel would be coordinated with prior to construction activities to ensure prehistoric and historic resources are not adversely affected.
Airspace			
Alts. 1, 2a, & 2c	Operations	Potentially significant but mitigable	To avoid the potential for significant adverse impacts to airspace, Fort Carson would: • Construct as far away from the airfield as possible on the eastern edge of the proposed site by the Installation boundary (Alts. 1 and 2a). • If feasible, construct smoke stack(s) no higher than 150 feet AGL and should be conditioned so as to eliminate the possibility of releasing excess heat, PM or condensation or the possibility of creating condensation through the normal process of heat being exposed to moisture naturally occurring in the atmosphere. • Conduct FAA consultation for compliance to the regulations and validation of continued safe flight operations.
Alt. 5	Construction & Operations	Potentially significant but mitigable	The FAA would be consulted for compliance to the regulations and validation of continued safe flight operations in the siting and design of turbines. Coordination with the DoD Clearinghouse would also be required regarding avoiding adverse impacts to the DoD mission including the use of training ranges and airspace.
Hazardous and Toxic Substances			
Alt. 1	Operations	Potentially significant but mitigable	Fort Carson would use SCR and other more effective air pollution control technologies which would be designed to remove acid gases, heavy metals, organic chemicals, and particulate matter in order to prevent the escape of combusted hazardous waste into the air.

AQCC= Air Quality Control Commission; CCR=Colorado Code of Regulations; CRM= Cultural Resources Management; dBA=A-weighted decibel; DoD=Department of Defense; FAA=Federal Aviation Administration; ICRMP=Integrated Cultural Resources Management Plan; PM=particulate matter; SCR= Selective Catalytic Reactors; USFWS=U.S. Fish and Wildlife Service

4. Public Review and Comment

The Final EA/Draft FNSI was made available for public review and comment from July 25th to August 24th, 2012. Documents were made available at the following local libraries: Cañon City Public Library, East Library and Information Center, Fort Carson Grant Library, Fountain Library, Manitou Springs Public Library, Penrose Public Library, Pueblo City-County Library, and the Security Public Library. A Public Notice was published in three newspapers (Pueblo Chieftain, The Gazette, and El Paso County & Fountain Valley News). All documents were posted on Fort Carson's NEPA website, http://www.carson.army.mil/DPW/nepa.html. No comments were received during the 30-day comment period.

5. Finding of No Significant Impact

I have considered the results of the analysis in the EA, comments received within the public comment period, and Fort Carson's operational needs. Based on these factors, I have decided to proceed with the implementation of the Proposed Action Alternatives 1 through 7 for meeting Net Zero Waste, Water, and Energy goals at Fort Carson. Implementation of these alternatives, along with specified mitigation identified above will not have a significant impact on the quality of the human life or natural environment.

The energy development alternatives (Alternatives 1, 2, 3, 5 and 6) will be presented for private sector investment for energy development proposals. We recognize our continuing obligation to consult under Section 106 of the National Historic Preservation Act, the Endangered Species Act, and that additional interagency coordination and permitting would be required depending on which projects are ultimately proposed and pursued.

While I have reviewed the EA and made the decision to support implementation of Alternatives 1 through 7, I recognize that implementation of these Alternatives will be subject to the availability of funds and standard planning processes. I further recognize that additional environmental analysis of waste-to-energy or biomass project proposals discussed in Alternatives 1 and 2 would be required to supplement this EA analysis before such projects could proceed. More information on the specific proposed facility design, mitigation measures, and feedstock or waste streams will be needed to ensure a full understanding and accounting of the environmental impacts resultant from the implementation of these alternatives. Conducting additional site-specific environmental analysis prior to implementation will ensure that the impacts of these projects are more accurately characterized while conservatively ensuring none of the impacts from any future design proposals are understated. Therefore, while I am making the decision to pursue all alternatives, the implementation of Alternatives 1 and 2 is contingent on more project-specific future NEPA. Additionally, if the design of any proposal based on any of the other selected alternatives were to exceed the parameters assessed here, additional mitigation may be required and supplemental analysis will be conducted as necessary.

This analysis fulfills the requirements of the National Environmental Policy Act of 1969, as implemented by the CEQ regulations (40 CFR Parts 1500-1508), as well as the requirements of the Environmental Analysis of Army Actions (32 CFR Part 651). Therefore, issuance of a FNSI is warranted and an Environmental Impact Statement is not necessary.

Roderick Chisholm
/DAVID L. GROSSO
COL, SF
Garrison Commander
Fort Carson, Colorado

25 Sep 12
Date

FORT CARSON
NET ZERO
WASTE, WATER, AND ENERGY
IMPLEMENTATION
FINAL ENVIRONMENTAL ASSESSMENT

Reviewed By:

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1. PURPOSE, NEED, AND SCOPE

Fort Carson has long been at the forefront of implementing sustainability practices within the Army. In 2002 Fort Carson finalized a 25-year sustainability plan which defined explicit sustainability goals. In April, 2011, Fort Carson's proposal to begin planning and to implement "Net Zero" waste, water, and energy was approved by the Assistant Secretary of the Army for Installations, Energy and Environment. This Net Zero designation would cause considerable changes in Installation policy, tenant operations, and individual behavior, as well as new infrastructure. The proposed Fort Carson Net Zero Program would require Fort Carson to make every fiscally prudent effort to reduce the Installation's overall consumption of energy and water resources and disposal of solid waste in landfills to an effective rate of zero. This requires an examination and balancing of resource requirements against the increased constraints on energy and water supplies and disposal methods. While achieving absolute "Net Zero" may not be achievable at all installations with currently available technology, Fort Carson's pursuit of Net Zero would require the Installation to evaluate itself against the "Net Zero" benchmark to identify opportunities for reduction, repurposing, recycling and composting, and energy recovery.

The implementation of the Net Zero program at Fort Carson would involve: (1) producing as much renewable energy on the Installation as it uses annually; (2) limiting the consumption of freshwater resources so as not to deplete the groundwater and surface water resources of that region in quantity or quality; and (3) reducing, reusing, and recovering waste streams, converting them to resource value with zero solid waste landfilling. The subsequent sections define alternatives for how Fort Carson could potentially move forward with programs, policies and projects to implement the Net Zero Initiative.

The National Environmental Policy Act (NEPA) of 1969 requires all Federal agencies to give appropriate consideration to potential environmental effects of proposed major actions in planning and decision-making. The Council on Environmental Quality (CEQ) is responsible for issuing regulations (40 Code of Federal Regulations [CFR] 1500-1508) implementing the provisions of NEPA. CEQ regulations in turn are supplemented by procedures adopted on an agency-specific basis. For the Department of the Army (DA), the pertinent regulation is 32 CFR 651 *Environmental Analysis of Army Actions*. The Army is completing this Environmental Assessment (EA) to evaluate the potential impacts and involve the public as it pursues the suite of policy changes and other actions that would make Fort Carson a Net Zero Installation.

1.1 Installation Setting

Fort Carson is located south of Colorado Springs, Colorado, east of the Rocky Mountain Front Range, and occupies portions of El Paso, Pueblo, and Fremont counties. Fort Carson is generally bounded by State Highway 115 (SH 115) on the west and by Interstate 25 (I-25) and mixed development on the east. The City of Pueblo lies approximately 10 miles south of Fort Carson's southern boundary and the City of Fountain is located east of Fort Carson. Fort Carson comprises approximately 137,000 acres and ranges from 2 to 15 miles from east to west and up to 24 miles from north to south. Fort Carson is responsible for supporting the living and training requirements of Army troops stationed at the Installation. Soldier support facilities are provided in the Main Post area, which contains most of the facilities on Fort Carson, such as troop and Family housing and administrative, maintenance, community support, recreation, classroom, supply, and storage facilities. The rest of Fort Carson is the downrange area, which is used for weapons qualification and field training and includes firing ranges, training areas, and impact areas. Training lands at Fort Carson are actively managed to sustain them for continued use in supporting the Army's training mission. Figure 1-1 depicts the Installation setting and relevant components within the Installation. The Proposed Action pertains only to Fort Carson and not Piñon Canyon Maneuver Site (PCMS).

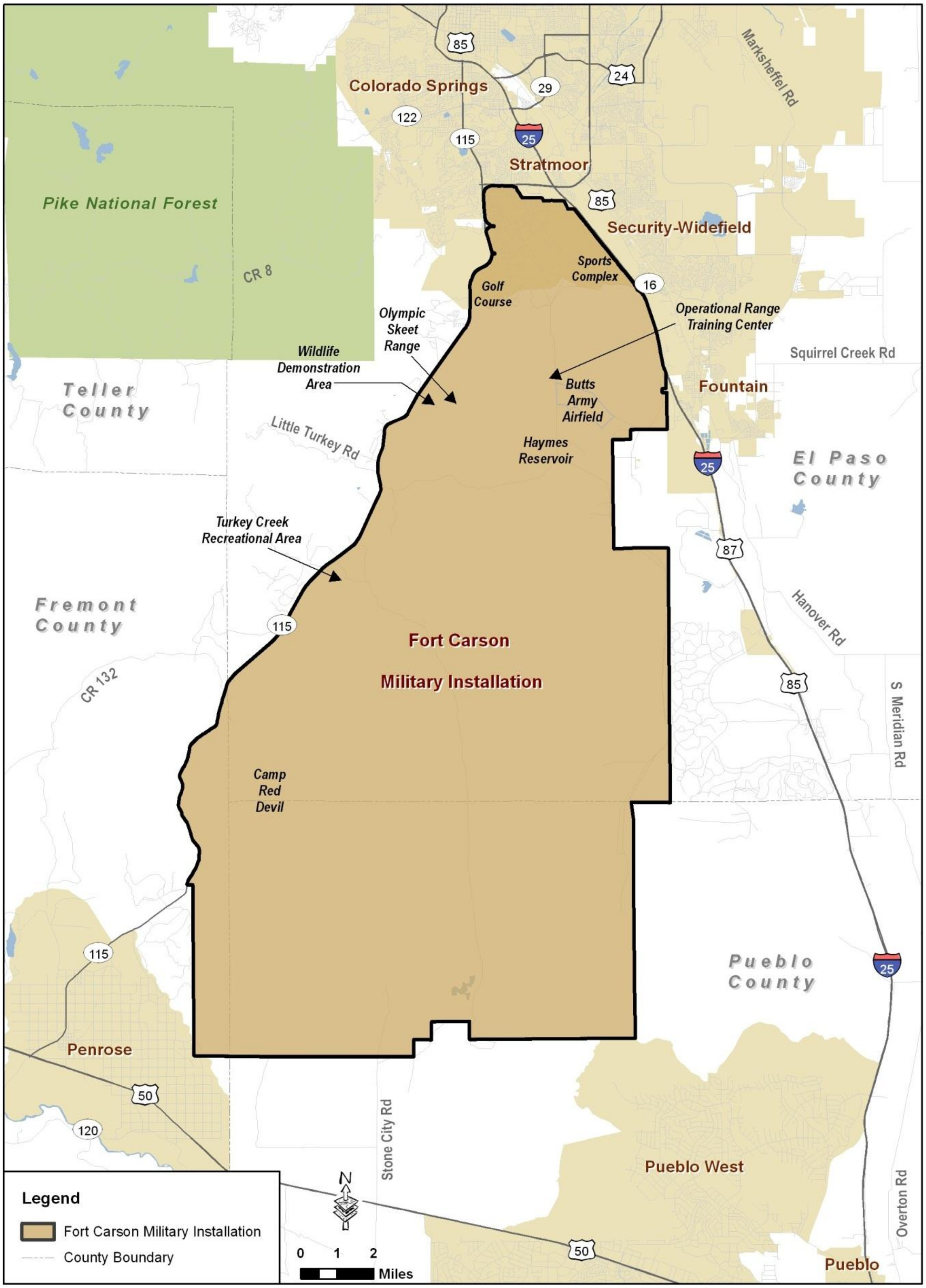

Figure 1-1. Installation Setting

Fort Carson's overall mission is to provide units mission support and services, including quality of life programs for the Fort Carson Soldiers and Families.

1.2 Purpose and Need for the Proposed Action

1.2.1 PURPOSE

In April, 2011, the Assistant Secretary of the Army for Installations, Energy, and Environment announced that Fort Carson would be one of the Army's pilot installations for the integrated implementation of Net Zero goals across all three Net Zero areas (waste, water, and energy). Eventually, all Army installations will conduct more aggressive sustainability planning in accordance with the principles of Net Zero. The aim of the Army is to define the Net Zero planning process and streamline implementation at pilot sites like Fort Carson, and then transfer lessons learned to other locations across the Army. The purpose of the Proposed Action is to implement Net Zero waste, water, and energy goals at Fort Carson to secure the Installation's mission moving into the future. By implementing Net Zero at Fort Carson, the Installation would meet and exceed Federal and state requirements for improving energy and water use efficiency, increase the use of renewable energy sources, and improve the efficiency of waste processing all while improving energy and water security, reducing operating costs, and improving the Installation's operations. Implementation of Net Zero at Fort Carson would support Department of Defense (DoD), Army, and other Federal government goals and objectives for increasing use of renewable energy, lowering greenhouse gas (GHG) emissions, and reducing the Army's reliance on fossil fuels. In achieving Net Zero goals, the Army intends to promote progress towards the following objectives:

- Comply with near-term government mandates and goals regarding renewable energy use and GHG reduction;
- Enhance the energy security of Fort Carson to support critical operations;
- Integrate renewable energy development activities with natural and cultural resource management requirements;
- Better position the Installation for compliance with long-term renewable energy and GHG reduction mandates;
- Reduce land required for landfills and increase waste stream repurposing; and
- Preserve water resources to support an enduring mission at Fort Carson and the long-term sustainability of the greater Colorado Springs community.

In working towards these objectives, the Army and Fort Carson will implement goals, strategies, mandates and directives outlined in the 2010 Quadrennial Defense Review (QDR), Executive Orders (EOs) 13514 & 13423 (*Federal Leadership in Environmental, Energy, and Economic Performance & Strengthening Federal Environmental, Energy, and Transportation Management*), the Energy Policy Act (EPAct 2005), the Energy Independence and Security Act (EISA) 2007, DoD Instruction 4170.11 [*Installation Energy Management*], DoD Energy Managers Handbook, Army Regulation (AR) 420-1 *Army Facilities Management*, and the Army Energy & Water Campaign Plan. These documents highlight and address the need to increase the production and use of power derived from renewable energy sources. Further information on the Army Energy Program, including a listing of key directives regarding the Army Energy Program can be found at http://army-energy.hqda.pentagon.mil/.

Fort Carson's vision is to appropriately manage its operations, materials, and natural and cultural resources with a goal of achieving Net Zero status as defined by the Army. The goal and purpose of the Proposed Action is to manage Fort Carson not only on a Net Zero energy basis, but Net Zero water and waste as well. In doing so, Fort Carson strives to create a culture that recognizes the value of sustainability measured not just in terms of financial benefits, but also in terms of maintaining mission capability, quality of life, relationships with local communities, and the preservation of options for the Army's future. Fort Carson recognizes the need to improve efficiencies in waste, water, and energy management for the benefit of current and future missions and is moving forward to implement Net Zero sustainability goals as defined by the Army (see Section 1.3).

1.2.1.1 Net Zero Definitions

The Army Net Zero Initiative is a holistic approach to addressing waste, water, and energy at Army installations. The Army Net Zero approach is comprised of five interrelated steps: reduction, re-purpose, recycling and composting, energy recovery, and disposal. Each step is a link towards achieving Net Zero goals. Reduction includes maximizing energy efficiency in existing facilities, implementing water conservation practices, and eliminating generation of unnecessary waste. Re-purpose involves diverting waste, water, or energy to a secondary purpose with limited processes. Recycling or composting involves management of the solid waste stream, development of closed loop systems to reclaim water, or co-generation where two forms of energy (heat and electricity) are created from one source. Energy recovery can occur from converting unusable waste to energy, renewable energy, or geothermal water sources. Disposal is the final step and last resort after the last drop of water, the last bit of thermal energy and all other waste mitigation strategies have been fully exercised.

This approach will enable the Army to appropriately steward available resources, manage costs, and provide Soldiers, Families, and civilians with a sustainable future. Executing the Net Zero vision will ensure that sustainable practices will be instilled and managed, while also maximizing operational capability, resource availability, and well-being. A visual depiction of the Net Zero hierarchy is presented below in Figure 1-2.

Figure 1-2. The Net Zero Process Hierarchy

Energy: A Net Zero Energy Installation is an installation that produces as much energy on site as it uses, over the course of a year. To achieve this goal, installations must first implement aggressive conservation and efficiency efforts while benchmarking energy consumption to identify further opportunities. The next step is to utilize waste energy or to "re-purpose" energy. Boiler stack exhaust, building exhaust, or other thermal energy streams can all be utilized for a secondary purpose. Cogeneration can recover heat from the electricity generation process for increased overall energy efficiency. The balance of energy needs can then be met by renewable energy project implementation.

Water: A Net Zero Water Installation limits the consumption of freshwater resources and returns water back to the same watershed so as not to deplete the groundwater and surface water resources of that region in quantity or quality over the course of a year. The Net Zero water strategy balances water availability and use to ensure a sustainable water supply for years to come. This concept is of increasing importance since scarcity of clean potable water is quickly becoming a serious issue at many military installations and in many countries around the world. The continued draw-down of major aquifers will result in significant problems for future generations. Strategies such as recycling discharge water for reuse can reduce the need for municipal water and the production of exported sewage or storm water. The first step is to implement water efficiencies through improving distribution system integrity. Installations would identify opportunities to develop closed loop systems to reclaim and/or treat water. Installations should also determine whether there are opportunities to capture waste water while working on efforts to monitor water use and distribution systems, and while working to change water use behavior. To achieve Net Zero water status at an installation, efforts begin with conservation followed by efficiency in use and improved integrity of distribution systems. Water is re-purposed by utilizing grey water generated from sources such as showers, sinks, and laundries.

Waste: A Net Zero Waste Installation is an installation that reduces, reuses, and recovers waste streams, converting them to resource values with zero landfill requirements over the course of a year. The components of Net Zero solid waste include reducing the amount of waste generated, re-purposing waste, maximizing recycling of waste stream to reclaim recyclable and compostable materials, and recovery to generate energy as a by-product of waste reduction, with disposal being non-existent. Every day, more recycling strategies are developed moving beyond metals, paper and cardboard to include mattresses, glass, plastics, batteries, computer printers, and motor oil. Strategies include reducing the waste stream when purchasing items, reducing the amount of packaging, reusing as much as possible, and recycling the rest. A true “cradle-to-cradle” strategy considers the end state at the time the purchase decision is made. A Net Zero waste strategy eliminates the need for landfills, protects human health, optimizes use of limited resources and keeps the environment clean.

1.2.1.2 Energy and Water Security

The United States (U.S.) Army installations and personnel face significant near and long-term threats (e.g., terrorist, manmade, natural disasters, climate change), both home and abroad, that can affect its access to energy and water resources in the quantity, quality, and cost needed to carry out its national defense mission. Ensuring uninterrupted supplies of energy and water to support installation’s missions is increasingly challenging. “Energy and Water Security” means the capacity to ensure that energy and water of suitable quality are provided at a sustained rate sufficient to support all current and future Army missions. Similarly, materials must be managed throughout their life-cycle to maximize the material’s utilization and minimize its disposal, ensuring the Army obtains its full resource value while reducing disposal costs. The Army also has numerous legal and policy requirements related to conservation of resources and sustainability. The Net Zero Installation program would address these needs.

Energy and water security are increasingly viewed as essential to ensuring and protecting the long-term viability of installation operations. Safe and reliable access to energy and water are critical to virtually all activities on Army installations. The Army recognizes the threats to its installations and operations posed by increasing costs of centrally distributed, over-burdened, utility-provided energy grids, as well as the vulnerabilities posed by potential disruption of military installation energy and water supplies. Many of these challenges were directly addressed by the 2010 QDR, which cited the need for DoD installations to “assure access to reliable supplies of energy and water to meet operational needs.” The current state of dependence on fossil fuels, a vulnerable electric power and transmission grid, and public water supplies jeopardizes the security of installations and their critical training and operational missions. Increasing installation energy and water security to protect future operations is a central tenet of the Net Zero concept and of the *U.S. Army Energy Strategy for Installations*, signed 8 July 2005, which states the importance of integrating Army energy and water use improvements with a broad focus on sustainability. Implementation of the Net Zero Initiative at Fort Carson would help to reduce consumption, conserve resources, and increase efficiencies in resource usage while protecting future operations. The implementation of Net Zero would assist Fort Carson in achieving the five basic goals of the *U.S Army Energy Strategy for Installations*, which include the following five broad objectives:

- Eliminate energy waste in existing facilities;
- Increase energy efficiency in renovation and new construction;
- Reduce dependence on fossil fuels;
- Conserve water resources; and
- Improve energy security.

The purpose of the Proposed Action is, to the maximum extent possible, to (1) improve Fort Carson's energy security posture, (2) improve Fort Carson's water security posture, (3) minimize solid waste generation and disposal, (4) improve the management of natural and fiscal resources in order to sustain Fort Carson's operational capability in support of its mission, (5) incorporate sustainability and security considerations into Installation management decisions, and (6) enable Fort Carson to achieve Federal and DoD sustainability goals for waste, water, and energy.

By becoming effectively self-sufficient, Fort Carson can insulate itself from potential disruptions to its energy supplies. Fort Carson proposes to reduce reliance on energy infrastructure susceptible to disruptions and logistical mechanisms that add risk to Installation missions through application of Net Zero approaches. Fort Carson's water security would be enhanced because Fort Carson will be better prepared to address both short- and long-term variations in water supply and quality (due to drought conditions, increased water usage by the community, etc.). Fort Carson proposes to reduce reliance on water infrastructure susceptible to disruptions and logistical mechanisms that add risk to Installation missions through application of Net Zero approaches. In addition, reduced water use, and thus need, increases the ability of Fort Carson to continue its mission uninterrupted. Identifying and pursuing opportunities for waste avoidance in Fort Carson's procurement processes will minimize or eliminate the unnecessary use, and eventual disposal, of raw materials. More aggressive material utilization also preserves raw materials for future use. Similarly, minimizing the volume of solid waste to be disposed of will reduce the land space that is occupied by landfills. Improving Fort Carson's energy and water usage, and minimizing waste generation and disposal will reduce operating costs, which will help maintain mission operations during periods of constrained fiscal resources, reduced access to natural resources, or uncertain future constraints. In addition, it will reduce the demand for services provided by off-Post service providers (e.g., utility companies), which in turn could extend Fort Carson's ability to continue operations during potential service interruptions. Incorporating sustainability and security considerations into Installation management decisions ensures that the access to, and the lifecycle cost of, material/waste, water, and energy are evaluated during decision-making. Consideration of the total life-cycle cost of actions, materiel, and services will improve Fort Carson's ability to make informed decisions.

1.2.1.3 Fort Carson's Current Sustainability Program

Fort Carson began its Sustainability Program in 2002 when the Installation committed to several ambitious sustainability performance goals to be accomplished by 2027. These goals included: 100 percent renewable energy, 75 percent reduction in water purchases, and zero waste (including solid and hazardous waste and waste water), as well as sustainable transportation, procurement, and mission capability. Progress is reported annually to the public, and the Installation has held annual Sustainability Conferences to interface with stakeholders and members of the general public. To assist in monitoring its progress, Fort Carson developed its own Sustainability & Environmental Management System. Although, by mandate, the Environmental Management System has recently been separated from sustainability, Fort Carson continues its robust sustainability efforts.

Fort Carson's Sustainability Program has been extremely active. As of 2010, Fort Carson obtained 43 percent of its electrical energy from a combination of the Installation's two megawatt solar photovoltaic (PV) arrays, its purchase of hydropower and qualifying wind power from Colorado Springs Utilities (CSU) and the Western Area Power Administration (WAPA), and its purchase of renewable energy certificates (RECs) from WAPA. Fort Carson has also reduced its water use by 47.5 percent since 2002, greatly exceeding the Federal goal of a 2 percent reduction per year. In addition, Fort Carson has made tremendous strides in reducing its waste stream. For example, during Fiscal Year (FY) 2010, Fort Carson diverted 4,300 tons of waste from landfill disposal, initiated a Soldier Incentive Program to reward units for the best recycling program, and distributed to its Soldiers a new "Environmental Battle Book" [available at: www.carson.army.mil/DPW], which provides practical guidance on various environmental and sustainability issues to leaders on Fort Carson.

The Net Zero initiative would not replace the existing Fort Carson Sustainability Program. Instead, the two programs would work hand-in-hand toward achieving their shared goals.

1.2.2 NEED

The Army faces significant near- and-long-term threats (e.g., terrorist, manmade, natural disasters, climate change), both home and abroad, that can affect its access to energy and water resources in the quantity, quality, and cost needed to carry out its national defense mission. Ensuring uninterrupted supplies of energy and water to support installation missions is increasingly challenging. Similarly, materials must be managed throughout their life-cycle to maximize the material's utilization and minimize its disposal, ensuring the Army obtains its full resource value while reducing disposal costs. The Army also has numerous legal and policy requirements related to conservation of resources and sustainability.

Currently, less than 2.1 percent of the energy consumed by the Army comes from renewable energy sources. The Army must increase this percentage to 7.5 percent by 2013. As an Installation, Fort Carson currently generates less than 3 percent of its energy it consumes from on-site renewable sources (PV arrays). In addition, Fort Carson is not achieving optimal energy performance from its facilities, which can be retrofitted and enhanced to reduce energy consumption.

With regards to water usage, Fort Carson recognizes its key role in the Colorado Springs region as a major user of water resources. As is the case throughout most of the western U.S., potable water is becoming an increasingly diminished resource on the Front Range. Since Fort Carson depends on an outside utility, CSU, for its potable water supply, regional shortages and resulting rationing could and would adversely affect both operations and quality of life at Fort Carson. Given Fort Carson's large consumption, the Installation needs to be an active participant and regional leader in ensuring the sustainability of not just the Installation, but the surrounding community.

Currently, Fort Carson diverts approximately 40 percent of its solid waste stream from landfills by recycling or re-using with the rest being collected and hauled by a contractor for off-Post disposal in a local landfill. Fort Carson recognizes that much of the waste currently going to landfill needs to be and can be reduced, re-purposed, recycled, or re-used to reduce costs and avoid the long-term environmental impacts associated with landfills and inefficient use of resources associated with a "throw-away" culture.

1.2.2.1 Laws, Executive Orders & Policy Requiring Increasing Waste, Water and Energy Efficiency

In addition to increasing Installation efficiency, reducing resource consumption, and improving energy security, the Army and Fort Carson must meet the requirements of numerous Federal statutes, EOs, and mandates, which require changes in our nation's energy consumption and production and require reductions in GHG emissions. The Army and Fort Carson must strive to attain the energy targets outlined in EPAct 2005, which requires that in FY 2010-2012, 5.0 percent of the total electricity consumed by the Federal government shall come from renewable energy sources. The required percentage of electricity consumed from renewable sources rises to at least 7.5 percent by FY 2013. Under EO 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*, at least 50 percent of the renewable energy used must come from "new renewable sources" placed in service after 01 January 1999. In addition, EO 13423 requires Federal agencies to reduce GHG emissions through reduction of energy intensity by (i) 3 percent annually through FY 2015 or (ii) 30 percent by 2015. Along with these requirements, the National Defense Authorization Act of 2007 requires that 25 percent of DoD's total electric energy consumption come from renewable sources by 2025. Numerous other statutes and requirements also create a framework that increases the need for the Army to take action. A list of these is included below in Table 1-1.

Table 1-1. Summary of Legislation and Executive Orders Impacting Energy, Waste Generation, and Water Consumption

Federal Mandate	Net Zero Area	Performance Target
EPAct of 2005	Electricity use for Federal government from renewable sources	At least 3 percent of total electricity consumption (FY 2007- 2009), 5 percent (FY 2010- 2012), 7.5 percent (FY 2013 +)
EO 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*	Energy use in Federal buildings	Reduce 3 percent per year of total by 30 percent by FY 2015 (FY 2003 baseline)
	Total consumption from renewable sources	At least 50 percent of required annual renewable energy consumed from "new" renewable sources
	Fleet vehicle alternative fuel use	Increase by 10 percent annually to reach 100 percent (FY 2001 baseline)
EISA of 2007	Total consumption from renewable sources	25 percent by FY 2025 – "Sense of Congress"
	Hot water in new / renovated Federal buildings from solar power	30 percent by FY 2015 if life cycle cost-effective
	Fossil fuel use in new / renovated Federal buildings	Reduce 55 percent by FY 2010; 100 percent by FY 2030
EO 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*	GHG emission reduction	DoD Goal: reduce Scope 1 & 2 GHGs by 34 percent by FY 2020 DoD Goal: reduce Scope 3 GHGs by 13.5 percent by FY 2020
	Net Zero buildings	All new buildings that enter design in FY 2020 and after achieve Net Zero energy by FY 2030
	Water consumption	Reduce consumption by 2 percent annually for 26 percent total by FY 2020 (FY 2007 baseline)
	Waste minimization	Divert at least 50 percent of solid waste and 50 percent of C&D waste by FY 2015

Table 1-1. Summary of Legislation and Executive Orders Impacting Energy, Waste Generation, and Water Consumption

NDAA of 2007	Renewable Fuels Use	Directs the Secretary of Defense to consider renewable fuels in aviation, maritime, and ground transportation fleets
	Facility Renewable Energy Use	Produce or procure 25 percent of the total quantity of facility energy needs, including thermal energy, from renewable sources starting in FY 2025

C & D = construction and debris; DoD = Department of Defense; EISA = Energy Independence and Security Act; EO = Executive Order; EPAct 2005 = Energy Policy Act of 2005; FY = Fiscal Year; GHG = greenhouse gas; NDAA = National Defense Authorization Act

1.3 Scope of the Analysis and Decision to be Made

This EA addresses environmental, cultural, and socioeconomic impacts associated with the implementation of Net Zero Initiatives at Fort Carson. This EA has been developed in accordance with NEPA; the regulations issued by the CEQ, 40 CFR Parts 1500–1508; and the Army's implementing procedures published in 32 CFR Part 651, Environmental Analysis of Army Actions.

The following Valued Environmental Component (VECs) were identified by Fort Carson as having the potential for adverse impacts, and are therefore, analyzed for the Proposed Action and No Action alternatives:

- Land Use
- Air Quality and GHG
- Noise
- Geology and Soils
- Water Resources
- Biological Resources
- Cultural Resources
- Socioeconomics
- Traffic and Transportation
- Airspace
- Utilities
- Hazardous and Toxic Substances

The Proposed Action consists of a number of proposed projects, some of which are possibly related or interconnected, that may be necessary to implement Net Zero goals, comply with Federal and Army energy mandates, and meet Fort Carson's energy and water security objectives. Section 2.4.2 discusses specific projects or technologies (Proposed Action Alternatives) which may be implemented to help Fort Carson meet Net Zero goals. As part of Net Zero implementation at Fort Carson, one or a combination of the Proposed Action Alternatives may be chosen. The final decision of which alternatives to be implemented will, therefore, be covered within the FNSI, or if it is determined that implementation of the selected Proposed Action Alternatives would result in unavoidable or non-mitigable significant environmental impacts, the Army would publish an NOI and initiate the preparation of an Environmental Impact Statement (EIS). The geographical scope of the analysis includes alternatives being considered for implementation at Fort Carson. The Proposed Action does not include proposed actions at the PCMS, which is outside of the scope of this analysis.

1.4 Related Environmental Documentation

The following documents (incorporated by reference) contain baseline data and information for day-to-day operations (see http://www.carson.army.mil/DPW/nepa.html for electronic versions of these documents):

1.4.1 FORT CARSON INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

The *Integrated Natural Resources Management Plan* (INRMP) guides the implementation of a natural resources program at Fort Carson to ensure that the Installation complies with applicable environmental laws and regulations. The INRMP describes the procedures and best management practices (BMPs) used at Fort Carson to ensure that impacts to the environment from construction, training, and operational activities are reduced. The INRMP is currently being updated by Fort Carson.

1.4.2 FORT CARSON FUGITIVE DUST CONTROL PLAN

The *Fort Carson Fugitive Dust Control Plan* focuses on control measures to implement for minimizing fugitive dust emissions and to avoid exceeding the threshold levels dictated by the state regulations. The plan describes all of the fugitive dust sources and the technologically feasible and economically reasonable control measures and operating procedures that can be used to minimize dust on Fort Carson. The plan also serves as a planning tool that can be incorporated into project design and construction phases to help reduce fugitive dust emissions on Fort Carson.

1.4.3 FORT CARSON STORMWATER MANAGEMENT PLAN

The *Fort Carson Stormwater Management Plan* (SWMP) outlines management practices, control techniques, system designs, engineering methods, and other provisions appropriate for the control of pollutants in discharges from Fort Carson. This plan also includes the BMPs that can be implemented for stormwater quality and quantity control, including measurable goals for each of the BMPs.

1.4.4 FORT CARSON INTEGRATED SOLID WASTE MANAGEMENT PLAN

The *Integrated Solid Waste Management Plan* (ISWMP) contains details of the Solid Waste Management Program at Fort Carson. The ISWMP complies with AR 200-1, *Environmental Protection and Enhancement,* and is consistent with Chapter 23 Section III of AR 420-1, *Non Hazardous Solid Waste Management*, and other applicable guidance on solid waste management.

1.4.5 FORT CARSON ENVIRONMENTAL NOISE MANAGEMENT PLAN

The *Fort Carson Installation Environmental Noise Management Plan* provides Fort Carson with a methodology for analyzing exposure to noise and safety hazards associated with military operations, and presents land use guidelines for achieving compatibility between the Army and surrounding communities. Elements of the plan include discussions of noise and vibration, mitigation techniques, noise abatement procedures, encroachment/training issues, recommendations for working with local communities, and noise modeling.

1.4.6 FORT CARSON SUSTAINABILITY REPORTS

Fort Carson produces annual sustainability reports that document the progress of Fort Carson's sustainability program (Section 1.2.1.3). The annual reports include information on energy and water resources, sustainable transportation, air quality, sustainable development, sustainable procurement, zero waste, and sustainable training lands.

1.4.7 PREVIOUS NEPA DOCUMENTATION

Previous NEPA documentation such as the *Final EIS for Implementation of Fort Carson Grow the Army Stationing Decisions* (2009) and *the EA for the Implementation of Combat Aviation Brigade (CAB) Stationing at Fort Carson* (2012) provide baseline data and environmental conditions at Fort Carson.

1.4.8 PREVIOUS PLANNING STUDIES

Previous planning studies such as the *Renewable Energy Opportunities at Fort Carson, Colorado* (2008), *Level One Energy Optimization Assessment at Fort Carson* (2009), *Fort Carson Comprehensive Energy & Water Master Plan* (2010), and *Targeting Net Zero Energy at Fort Carson: Assessment and Recommendations* (2010) provide background information related to the Proposed Action.

1.5 Public Review Process

As required by NEPA regulations, Fort Carson invites public participation in the EA process. Comments from all interested persons promote open communication and enable better decision-making. All agencies, organizations, and members of the public with a potential interest in the Proposed Action, were provided the opportunity to participate in this process. Appendix A provides a record of agency coordination and public involvement conducted in association with this EA.

An agency scoping period was held from 27 January 2012 to 15 March 2012, to solicit comments from agencies regarding the Proposed Action. In addition, Fort Carson held an agency scoping meeting on 29 February 2012, to provide an overview of Fort Carson's Net Zero Initiative, explain the purpose and need for the Proposed Action, and provide an overview of the alternatives being considered within this EA. A copy of the scoping letter and comments received from agencies are contained within Appendix A.

This EA process includes a 30-day public review period. Newspaper announcements have occurred in the following print media publications: the Pueblo Chieftain, The Gazette, and El Paso County & Fountain Valley News regarding the availability of this Final EA and the Draft FNSI, the duration of the public comment period, and how to obtain information about this Final EA and provide comments. Copies of this Final EA and Draft FNSI have also been placed at local libraries (Table 1-2). This document has also been placed for review on Fort Carson's NEPA website at the following URL address: http://www.carson.army.mil/DPW/nepa.html. Public comments received within the 30-day comment window will be made part of the Administrative Record. The Army will make revisions, as appropriate, to the EA and FNSI based on the comments received.

Table 1-2. Library Distribution

Library	Address
Cañon City Public Library	516 Macon Avenue Cañon City, Colorado 81212
Carnegie Public Library	516 Macon Avenue Cañon City, Colorado 81212
Fort Carson Grant Library	1637 Flint Street, Building 1528 Colorado Springs, Colorado 80913
Fountain Library	230 South Main Street Fountain, Colorado 80817
Huerfano County Public Library	323 Main Street Walsenburg, Colorado 81089
Manitou Springs Public Library	701 Manitou Avenue Manitou Springs, Colorado 80829
Penrose Public Library	20 North Cascade Avenue Colorado Springs, Colorado 80903
Pueblo City-County Library	100 East Abriendo Avenue Pueblo, Colorado 81004

Table 1-2. Library Distribution

Library	Address
Rocky Ford City Library	400 South 10th Street Rocky Ford, Colorado 81067
Woodruff Memorial Library	522 Colorado Avenue La Junta, Colorado 81050

1.5.1 AGENCY COORDINATION

Interagency and Intergovernmental Coordination for Environmental Planning (IICEP) is a Federally-mandated process for informing and coordinating with other governmental agencies regarding Federal Proposed Actions. CEQ regulations require intergovernmental notifications be made prior to making any detailed statement of environmental impacts.

Through the IICEP process, the Army notified relevant Federal, state, and local agencies and allowed them sufficient time to make known their environmental concerns specific to a Proposed Action. Comments and concerns submitted by these agencies during the IICEP process were subsequently incorporated into the analysis of potential environmental impacts conducted as part of this EA. This coordination fulfills requirements under EO 12372, which requires Federal agencies to cooperate with and consider state and local views in implementing a Federal Proposed Action. It also constitutes the IICEP process for this EA.

Federal agencies consulted for this EA include the Federal Aviation Administration (FAA), U.S. Environmental Protection Agency (EPA), U.S. Fish and Wildlife Service (USFWS), U.S. Army Corps of Engineers (USACE), U.S. Forest Service, and the Bureau of Land Management (BLM). State agencies consulted for this EA include the State Historic Preservation Office (SHPO), Colorado Parks and Wildlife (CPW), Colorado Department of Transportation, and Colorado Department of Public Health and Environment (CDPHE). Agency comments received within the 30-day comment window will be made part of the Administrative Record. The Army will make revisions, as appropriate, to the EA and FNSI based on the comments received.

2. DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

2.1 Proposed Action

The Proposed Action is to implement Net Zero waste, water, and energy goals by 2020 at Fort Carson while meeting energy mandates for renewable energy production and GHG emissions reduction. In doing so, Fort Carson would increase its energy and water security and sustain ongoing and future military missions. Fort Carson's Proposed Action includes evaluation of efforts to (1) produce as much renewable energy on the Installation as it uses annually; (2) limit the consumption of freshwater resources so as not to deplete the groundwater and surface water resources of that region in quantity or quality; and (3) reduce, reuse, and recover waste streams, converting them to resource value with zero solid waste landfilling.

As part of the Proposed Action, Fort Carson would implement policies, procedures, and BMPs similar in nature to their current sustainability program but at a larger scale and with greater intensity to maximize resource re-utilization, limit waste generation, increase resource re-purposing, and increase water and energy utilization efficiencies in new and existing facilities. This would include the following types of measures: installation of water and energy meters to establish baseline metrics; improvements to the water distribution system; installation of microgrids to improve energy security; installation of better insulation when buildings are repaired or renovated; requiring contractors to assist in meeting Net Zero goals; requiring the procurement of energy, waste, and water efficient systems; issuing aggressive Installation policies to help modify Soldier, Civilian, and contractor behavior in support of Net Zero goals; and utilization of all available communications media to educate the Fort Carson population on the importance of and ways to help meet the Net Zero goals. Sections 2.1.1 through 2.1.3 list the broad policies, procedures and BMPs that would be implemented to help Fort Carson meet Net Zero goals.

The Proposed Action also consists of a number of proposed projects, some of which are possibly related or interconnected, that may be necessary to implement Net Zero goals, comply with Federal and Army energy mandates, and meet the Army's energy and water security objectives. Section 2.4.2 discusses specific projects or technologies (Proposed Action Alternatives) which may be implemented to help Fort Carson meet Net Zero goals. Not all projects discussed in this EA would be implemented to the full extent as technology advancements, legislative changes, and other factors may drive certain changes to the proposed projects discussed in Section 2.4.2. This document has been framed to address potential projects that may move forward in the mid- to long-term (next 3-8 years) and also programmatically evaluates potential development footprints for future renewable energy, waste, and water infrastructure.

The Proposed Action is viewed primarily as a mission-enhancing and environmentally beneficial endeavor designed to increase Fort Carson's sustainability and foster regional coordination to reduce waste and to conserve energy and water. The implementation of the Proposed Action would enhance the overall sustainability and security of Fort Carson. The implementation of the Proposed Action may include the projects and advancements in waste, water resource, and energy management as listed in Sections 2.1.1 through 2.1.3.

2.1.1 WASTE

Fort Carson's proposed waste actions were selected to meet the goals of the Army's Net Zero waste program, which seeks to reduce, reuse, and recover waste streams, converting them to resource value with zero solid waste disposed in landfills. The first step is considering the waste stream when purchasing items to avoid or eliminate generation of unnecessary waste (e.g., packaging waste). In the second step, Fort Carson would look for opportunities to divert waste to a secondary purpose with limited processes. Third, Fort Carson would maximize the reclamation of recyclable and compostable materials. Fourth, Fort Carson may explore opportunities to convert unusable waste to energy. The balance of energy needs then are reduced and can be met by renewable energy projects. As part of the Army Net Zero waste program, Fort Carson proposes to implement the following waste initiatives:

- Assessment of baseline conditions
- Incorporate Installation policies to reduce consumption and demand where possible
- Implement policies and contracts requiring suppliers to reuse or reduce bulk solid waste (pallets, crates, etc.) from their products
- Development of a material recovery facility
- Integrate Installation policies on waste recycling and re-use (Soldier incentives)
- Acquisition of systems and products that produce less waste
- Repurposing/recycling/recovery
    - Expand on existing recycling and re-use programs (e.g., scrap wood, mattresses, printing cartridges, glass)
    - Continued reuse of used oils, anti-freeze, batteries, solvents (all hazardous materials except for oil filters)
- Development of a waste-to-energy (WTE) plant utilizing waste generated on- and off-Post (on-Post waste alone is not sufficient to develop an economically viable WTE plant)

2.1.2 WATER

The Army Net Zero water program seeks to limit the consumption of freshwater resources and return water back to the same watershed so as not to deplete the groundwater and surface water resources of that region in quantity or quality. Fort Carson's Net Zero water program goals are unique as the water used by the Installation comes from multiple watersheds beyond the watershed in which the Installation is physically located. Nonetheless, the first step is to implement water efficiencies through improving distribution system integrity. The second step is to identify opportunities to develop closed-loop systems to reclaim and/or treat water. Fort Carson would expand its use of reclaimed water for secondary use purposes. As part of the Army Net Zero water program, Fort Carson proposes to implement the following water initiatives:

- Engineering/facilities assessment of baseline conditions
- Reducing water consumption through Installation water conservation policies and enforcement of violations, incentives, and acquisition of more efficient systems and equipment
- Identifying distribution improvements and repairs to reduce evaporative loss
- Expanding the use of reclaimed water from the Waste Water Treatment Plant (WWTP) for irrigation and other viable uses
- Modifying contracts for landscaping/grounds maintenance and watering with more stringent specifications for vegetation, times for watering, sources of water to use
- Xeriscaping and low water demand landscaping
- Acquiring systems that use less water; for example, composting toilets

2.1.3 ENERGY

Fort Carson's proposed energy actions were selected to meet the goals of the Army's Net Zero energy program, which seeks to have each installation produce as much renewable energy on the installation as it uses annually. The first step is to reduce energy use in the most cost effective manner, by maximizing energy efficiency and conservation in existing facilities. The second step to look for opportunities to divert energy to secondary purposes, such as using boiler stack exhaust, building exhaust, or other thermal energy streams for a secondary purpose. For the third step, Fort Carson would explore converting non-recyclable solid waste to energy, and determine whether cogeneration (where two forms of energy, heat and electricity, are created from one source) is feasible. The final step and last resort after all reasonably feasible energy conservation and use efficiency measures have been implemented, is to develop options for generation of renewable energy. Fort Carson proposes to implement some or all of the following energy initiatives as part of the Net Zero energy program:

- Assessing baseline energy efficiency of Installation infrastructure using building and grid metering
- Establishment of an energy surety microgrid under the Smart Power Infrastructure Demonstration for Energy Reliability and Security (SPIDERS) program
- Building renovations, expansions, and technology upgrades to increase energy efficiency
- Acquiring systems with lower energy requirements
- Establishing cogeneration and heat energy recovery
- Constructing and using energy storage facilities
- Developing renewable/alternative energy infrastructure (including construction, electrical tie-in, and facility operations and maintenance) such as:
  - Construction and operation of a WTE plant
  - Construction of a Biomass plant (heat or combined heat and power)
  - Construction and operation of ground source heat pumps
  - Construction and operation of wind turbines
  - Installation of PV systems (solar cells)
- Assessing baseline energy efficiency of Installation infrastructure
- Using renewable technologies and fuels

Renewable energy development would involve three main phases - construction, electrical tie-in, and operations and maintenance. Descriptions of the proposed technologies are provided in the Alternatives discussion in Section 2.4.2.

2.2 Screening Criteria

Fort Carson has completed a screening process to determine which technologies and Installation sites are available to support implementation of the Net Zero Initiative. In order to be considered a viable alternative and carried forward for analysis, the alternative must meet the following screening criteria:

- **Mission Compatibility:** Must be compatible with the military missions and training occurring at Fort Carson and on other nearby military installations. Site development and operations may not adversely impact training activities.
- **Grid Access and Electrical Tie-in Potential (Renewable Energy):** Must be within a viable distance to transmission facilities (substations) and grid access. The grid infrastructure must be capable of transporting, or being upgraded to transport, electricity generated by the alternative.
- **On-Installation Energy/Water Generation Potential for Increased Energy and Water Security:** Must allow Fort Carson to have greater control of and access to its energy and water supplies while reducing the possibility of external distribution failures.
- **Geophysical Factors:** Must have topography, aspect, slope, and soils compatible with the proposed infrastructure.
- **Environmental Factors:** Must allow acceptable accommodation of cultural or sensitive natural resources.
- **Safety & Unexploded Ordnance:** Must involve minimal exposure to unexploded ordnance (UXO) and damage from munitions. Must not conflict with military training activities or jeopardize personal safety of those constructing or operating the facilities.
- **Project Financeability & Use of Proven Technologies:** Must use proven renewable energy technologies that may be financed at reasonable rates.

- **Compliance with Federal Mandates and DoD or Army Goals:** Must enhance compliance with government mandates and DoD and Army goals and objectives regarding renewable energy production, energy security, increased energy efficiency, water conservation, waste reduction, and GHG emissions reduction.
- **Utility Considerations:** Must be reasonably acceptable to CSU, the current electric supplier, and not unreasonably interfere with CSU's ability to absorb intermittent impacts and variance in peak energy generation.
- **Conflicts Among Net Zero Goals:** Must not unduly detract from satisfying another Net Zero goal (e.g., project to reduce waste by incineration must not use an undue amount of energy).

2.3 Alternatives Screened From Further Consideration

A) Construct and Operate Renewable Energy Facility Off-Post: The construction and operation of a renewable energy facility off-Post would not provide Fort Carson with the necessary energy security. Energy supply and transmission must be protected through on-Post energy generation. In addition, EO 13423, Sec. 2(b) states a preference that Federal agencies implement new renewable energy generation projects on agency property for agency use. Likewise, to reinforce that preference, EPAct 2005, Sec. 203, provides Federal agencies a double credit toward the agency's renewable energy consumption mandate if the renewable energy is produced and used on-site.

B) Purchase Renewable Energy Credits in Lieu of Renewable Energy Development: Under this alternative, there would be no renewable energy development on Fort Carson. Instead, RECs would be purchased on the open market and/or through a REC brokerage. A REC typically represents delivery of 1 megawatt-hour (MWh) of renewable energy to the grid and all associated environmental benefits of displacing 1MWh of conventional energy. RECs allow the environmental attributes associated with renewable energy production to be monetized and marketed. This alternative would not alleviate the energy threats to installations or enhance energy security. Energy dependence on off-Post electrical supplies and transmission would continue. Moreover, since RECs may arise from renewable energy production that occurs at facilities far distant from the Installation, the REC purchases are unlikely to provide the environmental, socio-economic benefits and energy security associated with localized renewable energy production.

C) Construct and Operate Some Renewable Energy Technologies: The uses of these technologies are not feasible on Fort Carson.

- ***Landfill gas.*** Landfill gas typically requires a landfill with 1 million tons of waste in place, be at least 30 feet deep, contain a high amount of organic material and have been recently closed. A previous Department of Energy National Renewable Energy Laboratory (NREL) assessment concluded no landfill area on Fort Carson met the criteria for landfill gas (NREL, 2011c).
- ***Use of small-scale wind turbine technologies***. Only the southeast corner of Fort Carson has sufficient wind resource for wind power development. Putting in 10 – 100 kilowatt (kW) wind turbines would be much more expensive than a single 1 Megawatt (MW) turbine, and have much higher maintenance requirements. They would also likely have a much bigger environmental footprint as additional turbines would be spaced across the landscape. To transmit the power from only a few of these small turbines would not be economically feasible and the electric losses through transmission would be a significant percentage of the power generated. The Main Post area in the northern part of the Installation, where transmission distance would be shorter, has a poor wind regime due to topographical variation and the influence of Pikes Peak, and is not a viable area for wind development.
- ***Geothermal.*** No geothermal resource exploration for power generation has taken place on Fort Carson. The closest investigations found are in Mt. Princeton about 60-70 miles due west of Colorado Springs. Based on the Colorado geothermal heat flow map, Fort Carson is not in a

good location to find temperatures adequate for geothermal power generation (Berkman and Carroll, 2007).

D) Use of Concentrated Solar Technologies. Under this alternative, Fort Carson would pursue the use of concentrated solar technologies (CSP) such as parabolic trough solar technology at various locations. CSP is sometimes referred to as solar thermal or thermoelectric power since all variations are designed to convert the sun's energy to heat and then apply that heat in various ways to produce electricity. To produce heat, all CSP technologies utilize direct normal insolation only; that is, sunlight that directly strikes the reflecting/concentrating surface, rather than global sunlight, which also includes sunlight that has been refracted or diffused by clouds, airborne dusts, or the ground. Thus, for optimal performance, the reflective surfaces of CSP technologies must track the sun (keeping the sun's incident rays perpendicular to the reflecting surface), and reflectors and/or concentrators must exhibit good optical characteristics. This type of technology, however, was not determined feasible as approximately 300 acres of land would be required for implementation; none of the Net Zero sites under consideration meet the 300 acres requirement.

E) Construction and Operations of a WTE Plant within the Main Post Area of Fort Carson. Under this alternative, Fort Carson would construct and operate an up to 40MW WTE plant within a 40-acre parcel in the Main Post area. As operations of a WTE plant would generate considerable amounts of truck traffic, this alternative was dismissed from further consideration. The increase in truck traffic would cause significant impacts to the traffic flow within the Main Post. Furthermore, numerous residential areas exist within the Main Post area; siting of this type of facility adjacent to residential communities would be an incompatible land use.

2.4 Alternatives Carried Forward for Consideration

2.4.1 NO ACTION ALTERNATIVE

Under the No Action alternative, Fort Carson would not leverage the Net Zero Initiatives to accelerate reduction of waste, water, and energy consumption beyond those policies and procedures that are currently in place.

Fort Carson's Sustainability Program, as described in Section 1.2.1.3, above, would continue even if the Army selected the No Action alternative analyzed in this EA. In other words, the program would continue whether or not the Army decides to proceed with any Net Zero projects or initiatives. The Sustainability Program is, therefore, assumed in this document to be part of the No Action alternative; that is, part of the baseline environmental conditions.

2.4.2 PROPOSED ACTION ALTERNATIVES

The following alternatives include specific projects that might be implemented to support the Proposed Action. As part of Net Zero implementation at Fort Carson, the Army may choose to implement one or a combination of these alternatives. It should be noted, however, that Fort Carson would not proceed with both the construction of a large scale (10MW or above) WTE and biomass plant. Fort Carson's energy strategy does not require development of two large-scale WTE and biomass plant projects. Only one such project would be needed to meet the Installation's energy requirements and the need for the action discussed in Chapter 1. The final decision of which alternatives could be implemented will, therefore, be covered within the FNSI, or if it is determined that implementation of the selected Proposed Action Alternatives would result in unavoidable or non-mitigable significant environmental impacts, the Army would publish an NOI and initiate the preparation of an EIS.

Energy development alternatives (Alternatives 1, 2, 3, 5 and 6), if selected for further implementation by Fort Carson, would be presented to the private sector as opportunities for bid and investment. Based on private sector interest, project finance considerations and energy delivery costs to the Installation, as well as environmental considerations, Fort Carson would choose the most favorable energy proposals to pursue in support of the Installation's energy strategy. All of the energy development alternatives discussed in this EA would not proceed to future development, as this would far exceed Fort Carson's requirements for energy. If no proposals or acceptable proposals were received, energy development technologies associated with alternatives selected for implementation would not be constructed.

Table 2-1 provides a summary of Net Zero energy sites by alternative and potential energy technologies to be considered within these proposed sites.

Table 2-1. Net Zero Energy Sites Summary

Site Location	Description/Name	Acres	Associated Alternative(s)	Potential Technology
Main Post	Gate 2 North	3.0	3, 6	PV
Main Post	Gate 2 South	7.6	3, 6	PV
Main Post	Chiles	12.7	3, 6	PV
SWMU	SWMU 1-170	86.9	3, 6	PV
SWMU	SWMU 5 (Site 1)	14.3	3, 6	PV
SWMU	SWMU 5 (Site 2)	41.9	3, 6	PV
Training Area	Gate 19	163.2	1, 2a, 6	WTE, Biomass, PV
Training Area	CEP Biomass	16.5	2c, 6	Biomass, PV
Training Area	Bravo North (Site 1)	71.5	3, 6	PV
Training Area	Bravo North (Site 2)	22.6	2b, 6	Biomass, PV
Training Area	Butts Road	89.4	3, 6	PV
Training Area	Magrath Avenue	19.5	3, 6	PV
Training Area	Wildhorse	361.1	3, 5, 6	Wind, PV
Training Area	Titus/Signal Hill	31.9	3, 6	PV
Training Area	Ray Nixon	146.8	3, 6	PV
Training Area	Tent City	97.1	3, 6	PV
Training Area	Highway 115	1.0	6	PV
Training Area	Fremont	1.0	6	PV
Training Area	COARNG	115.2	6	PV

CEP = Central Energy Plant; COARNG = Colorado Army National Guard; SWMU = solid waste management unit

2.4.2.1 Alternative 1: Construction and Operation of a Waste-to-Energy Plant

Fort Carson would pursue the construction and operation of a WTE plant to reduce Installation and local community generated landfill waste and to provide the Installation with a source of secure, alternative power. Under this alternative, it is anticipated that Fort Carson would combust all but approximately 10-20 percent of its generated municipal waste stream.

The NREL economic analysis of a WTE plant on Fort Carson using only on-Post waste as a source concluded that low tipping fees and relatively low electric rates would be uneconomical and that combining Fort Carson waste with the much larger waste stream (300,000-400,000 tons/years) from either the Fountain, Midway, or Colorado Springs landfills would fuel an up to 40MW combustion plant with payback periods of seven to nine years (NREL, 2011c). Supplemental waste for fuel required from off-Post would commensurately reduce locally generated landfilled amounts. Although feedstock would be required for operations from off-Post sources, energy security would still be met as the electricity would be generated from locally-sourced feedstock and distributed on-Post.

The WTE plant would utilize standard combustion techniques. Waste materials (feedstock for the WTE plant) would be delivered to the plant using collection trucks, each carrying 13-14 tons of municipal solid waste (MSW), or transfer trucks carrying approximately 24 tons of MSW each. The waste would be tipped in an indoor receiving area and kept at a slight negative pressure to minimize the release of odors to the surrounding areas. An operator would remove large appliances or other non-combustible materials and would feed the remaining material into a chute that would direct the waste into a furnace. In the furnace, the waste would either be combusted on a grate or in a fluidized bed to release energy in the form of heat. The gaseous and particulate products of the combustion reaction would pass through several stages of emissions controls to meet EPA requirements. The heat released from the combustion of the fuel would be transferred to water in the boiler. The water would then be converted to steam, which would drive a steam turbine to produce electricity or would be used for various heating applications.

Construction: This project would involve the construction of an access gate and roads. Roads would be paved and designed to accommodate 24-ton garbage collection vehicles. The WTE plant would encompass approximately 40 acres, to include tipping areas/floor, sorting areas, weigh area, translocation area, and plant. A fence would be constructed around the site to contain blowing debris. The plant would include one or more exhaust stacks up to 200 feet in height. It is anticipated that site grading would occur across the entire construction footprint of the site to obtain proper grade (in most cases less than 2 percent grade). To the greatest extent possible, existing vegetation would be left in place, and mowed or brush-hogged as needed.

Electrical Tie-In: The WTE plant would tie into the closest interconnection point to the site. Upgrades would be required to the substation and transmission lines to ensure that power could be directed to Fort Carson, with priority over other CSU electric customers. As most electrical distribution lines within the Installation are buried, the tie-in for the WTE plant would likely be buried and either connected to the existing grid or run parallel (adjacent) to existing utility rights-of-way (ROW). Typically, a 3-foot depth is required for buried electrical lines.

Operations and Maintenance: The plant would generate energy through a steam-powered turbine. The maximum upward bound size of the plant being considered is a 40MW plant with maximum stack heights of 200 feet. This type of plant would require potentially 60-120 trucks/day for operations, which would involve hauling waste (feedstock) to the plant from Fort Carson and the surrounding Colorado Springs area. The majority of waste used would be off-Post waste streams (i.e., Colorado Springs) to supplement the limited and diminishing on-Post generation of wastes. The WTE plant would average approximately 15 percent down-time for maintenance. A percentage (10-20 percent) of the tonnage of waste would become ash and would need to be disposed of in an off-Post landfill or to a re-use facility where it could be converted to landfill roadbed material, road aggregate, or asphalt-mixture. This includes all non-combustible materials received.

Emissions Control: Scrubbers, baghouses, catalytic, and non-catalytic emissions control equipment would be included as part of the WTE plant. Technologies would be similar to air pollutant reduction technologies used by other solid fuel generation facilities and would ensure that the WTE is in conformity with air regulations and permit(s).

Project Location: One site has been identified for the proposed WTE plant, the Gate 19 area (see Figure 2-1a, page 23). The overall site is approximately 163 acres; however, as previously stated, only approximately 40 acres would be required for plant operations.

2.4.2.2 Alternative 2: Construction and Operation of a Biomass Plant

Fort Carson would pursue the construction and operation of a biomass plant to reduce Installation-generated waste and augment Fort Carson's sources of alternative energy. It is anticipated that all but approximately five to ten percent of Fort Carson generated biomass would be consumed through use of a biomass plant. The NREL economic analysis of a biomass plant on Fort Carson concluded that 10,000 tons per year (tpy) of woody biomass exists on-Post (NREL, 2011c). As a comparison, a biomass combined heat and power plant (supplying 5MW thermal power and 7MW of electrical power) would require approximately 100,000 tons of biomass fuel per year to operate; therefore, off-Post sources of feedstock would be required. Supplemental biomass generated from outside the region would be required under this alternative, but would not increase the Installation's waste generation amounts. Instead, the biomass transported onto the Installation would be used to supplement Fort Carson's feedstock. In short, biomass generated from outside the region would be redistributed to the Installation and used for fuel in lieu of being disposed.

Although feedstock would be required for operations from off-Post sources, energy security would be enhanced by generating electricity from locally-sourced materials as it helps diversify Fort Carson's energy supply. This alternative would benefit Fort Carson and the State of Colorado through increasing the Installation's energy independence and diverting a solid waste stream from Colorado's landfills.

Biomass heating and cooling systems are similar to the WTE systems (Alternative 1) with the exception of the feedstock. Biomass systems typically use residual organic materials such as woody biomass from forestry operations or crop residues from agricultural operations. The biomass plant would contain standard combustion techniques. Biomass materials would be delivered to the plant using walking floor trailers holding an average of 24 tons each. The materials would primarily be hauled from off-site sources at distances of up to 120 miles away from forestry operations such as wildfire mitigation and invasive species eradication. Biomass material would be processed at the suppliers' facilities and would be delivered as mulch or chips ranging from ¼" to 4" in size. The biomass plant on Fort Carson would store approximately 30 days' supply of material to ensure a constant supply (particularly important during winter with sporadic access to mountain locations). Material would be stored in covered piles or in wind rows adjacent to the plant.

From the storage location, material would typically be transferred using wheeled front end loaders to conveyors, which feed the fuel into a furnace where it is combusted to create heat. The gaseous and particulate products of the combustion reaction would pass through several stages of emissions controls to meet or exceed EPA requirements. The heat released from the combustion of the fuel would be transferred to water in the boiler. The water would then be converted to steam which would drive a steam turbine to produce electricity or used for various heating applications.

Construction: This project would involve the construction of an access gate (Alternative 2a) and roads. Roads would be paved and designed to accommodate 18-wheel commercial hauling trucks weighing up to 24 tons. The biomass plant would encompass up to 20-40 acres, to include storage areas, weigh area, translocation area, and plant. The plant would generate energy through electrical generation or heat recovery systems. The plant would include one or more exhaust stacks up to 200 feet in height. It is anticipated that site grading would occur across the entire construction footprint of the site to obtain proper grade (in most cases less than 2 percent grade max). To the greatest extent possible, existing vegetation would be left in place, and mowed or brush-hogged as needed.

Electrical Tie-In: The biomass plant would tie into their nearest interconnection points. Upgrades would be required to the substation and transmission lines to ensure that power could be directed to Fort Carson, with priority over other CSU electric customers. As most electrical distribution lines within the Installation are buried, the tie-in for the biomass plant would likely be buried and either connected to the existing grid or run parallel (adjacent) to existing utility ROW. Typically, a 3-foot depth is required for buried electrical lines.

Heating System Interconnection: In the case of heat generation, the system would be interconnected with the district heating system.

Operations and Maintenance: The maximum upward bound size of the plant being considered is a 13MW plant with maximum stack heights of 200 feet. This type of plant would require 15-25 trucks per day hauling 24 tons each. The biomass plant would average approximately 15 percent down-time for maintenance. Five to ten percent of the tonnage of waste would become ash and would need to be disposed of in an off-Post landfill. This includes all non-combustible materials, primarily dirt, received with the biomass fuel.

Emissions Control: Scrubbers, baghouses, catalytic and non-catalytic emissions control equipment would be included as part of the biomass plant. Technologies would be similar to air pollutant reduction technologies used by other biomass generation facilities and would ensure that the plant is in conformity with air regulations and permit(s).

Project Location: The following are potential sites for a biomass plant (see Figure 2-1a, page 23):

- **Alternative 2a:** Construct and operate an up to 13MW biomass plant in the Gate 19 area. This is the same site being considered for the WTE plant and is approximately 163 acres; however, as previously stated, only 20-40 acres would be required for plant operations. The biomass plant would tie into the closest interconnection point to the site.
- **Alternative 2b:** Construct and operate an up to 13MW biomass plant in Bravo North Sites 1 and 2 near the Magrath substation. The total site area is approximately 94.1 acres; however, as previously stated, only 20-40 acres (primarily concentrated in the 22.6-acre Bravo North Site 2) would be required for plant operations. The biomass plant would tie into the closest interconnection point to the site.
- **Alternative 2c:** Upgrade the proposed CAB Central Energy Plant (CEP) into a 2.5MW biomass plant. CAB stationing requires the construction of a CEP to efficiently provide electricity, heating, and cooling to CAB facilities. The proposed CEP is analyzed within the *EA for the Implementation of Combat Aviation Brigade (CAB) Stationing at Fort Carson* Proposed Action and is a natural gas plant to be constructed on 6.6 acres of land within the Wilderness Road Complex. As part of the Proposed Action under Alternative 2c, Fort Carson would upgrade the CAB natural gas CEP to include biomass energy production capabilities. Besides internal equipment changes within the CEP natural gas plant, upgrades to a biomass plant would require an additional approximately 16.5 acres to accommodate the biomass delivery and stockpile operations (i.e., woodchip piles, scalehouse, and truck queuing).

2.4.2.3 Alternative 3: Use of Photovoltaic Technology

Fort Carson would pursue the construction, operation, and maintenance of PV systems for energy generation on Fort Carson. PV systems are based on the use of semiconductors, materials that can generate small amounts of electric current when exposed to sunlight. To produce electricity at utility scale, many individual solar cells are connected as a module; modules are combined to make individual solar panels; and solar panels are grouped into arrays producing direct current (DC) electricity. The power-producing components of utility-scale PV facilities are the solar field, which contains the PV panels, and the power conditioning system (PCS), which contains an inverter to convert the produced DC to AC and a transformer to boost voltage for feeding into the power grid. The PCS also contains devices that can sense grid destabilization and automatically disconnect the PV facility from the grid, if needed.

Construction: It is anticipated that site grading would occur within the site, as needed, to obtain proper grade for PV placement. To the greatest extent possible, existing vegetation would be left in place, and mowed or brush-hogged as needed. Access/maintenance roads, to the greatest extent possible, would be sited and constructed from existing roads to access the sites. Fencing would also likely be placed around these sites.

Electrical Tie-in: It is assumed that electrical tie-in would occur at the closest interconnection point to the site. From the PV site to the interconnection point, the transmission lines may or may not parallel an existing ROW. As most electrical distribution lines within the Installation are buried, the tie-in for the PV sites would likely be buried to depths of typically 3 feet and either connected to the existing grid or run parallel (adjacent) to existing utility ROW. PV sites located within Solid Waste Management Units (SWMUs), however, may have depth restrictions for surface disturbance. Any disturbance within these sites would be coordinated with the CDPHE to maintain compliance and design approval (also see Section 3.13).

Operations and Maintenance: Occasional maintenance would be required for the PV fields, including vegetation control (see Section 3.7.2.2), panel washing (see Section 3.6.2.2), and panel replacement.

Project Location: Alternative 3 contains 13 sites throughout Fort Carson that meet the screening criteria (see Figures 2-1a and Figure 2-1b). The PV systems would vary in scale based on available land area and terrain (requiring flat to low-sloping areas); and acreage of the proposed site areas scaled to suitable land availability and terrain. Approximately 1MW of electricity would be produced for every 6 acres of PV systems. The decision to implement this alternative may include selection of a single or multiple sites. Sites selected for potential PV systems include seven training areas locations, three SWMU locations, and three residential locations (see Table 2-1).

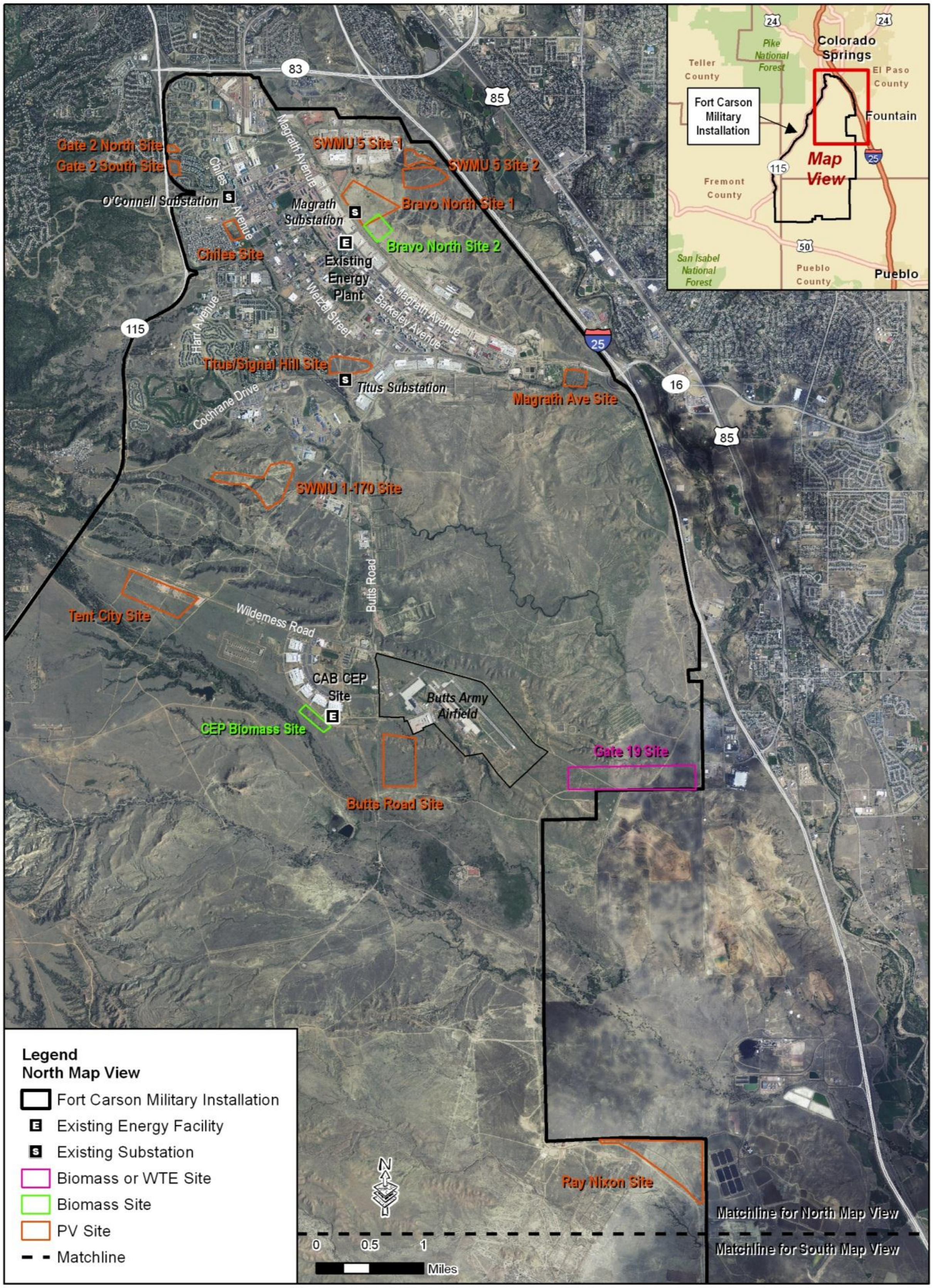

Figure 2-1a. Net Zero Energy Sites in the Main Post and Northern Downrange Areas

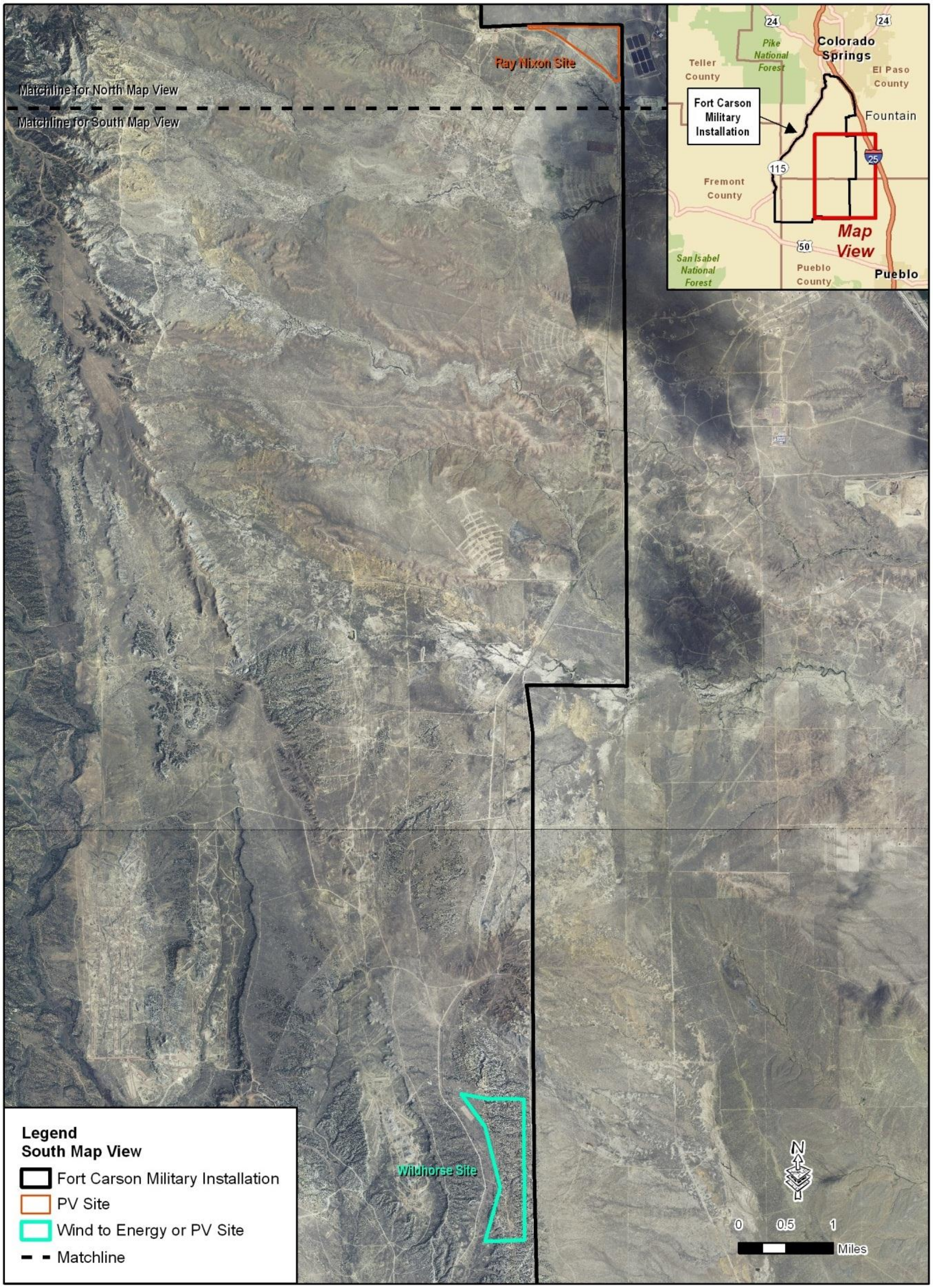

Figure 2-1b. Net Zero Energy Sites in Southern Downrange Area

2.4.2.4 Alternative 4: Expansion of the Existing Reclaimed Water System

Under Alternative 4, Fort Carson would expand the existing reclaimed water system (see Figure 2-2), increasing the distribution capacity for treated WWTP effluent. Fort Carson WWTP treated effluent falls under the definition of "Reclaimed Water" in CDPHE Regulation No. 84. "Reclaimed Water" and is defined as "domestic wastewater that has received secondary treatment by domestic wastewater treatment works and such additional treatment as to enable the wastewater to meet standards for approved uses". Under Regulation No. 84, reclaimed water that is applied to landscape irrigation access sites, such as the Fort Carson golf course, must comply with water quality standards set by the type of user, site accessibility and the water treatment category.

This alternative utilizes the existing reclaimed irrigation reservoir (golf course pond) as the storage and central distribution point for all irrigation at the Main Post area. This reclaimed irrigation reservoir would be able to store and use 100 percent of the treated wastewater supply during most of the irrigation periods. WWTP effluent would be used to supply irrigation water from May through September. During months when the irrigation demands exceed the volume of effluent available from the WWTP, domestic water would supplement the golf course pond during the high demand periods.

Expansion would include potentially increasing the reclaimed irrigation reservoir at the golf course to meet the maximum daily flow from the WWTP and lining the reservoir with an impervious liner to prevent seepage. In addition, the pumping station at the WWTP would be upgraded to utilize two 1,400 gallons per minute (gpm) pumps and provide space for a third 1,400 gpm pump for future capacity in order to maximize usage of the effluent at the WWTP and to convey reclaimed water.

The existing approximate 20,500 feet of 12-inch asbestos cement pipe reclaimed water transmission line from the WWTP to the golf course would be replaced with a 16-inch polyvinyl chloride (PVC) or high density polyethylene (HDPE) transmission pipe that is rated for a minimum operating pressure of 200 psi to accommodate increased pressure requirements and for the maximum effluent discharge from the WWTP.

A dedicated reclaimed water irrigation system would be installed to provide irrigation water from the reclaimed irrigation reservoir to the sprinkler systems within the Sports Complex and other locations requiring irrigation in the Main Post area. Preliminary engineering data indicates up to approximately 25,845 linear feet of piping would be required ranging in size from 20-, 18-, 12-, 8-inch lines (see Table 2-2). Installation of the reclaimed water lines would require approximately 30 feet of disturbance (15 feet on either side of the centerline) with a total of approximately 20 acres of temporary disturbance during installation. The reclaimed water lines would have 60 inches of cover and typically have a 3 to 1 ratio for grade.

Figure 2-2. Proposed Water Reclamation Expansion

Table 2-2. Proposed Reclaimed Water Distribution Lines

Location		Pipe Diameter (inches)	Length (feet)
From	**To**		
Golf Course Pond	Sheridan & Prussman Intersection	20	11,200
Sheridan & Prussman Intersection	Prussman & Wetzel Intersection	18	785
Prussman and Wetzel Intersection	Founders Parade Ground	12	3,500
Founders Parade Ground	Manhart Parade Ground	8	1,000
Prussman and Wetzel Intersection	Sport Complex	12	3,700
Manhart Parade Ground	Pershing Parade Ground	8	1,100
Titus & Sheridan	10th Special Forces Compound	8	4,560

In addition, as part of this alternative, inline variable frequency drive (VFD) boosters would be installed on along the Titus and Sheridan portion of reclaimed water line to facilitate reclaimed water flow for irrigation.

Fort Carson currently irrigates the Sports Complex with an estimated 100 million gallons of potable water per year. Switching to a reclaimed watering resource would reduce potable water consumption and reduce costs. Preliminary data shows 200 million gallons per year (gpy) excess is being discharged, which could be available for reuse.

2.4.2.5 Alternative 5: Construction and Operation of Wind Turbines

Fort Carson would pursue the construction, operation, and maintenance of up to eight utility-scale wind turbines in the southeastern corner of the Installation in Training Area 48 (see Figure 2-1b). Wind turbines convert the kinetic energy in the wind into mechanical power. This mechanical power can generate electricity through conversion of mechanical power. The wind turns the blades of the wind turbines in the moving air, which spin a shaft that is connected to an electric generator and makes electricity. Wind turbines are often grouped together into a single wind power plant, also known as a wind farm, and generate bulk electrical power. Electricity from these turbines is fed into a utility grid and distributed to customers, just as with conventional power plants.

Each wind turbine would individually produce 1.5-3MW of energy. The turbine hub height would be up to 60 to 100 meters (197 to 328 feet) tall with a 30 to 50 meter (98 to 164 feet) radius for blades; total height of the turbine and the blade, therefore, would be up to 150 meters (492 feet). The footprint of operations for each turbine is approximately 50 acres; however, the turbines would require adequate spacing from one another to reduce turbulence effects between turbines. Disturbance would not occur across the entire footprint. The wind turbine construction footprint would consist of only a few acres, and access trails/routes to and from the siting location. The turbines tie into the nearest interconnection point. Although most of Fort Carson's distribution lines are buried, the tie-in may require use of powerlines due to increased complexity, impacts, and costs. The closest Fort Carson-managed powerlines are approximately one-quarter mile east of the proposed alternative's location.

2.4.2.6 Alternative 6: Implement Future Renewable Energy Development within Net Zero Footprints Identified by the Army

Alternative 6 involves future ground-source heating and cooling or additional solar energy Net Zero projects at Fort Carson on a programmatic level. This alternative includes developing energy Net Zero projects on sites identified within previous alternatives in addition to the Colorado Army National Guard (COARNG), Highway 115, and Fremont sites (see Figure 2-3 and Table 2-1); all of which have been determined by Fort Carson to meet the screening criteria discussed in Section 2.3 for Net Zero energy project development within the Installation. This alternative also considers the installation and operation of ground-source heating and cooling and solar energy technologies at existing and future buildings on the Installation. Environmental screening criteria have been developed and considered within this EA to assess and capture future impacts as specific projects are identified and sited in the future and tiered off this programmatic alternative (see Fort Carson Net Zero Project Checklist, Appendix B). The implementation of this alternative would allow the Installation to adaptively select future compatible footprints and best technologies to increase the Installation's energy security, reduce GHG emissions, and increase the percentage of energy consumed that is derived from renewable energy sources.

Future Ground-Source Heat Pump Projects

Fort Carson would pursue the construction, operation, and maintenance of ground-source heat pump (GSHP) units for use in heating and cooling buildings on Fort Carson. GSHPs use the constant temperature of the earth to heat or cool buildings instead of the outside air temperature. GSHP systems are generally composed of ground-source heating and cooling pumps, fluid circulating pumps, and a buried ground loop heat exchanger usually composed of plastic pipe. In the summer, GSHPs extract heat from buildings and transfer it to the circulating fluid in the cooler ground loop system. In the winter, fluid circulating in the ground loop system absorbs heat from the earth and transfers it to the GSHPs. The GSHPs then extract the heat from the fluid which is then used to increase the temperature of the air transported to the buildings.

Implementation of this alternative would involve the installation of GSHP units within existing and future buildings at Fort Carson. These projects would be associated (where feasible) with existing buildings and potentially incorporated into future building construction. Wells would typically be constructed to vertical depths of approximately 400 feet below the surface. They could also be installed vertically or diagonally using small boring equipment. Disturbance footprints for borehole drilling are typically very small involving a 7 to 14 foot diameter of disturbance. The location of the units within each building would be dependent upon the thermal and occupancy zoning requirements of each building. The number of wells would be based on the dominant load condition (i.e., heating or cooling) of each building. Each building would require the design and installation of new supply air ductwork.

Future Solar Projects

Fort Carson would consider the development of future solar energy projects (i.e., PV technologies as discussed within Section 2.4.2.3) within the sites identified on Figure 2-3. Future placing of PV systems on the rooftops of existing and future buildings would also be considered to conserve future developable space. Due to the distance of the downrange sites (Fremont, Highway 115 and Wildhorse), Fort Carson may choose to tie into adjacent powerlines that parallel the Installation. Although most of Fort Carson's distribution lines are buried, these tie-ins may require use of powerlines due to increased complexity, impacts, and costs. Other compatible sites across the Installation would also be considered as part of this alternative.

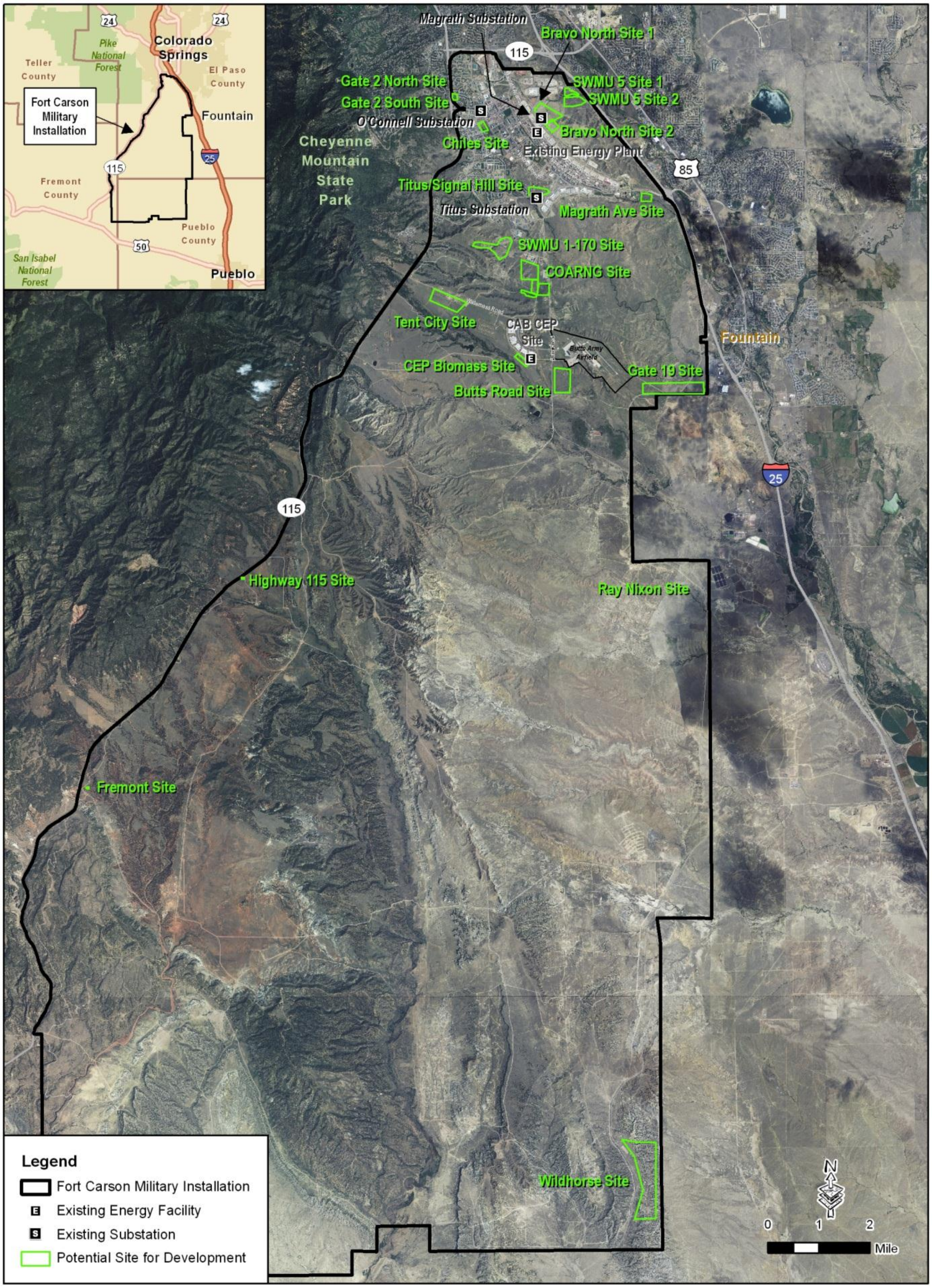

Figure 2-3. Future NetZero Energy Sites at Fort Carson

2.4.2.7 Alternative 7: Maximum Conservation and Re-use

Alternative 7 includes maximizing the conservation, re-use, and recovery of resources on a programmatic level. As part of Alternative 7, Fort Carson may implement all policies, procedures, BMPs, and actions described in Sections 2.1.1 through 2.1.3 which are not already covered under Alternatives 1 through 6. These actions support the conservation of water and energy and seek to limit the production of waste.

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 Impact Assessment Methodology

3.1.1 INTRODUCTION AND DESCRIPTION OF BASELINE DATA AND SOURCES

Besides the documents listed in Section 1.4, which contain baseline data and information for day-to-day operations managed by Fort Carson, the following types of data were used to characterize the affected environment:

- Geographic Information System data and aerial photography
- Existing permits (e.g., CDPHE Air Quality Permit, Municipal Separate Storm Sewer Permits, and Resource Conservation and Recovery Act [RCRA] Part B Permit)
- Public information from databases and publications managed and authored by EPA, CDPHE, U.S. Army Public Health Command (USAPHC), Natural Resources Conservation Service (NRCS), U.S. Geological Survey, Colorado Department of Natural Resources, Colorado Heritage Program, USFWS, National Wetland Inventory (NWI), U.S. Census, Bureau of Economics, and Departments of Transportation
- Additional publications, research, and surveys (i.e., plant surveys; NREL studies, USACE Environmental Laboratory data; traffic, utilities, noise, and aircraft operations studies; and Institute of Transportation Engineers Trip Generation Manual and Highway capacity Manual)
- County Planning Department/County Records/Online databases and plans
- State, county, and local agencies and local chamber of commerce
- Personal communications with Butts Army Airfield (BAAF) Manager; surrounding airfield and range managers and users; Directorate of Public Works (DPW) planners/engineers; and WTE Program managers
- Manufacturers data of proposed technologies

A region of influence (ROI) was determined for each resource area and was based on the potential impacts to the affected resource. The ROI was generally limited to Fort Carson and where applicable, the site-specific locations of each alternative (the approximate area required for construction and operation of each alternative) for the following VECs: biological resources, wetlands, cultural resources, soils, land use, and hazardous and solid wastes. These VECs are directly connected to specific existing conditions at the site and proposed uses at the site. For the remaining VECs, the ROI was generally expanded to include larger geographic areas (e.g., airsheds for air quality and watersheds for surface waters). Although portions of the potential feedstock sources (biomass and solid waste) for Alternatives 1 and 2 would originate outside of the ROI discussed within the EA (up to 120 miles radius for biomass and the surrounding communities for solid waste), these sources would be from ongoing existing operations such as industrial wood residue and fire mitigation residue generating biomass and solid waste collection providing WTE feedstock. No new impacts to the source locations would be anticipated as a result of implementation of either of these Proposed Actions, and therefore, the ROI does not include these areas from which all feedstocks are derived.

3.1.2 APPROACH FOR ANALYZING IMPACTS

Context and intensity are taken into consideration in determining a potential impact's significance, as defined in 40 CFR Part 1508.27. The intensity of a potential impact refers to the impact's severity and includes consideration of beneficial and adverse impacts, the level of controversy associated with a project's impacts on human health, whether the action establishes a precedent for future actions with significant effects, the level of uncertainty about project impacts, or whether the action threatens to violate Federal, state, or local law requirements imposed for the protection of the environment. The severity of environmental impacts is characterized as negligible, minor, moderate, major or beneficial:

- **None/Negligible –** No measurable impacts are expected to occur.
- **Minor** – Primarily short-term but measurable adverse impacts are expected. Impacts may have slight impact on the resource.
- **Moderate** – Noticeable adverse impacts that would have a measurable effect on a resource and are not short term.
- **Severe** – Adverse impacts would be obvious; both short term and long term, and would have serious consequences on a resource. These impacts would be considered significant unless mitigable to a less-than-significant level.
- **Beneficial –** Impacts would benefit the resource/issue.

Impacts that range from none to moderate are considered insignificant. Significant adverse impacts would result from those impacts categorized as severe.

To maintain a consistent evaluation of impacts in the EA and in accordance with the Army NEPA Regulations, thresholds of concern were used for each resource. Although some thresholds have been designated based on legal or regulatory limits or requirements, others reflect discretionary judgment on the part of the Army in accomplishing its primary mission of military readiness, while also fulfilling their conservation stewardship responsibilities. Significance thresholds are bolded and summarized in Table 3.1-1 and are also discussed within each resource section. Quantitative and qualitative analyses have been used, as appropriate, in determining whether, and the extent to which, a threshold would be exceeded. Based on the results of these analyses, this EA identifies whether a particular potential impact would be adverse or beneficial, and to what extent.

Table 3.1-1. Thresholds of Concern and Significance

Areas of Concerns	ROI	Threshold of Concern and Significance[1]
Land Use	Land use within Fort Carson and immediate surrounding communities.	• Concern that land use conflicts would occur, including adverse impacts to viewsheds. • Proposed Action reduces training availability.
Air Quality and GHG	Airshed and Installation boundary for criteria pollutant and HAPS.	• **Violation of NAAQS which may threaten the attainment status of the region.** • **Generate substantial GHG emissions (>75,000 tons CO_2 equivalents per year).**
Noise	Areas adjacent to and within Fort Carson including the alternative site-specific study areas.	• Exceedence of noise limit guidelines published in AR 200-1, Chapter 7 (2007). • Noise impacts causing reclassification of noise zones to zone 2 or 3 around sensitive receptors. • **Violate any Federal, state, or local noise ordinance.** • **Create incompatible land uses for areas with sensitive noise receptors outside the Installation boundary.** • **Would be loud enough to threaten or harm human health.**
Geology and Soils	Soils and geological features within Fort Carson including the alternative site-specific study areas.	• Proposed Action or alternative induces wind borne or stormwater related soil erosion beyond the threshold acceptable for the soil type as classified by the NRCS.

Table 3.1-1. Thresholds of Concern and Significance

Areas of Concerns	ROI	Threshold of Concern and Significance[1]
Water Resources: Streams and Floodplains, Surface Water Quality, and Groundwater and Aquifers	Watersheds, USACE jurisdictional "waters of the U.S.," or state-designated stream segment associated with Fort Carson, including the alternative site-specific study areas.	• Sedimentation or discharge into streams. Wetlands or other "waters of the U.S." within footprint or adjacent (within a distance to be concerned about sedimentation) within the watershed. • **Degradation of water quality resulting in long-term impacts (chemical, physical, or biological effects) that exceed TMDLs or cause a change in surface water impairment status.** • **Unpermitted direct impacts to waters of the U.S.**
Biological Resources: Native Plant Species and Communities	Biological resources within Fort Carson, including the alternative site-specific study areas.	• Permanent loss or degradation of designated rare/sensitive plant sites. • Introduction or increased prevalence of undesirable nonnative species.
Biological Resources: Wildlife and Aquatic Life	Species home range, local habitat, or migratory range intersecting Fort Carson, including the alternative site-specific study areas.	• Long-term loss or impairment of a substantial portion of local habitat (species-dependent). • Actions that can be tied to a noticeable decline in regional wildlife or aquatic populations. • Actions that can be tied to decline in Migratory Bird Treaty Act (MBTA) population.
Biological Resources: Rare, T&E Species	Home range or protected habitat within Fort Carson, including the alternative site-specific study areas.	• Impacts to rare or protected species habitat. • **Unpermitted "take" of T&E species.** • **Violation of the Bald and Golden Eagle Protection Act.**
Cultural Resources	Cultural Resources within Fort Carson, including the alternative site-specific study areas.	• Irretrievable or irreversible damage to burials (particularly unmarked or poorly marked cemeteries). • Concerns raised by Native American Groups regarding potential environmental or cultural impacts. • **Irretrievable or irreversible damage to a prehistoric or historic site (exclusive of data recovery or mitigation) that has not been evaluated, is listed, or is eligible/potentially eligible for listing on the NRHP.**
Socioeconomics	Socioeconomic factors within Fort Carson, and immediately surrounding communities and counties.	• Public health hazard from exposure to hazardous waste or hazardous materials. • Disproportionate environmental health or safety risk to children. • **Disproportionate environmental, economic, social, or health impacts on minority or low-income populations (EO 12898).** • **Negative exceedance of socioeconomic indicators; if the action causes a substantial decline of economic activity outside the historical range of ROI economic variation.**

Table 3.1-1. Thresholds of Concern and Significance

Areas of Concerns	ROI	Threshold of Concern and Significance[1]
Traffic and Transportation	Roads within Fort Carson and public roadways near the Installation.	• Increase in traffic volumes or delays to levels that impair a roadway's handling capacity or increase traffic safety hazards. • Road failure resulting in rutting, cracking, or other pavement problems that requires substantial maintenance or construction activities. • **Reduction in state or Federal highway function by more than two levels of service.**
Airspace	Airspace above Fort Carson.	• **Violation of FAA regulation that undermines the safety of military, civil, or commercial aviation.** • Infringement on current military, private, and commercial flight activity and flight corridors.
Utilities	Utilities within Fort Carson and immediate surrounding communities and counties.	• Any action that would cause an impairment of utility service to local communities, homes, or businesses.
Hazardous and Toxic Substances	Fort Carson, including the alternative site-specific study areas.	• Impairment of the Installation's ability to meet Federally-mandated or Army objectives for waste minimization and pollution prevention. • Exceedance of existing facility or system capacity for hazardous waste/hazardous material management. • Public health hazard from exposure to hazardous waste or hazardous materials. • **Considerable risk to human health or safety attributable to Army actions, including direct human exposure, substantial increase in environmental contamination or violation of applicable Federal, state, DoD, and local regulations.**

[1]Thresholds that are bolded are thresholds of significance, which, if exceeded without mitigation would lead to a significant impact. Thresholds of concern, if exceeded, may not lead to significant environmental impacts, depending on the overall intensity of the impact.

AR = Army Regulation; CO_2 = carbon dioxide; DoD = Department of Defense; EO = Executive Order; FAA=Federal Aviation Administration; GHG = greenhouse gas; HAPs = hazardous air pollutants; MBTA = Migratory Bird Treaty Act; NAAQS = National Ambient Air Quality Standards; NRCS = Natural Resource Conservation Service; NRHP=National Register of Historic Places; ROI=region of influence; T&E = threatened and endangered; TMDL = total maximum daily loads; USACE = U.S. Army Corps of Engineers

Somewhat different terms were used to describe the ROI for cultural resources. The ROI for cultural resources is referred to as the "Area of Potential Effect" (APE), consistent with NHPA Section 106 review and Fort Carson's Integrated Cultural Resources Management Plan (ICRMP). During cultural resource reviews, Fort Carson assesses adverse effects on the identified cultural resources based on criteria found in the ICRMP. The determination typically results in a 'no adverse effect' or an 'adverse effect.' For the purposes of this EA, a determination of adverse effects to cultural resources would be considered significant.

3.1.3 CUMULATIVE EFFECTS

CEQ Regulations implementing NEPA defines a "cumulative impact" as follows:

> *Cumulative impact is the impact on the environment, which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).*

EPA guidance to reviewers of cumulative impacts analyses further adds:

> *…the concept of cumulative impacts takes into account all disturbances since cumulative impacts result in the compounding of the effects of all actions over time. Thus, the cumulative impacts of an action can be viewed as the total effects on a resource, ecosystem, or human community of that action and all other activities affecting that resource no matter what entity (Federal, non-Federal or private) is taking the action (EPA, 1999).*

For the purposes of this EA, cumulative impacts result from the incremental impacts of the action when added to other past, present, and reasonably foreseeable actions regardless of who undertakes such actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time. For the purposes of the cumulative impacts analysis, the Proposed Action's ROI is limited to Fort Carson and adjacent lands (including communities around the Installation). This ROI includes areas where the Proposed Action's effects would most likely contribute to cumulative environmental effects.

The Army considered a wide range of past, present, and reasonably foreseeable future actions by researching existing literature and contacting local area planners and state and Federal agencies to identify other projects in the ROI that could contribute to cumulative environmental effects. The Army considered other past, present, or foreseeable future actions regardless of whether the actions are similar in nature to the Proposed Action or outside the jurisdiction of the Army.

Cumulative effects are addressed within each resource section following the discussion of environmental consequences for each alternative. This analytical approach provides a more complete understanding of resource conditions that implementation of the Proposed Action might magnify, amplify, or otherwise exacerbate or cause beneficial or adverse effects (i.e., synergistic or countervailing effects; CEQ, 1997) to resources on a regional or temporal scale.

Table 3.1-2 lists the past, present, and reasonably foreseeable Army actions, and other actions within the ROI, that were reviewed in conducting the cumulative effects analysis. The information in these tables represents a review of credible online sources, local planning documents, and communication with the local planning agencies having responsibility for, or jurisdiction over, lands or projects within the ROI. Only those projects that were determined to be reasonably foreseeable have been included for consideration in the cumulative impact analysis. "Reasonably foreseeable" is defined as those projects that are well-developed, in mature planning stages, and/or have funding secured. Conceptual projects, broad goals, objectives, or ideas listed in planning documents that do not meet the above criteria are not considered reasonably foreseeable for the purposes of this analysis.

Table 3.1-2. Past, Present, and Reasonably Foreseeable Actions within the Region of Influence

Potentially Contributing Project or Activity	Description of Activity	Time Frame		
		Pre- 2011	**2011-2013**	**2013-2018**
Soldiers Family Assistance Center (SFAC)	Construction of a 15,000-square-foot SFAC within the Main Post area. SFAC provides services to equip and aid Warriors in making life changing decisions as they transition either back to duty or to civilian life.	X		
Army and Air Force Exchange Service (AAFES) Tri-Foods	Construction of an 8,385-square-foot AAFES Tri-Foods along with a 104,022-square-foot parking area on approximately 3.7 acres. The site is located at the northwest corner of Prussman Boulevard and Specker Avenue, which contains three fast food restaurants.		X	
AAFES Post Exchange (PX) Expansion	Expansion of the existing Fort Carson PX located within the Main Post area from 53,000 square feet to over 100,000 square feet. The project would pave the way for the AAFES to provide its customers with one-stop shopping.		X	
Commissary	Construction of a new 120,000-square-foot commissary within the Main Post area at the corner of Prussman Boulevard and Chiles Avenue. The planned facility would include specialty departments such as meat, dairy, frozen foods, produce, deli, bakery and refrigerated display cases.		X	
Banana Belt Redevelopment	Implementation of the Area Development Plan (ADP) for the long-term redevelopment of the core operational area of Fort Carson known as the Banana Belt. The Banana Belt ADP is organized in stages and supporting steps, which are practical units of progress that would be funded by Military Construction and Sustainment, Restoration and Modernization appropriations over a period of 10 to 15 years. Construction under the ADP is anticipated to continue through 2021.		X	X
Physical Fitness Center	Construction of a new 92,496-square-foot physical fitness center located within the Main Post at Specker Avenue and Victory Loop.		X	
Family Housing	Construction of 180-200 new homes on Fort Carson to support Army Transformation and Growth initiatives.	X	X	

Table 3.1-2. Past, Present, and Reasonably Foreseeable Actions within the Region of Influence

Potentially Contributing Project or Activity	Description of Activity	Time Frame		
		Pre- 2011	**2011-2013**	**2013-2018**
Combat Aviation Brigade (CAB)-associated construction, including control tower, bulk fuel facility, hot refuel point, Central Energy Plant, and infrastructure	Construction of garrison support facilities for the CAB at the Wilderness Road Complex construction site off of Wilderness Road just west of Butts Army Airfield. Several hundred acres of ground disturbance and demolition/renovation/construction at the BAAF site is required for facilities to support approximately 2,700 Soldiers, 113 helicopters, between 600 and 700 wheeled vehicles and trucks, and other associated support equipment. The Proposed Action includes CAB training activities at Fort Carson and PCMS and CAB maneuvers and support of air-ground integrated maneuvers at Fort Carson and PCMS. The Proposed Action is anticipated to also result in the 2,700 CAB Soldiers being accompanied by slightly more than 4,000 Family members.		X	X
Battle Command Training Center (BCTC)	Construction of a standard design BCTC. Primary facilities include the BCTC, access control facility, tactical pads, communications tower, connection to Energy Monitoring and Control Systems, installation of Intrusion Detection Systems, and building information systems. In addition the project would include possible demolition of four (4) buildings totaling 57,754 total square feet.		X	
Convoy Skill Trainer	Construction of an 8,000-square-foot Convoy Skill Trainer facility located at the southwest corner of Polio Street and Wetzel Avenue. The purpose of this project is to provide a new Convoy Skills Trainer, which includes a single building and limited site work for this facility at Fort Carson. The purpose is to house convoy training operations. The facility is intended to be similar to a warehouse type building in the private sector community.	X		

Table 3.1-2. Past, Present, and Reasonably Foreseeable Actions within the Region of Influence

Potentially Contributing Project or Activity	Description of Activity	Time Frame		
		Pre- 2011	2011-2013	2013-2018
TUAV Facility (Pending, planned for FY 2012)	Construction of a single story TUAV maintenance, administrative, and operations facility. The building would include maintenance bays, meeting room/classroom, latrines with showers, administrative areas, storage, and a break room. Special construction includes sustainable construction features complying with Leadership in Energy and Environmental Design (LEED) "Silver" and special foundations based on expansive soils common to Fort Carson. Supporting facilities include all related site-work and utilities (electrical distribution, water, sanitary sewer, and natural gas), lighting, information systems, protected distribution system between buildings for classified communication, privately owned vehicle parking, walks, curbs and gutters, storm drainage, site accessories, landscaping, and other site improvements. Anti-terrorism/force protection measures include access control measures, mass notification system, laminated glass, and minimum stand-off distances.		X	
Child Development Center (CDC)	Construction of a 26,000-square-foot CDC facility located at the corner of Barkley Avenue and Womack Street. The facility would house administrative areas, a commercial kitchen and activity areas for about 230 children ages 6 weeks to 5 years. The LEED "Silver" project would feature radiant floor heating, a ground-source heat pump and solar hot-water heating.		X	
Warrior Transition Unit Complex (Barracks/Admin)	The complex which includes the recently opened Soldier Family Assistance Center would be located on the corner of Titus Boulevard and Cochrane Circle, close to Evans Army Community Hospital, for improved Soldier access to care. The first building finished in late 2011 is a four story, 96,400 square-foot barracks, which employs geo-thermal heating and cooling systems and the design targets a nationally recognized standard for high-performance green buildings: LEED "Gold" certification. The complex would eventually include two other administrative buildings, one for the Warrior Transition Battalion and the other for the headquarters of the battalion's companies.		X	

Table 3.1-2. Past, Present, and Reasonably Foreseeable Actions within the Region of Influence

Potentially Contributing Project or Activity	Description of Activity	Time Frame		
		Pre- 2011	2011-2013	2013-2018
Medical Clinic Addition and Alteration	Renovation and addition of the existing preventative medicine clinic (Building 2059) located on Magrath Avenue. The project involves 16,600 square feet (including renovation and addition).		X	
Iron Horse Park Development	Proposed implementation of an ADP for the existing approximately 290-acre Iron Horse Park bounded by Prussman Avenue on the north, Wetzel Avenue on the east, Sheridan Avenue on the west, and St. Lo Drive and undeveloped residential areas on the south. The proposed ADP establishes a specific development feature by considering the area's needs, goals and objectives, development layout options, and the location of potential new facilities. Vehicular circulation and parking, pedestrian circulation, land use compatibilities, and analysis of other constraints such as drainage, floodplain, and utility infrastructure are also highlighted. The preferred concept includes enhanced pedestrian/bicycle pathway system providing internal and external connectivity; wayfinding signage to help park patrons navigate to various park destinations; a pedestrian system hierarchy with primary and secondary paths; vehicular access at defined locations; a defined parking area on the east side of the park and identified overflow parking locations; reconfiguration of west side parking for better circulation; addition of track and all-purpose sports fields; additional pavilion/playground facilities; location for non-potable irrigation reservoirs for irrigation; landscape buffering; and breaks in existing berms to provide better access and circulation.		X	X

Table 3.1-2. Past, Present, and Reasonably Foreseeable Actions within the Region of Influence

Potentially Contributing Project or Activity	Description of Activity	Time Frame		
		Pre- 2011	2011-2013	2013-2018
Infantry Squad Battle Command (ISBC) Ranges	Construction of two ISBC ranges to support the infantry squad live-fire collective training at Fort Carson. The two ISBC ranges would be designated as Range 163 and Range 167, respectively, and would be sited in Training Areas 32 and 38, on Fort Carson. The site is a training area where current activities such as dismounted training, heavy vehicle maneuver training, parachute training and aviation training routinely occur. The ISBCs would be reconfigurable live-fire ranges. The reconfigurable nature of the range provides the ability to emplace the range or change the layout with minimal re-occurring ground disturbance, because the majority of the target mechanisms and objectives would be built above ground. The Proposed Action also includes thermal targets, night illumination devices, and visual flash simulators to produce a realistic training environment.		X	

AAFES = Army and Air Force Exchange Service; ADP = Area Development Plan; BCTC = Battle Command Training Center; CAB = Combat Aviation Brigade; CDC = Child Development Center;; FY = Fiscal Year; LEED = Leadership in Energy and Environmental Design; PCMS = Piñon Canyon Maneuver Site; PX = Post Exchange; SFAC = Soldiers Family Assistance Center; TUAV = Tactical Unmanned Aerial Vehicle; WRC = Wilderness Road Complex

3.2 Land Use

3.2.1 AFFECTED ENVIRONMENT

3.2.1.1 Existing Land Use Classifications on Fort Carson

Fort Carson is located in central Colorado at the foot of the Rocky Mountains in El Paso, Fremont, and Pueblo counties (see Figure 1-1). Fort Carson covers approximately 137,000 acres, and extends between 2 and 15 miles east to west and approximately 24 miles north to south. Fort Carson is bounded by I-25 and mixed development to the east and SH 115 to the west. Colorado Springs and Denver lie approximately 8 miles and 75 miles, respectively, to the north, while the City of Pueblo is located approximately 35 miles south of the Main Post area.

The Installation is divided into 56 training areas, three impact areas, the Main Post area, and areas from which training is restricted or accessible to the public. Those lands outside of the Main Post area are also referred to, collectively, as the "downrange area." Most of the developed land uses are located within the Main Post area (5,752 acres), BAAF (570 acres), Operational Readiness Training Complex (575 acres), and Camp Red Devil (1,166 acres). Semi-developed land uses include 1,853 acres for the Olympic Shooting Range and Turkey Creek Recreation Area. The remaining land (approximately 131,000 acres) consists of the downrange area and is generally unimproved, meaning it has either no permanent facilities or very limited facilities used by troops to complete training missions. The Main Post area is located in the northern portion of the Installation. BAAF is approximately four miles south of the Main Post area. ORTC lies adjacent to the west of BAAF. Camp Red Devil is located in the southwest corner of Fort Carson. Figure 1-1 identifies these locations throughout the Installation.

Land is used almost exclusively for military purposes, but also is utilized for non-training uses. The Main Post area consists of Soldier and Family housing; administrative, maintenance, community support, recreation, supply, and storage facilities; utilities; and classroom and simulation training facilities. Principal industrial operations include the repair and maintenance of vehicles. These operations mostly occur within the vicinity of the "banana belt" (so called because it is a banana-shaped arc of brick buildings) located within the north and east sides of the Main Post area, as well as at BAAF and ORTC. BAAF is used for command and control of flight operations, with a tactical airstrip also at Camp Red Devil. The downrange area is utilized for live-fire artillery training, small arms practice, wheeled and tracked vehicle maneuver operations, and bivouac training.

Portions of the downrange area are restricted from use or are available for limited training to protect natural and cultural resources, fragile soils, recreation areas, or other environmental concerns. Recreational uses include hunting, fishing, dog training, and activities such as picnics and trail rides. Military training is generally off limits at these sites, and the intensity, level, and type of recreational activities vary by site. Most of the sites that support recreational uses are also waterfowl nesting refuges; some sites also protect other species, including fish. Two permits have been issued by the State of Colorado to mine refractive clay on Fort Carson, near the Stone City site. Fort Carson is required by law to allow mining at existing sites provided permit conditions continue to be met by permittees.

Unimproved land use areas include impact area buffer zones. In addition, the Army maintains easements and special use permits on private lands. These easements and permits allow Fort Carson to conduct monitoring on buffer lands and use other Federal properties for military purposes.

Land-use planning is the responsibility of the DPW Master Planning Division. This Division continuously assesses the need for new facilities and how these facilities can be sited to complement existing land uses. Fort Carson has developed Master Planning Strategy Smart Growth Principles that provide 10 specific goals for facility siting and usage that guide conservation.

3.2.1.2 Adjacent Land Uses

Adjacent land uses include low density residential, industrial, and undeveloped agricultural and ranch land to the east of the Installation. Several residential areas in El Paso County are located immediately adjacent to Fort Carson (to the north and northwest) and are considered noise-sensitive land uses. El Paso County is responsible for regulating land use in these communities.

Land bordering the south and southeastern portion of Fort Carson is generally comprised of undeveloped agricultural and ranch land. Under the Army Compatible Use Buffer (ACUB) Program, a collaborative effort among the Army, The Nature Conservancy, El Paso County, and the USFWS, a number of conservation real estate interests have been obtained in the area. These interests minimize land use that is incompatible with Fort Carson's mission and enhance preservation of valued environmental assets associated with the land involved (Fort Carson, 2009). Fort Carson is also collaborating with El Paso County to avoid or mitigate incompatible development through purchases of plots of land on or near the Installation's eastern boundary that might otherwise be subject to residential development (Fort Carson, 2007a).

The City of Pueblo is located southeast of Fort Carson and extends up to ACUB lands, with low density residential lands directly adjacent to these lands. The other developed land use area nearby is the town of Penrose, located south of Fort Carson's southwest corner.

Federal, state, and other public lands border Fort Carson to the west and provide recreational uses and includes the Beaver Creek Wilderness Study Area (see Figure 1-1).

3.2.1.3 Regional Land Use Planning

Most of the developed land and land planned for future development borders the northern one-third of Fort Carson. These lands are part of unincorporated areas in El Paso County to the west; the city of Colorado Springs to the north and west; and Security-Widefield (a census-designated place) and the city of Fountain to the east.

The City of Colorado Springs future land-use plan indicates that the City plans to annex land adjacent to the western boundary of Fort Carson near Gate 2. Portions of this area have already been developed into single family residential use. The future land-use plan also includes general residential use to the west and north of Fort Carson, existing park/open space, and community activity center (City of Colorado Springs, 2008).

The City of Fountain's future land-use plan indicates that a business park, industrial, and parks and open space uses will abut the east boundary of Fort Carson. While several small pockets of residential land use will be maintained near Fort Carson according to this plan, most of the existing land zones for residential use near the Installation's eastern boundary will be changed to industrial or open-space uses in the future (City of Fountain, 2005).

The City of Pueblo's comprehensive future land-use plan indicates that future development will potentially abut the southeast boundary of the conservation easements. This area is currently designated for county residential development, suburban residential, and light industry mixed, but is not planned to be one of Pueblo's two long-term growth areas. One growth area is located northeast of Pueblo around the Baculite Mesa, and the other wraps around southwest of Pueblo from the Arkansas River to I-25, and includes portions of South Pointe. Neither of these two areas is located in the vicinity of Fort Carson (PACG, 2002).

3.2.2 ENVIRONMENTAL CONSEQUENCES

3.2.2.1 No Action Alternative

Under the No Action Alternative, no land use compatibility issues or land use conflicts would occur on-Post or to adjacent lands off-Post. Fort Carson would not leverage the Net Zero Initiatives to accelerate reduction of waste, water, and energy consumption beyond those policies and procedures that are currently in place. Fort Carson would continue to site current and future development according the Master Planning Strategy Smart Growth Principles to guide land conservation and sustainability.

3.2.2.2 Proposed Action Alternatives

3.2.2.2.1 Land Use Impacts Common to All Proposed Action Alternatives

All sites have been pre-screened by Fort Carson through the screening criteria discussed in Section 2.3, and implementation of the Proposed Action Alternatives have been determined to be compatible with the land use designations at each site. Table 3.2-1 lists the potential conversion of land use under each alternative. With the exception of Alternative 4, all Proposed Action Alternatives would involve changing current land uses into industrial use. The primary change in land use would involve the conversion of training areas into industrial use. As previously stated, all alternatives have undergone considerable Army review and would not constitute a significant loss in training land or compromise the mission of the Installation. Construction of Proposed Action Alternatives at these sites would have minor adverse impacts to their designated land use and operations would have negligible adverse impacts to land use at the sites.

In addition, for Alternatives 1, 2, 3, 5 and 6, new utility ROW may be required for the electrical distribution lines from the site of power generation to the nearest interconnection point. Change of existing land uses to accommodate the new ROW would not significantly affect land use and would run parallel to existing utility ROWs.

Construction of all Proposed Action Alternatives would have temporary and minor adverse impacts to adjacent land uses, primarily due to dust and noise generation during construction (see Sections 3.3 and 3.4). Operations of all Proposed Action Alternatives were considered to be compatible with adjacent land uses (see Table 3.2-1). Section 3.11 discusses impacts to airspace.

Table 3.2-1. Land Use Impacts by Alternative

Alternative	Current Land Use	Conversion into Industrial (acres)	Adjacent Land Uses	Compatibility
Alternative 1	Training	40	Training/Airfield (N,W) Industrial (off-Post, E) Mining (off-Post, S)	Yes Yes Yes
Alternative 2a	Training	40	Training/Airfield (N,W) Industrial (off-Post, E) Mining (off-Post, S)	Yes Yes Yes
Alternative 2b	Training	22.6	Training (N,E,S) Industrial/Administrative (W)	Yes Yes
Alternative 2c	Industrial	0	Training (N,S,W) Airfield (E)	Yes Yes

Table 3.2-1. Land Use Impacts by Alternative

Alternative	Current Land Use	Conversion into Industrial (acres)	Adjacent Land Uses	Compatibility
Alternative 3[1]:				
• Gate 2 North	Open Space	3.0	Residential (N,E,S) Highway/Residential (off-Post, W)	Yes Yes
• Gate 2 South	Open Space	7.6	Residential (N,E,S) Highway/Residential (off-Post, W)	Yes Yes
• Chiles	Open Space	12.7	Residential (W,S) Commercial/Institution/Residential (E,N)	Yes Yes
• SWMU 1-170	Limited[2]	86.9	Training (E,S,W) Administration/Medical/Residential (N)	Yes Yes
• SWMU 5 (Site 1)	Limited[2]	14.3	Industrial (W) SWMU (S) Open Space/Highway (off-Post, N,E)	Yes Yes Yes
• SWMU 5 (Site 2)	Limited[2]	41.9	Training (W,S) SWMU (N) Open Space/Highway (off-Post, E)	Yes Yes Yes
• Bravo North (Site 1)	Training	71.5	Training (E,S) Industrial/Administrative (N,W)	Yes Yes
• Butts Road	Training	89.4	Airfield (N,E) Training (S,W)	Yes Yes
• Magrath Avenue	Training	19.5	Training (N,S) Industrial (W) Highway/Industrial (off-Post, E)	Yes Yes Yes
• Wildhorse	Training	361.1	Training (N,S,W) Open Space (E)	Yes Yes
• Titus/Signal Hill	Training	31.9	Industrial (N,E) Residential (W) Commercial (S)	Yes Yes Yes
• Ray Nixon	Training	146.8	Training (S,W) Industrial/Open Space (off-Post, E,N)	Yes Yes
• Tent City	Training	97.1	Training	Yes
Alternative 4	Open Space/ROW	0	N/A[3]	Yes
Alternative 5	Training	3-5	Training (N,S,W) Open Space (E)	Yes Yes

Table 3.2-1. Land Use Impacts by Alternative

Alternative	Current Land Use	Conversion into Industrial (acres)	Adjacent Land Uses	Compatibility
Alternative 6 (additional sites[4]):				
• Gate 19	Training	163.2	Training/Airfield (N,W) Industrial (off-Post, E) Mining (off-Post, S)	Yes Yes Yes
• Highway 115	Training	1	Training (N,E,S) Highway/Open Space (W)	Yes Yes
• Fremont	Training	1	Training (N,E,S) Highway/Open Space (W)	Yes Yes
• COARNG	Training	115.2	Training	Yes
Alternative 7	Various[5]	0	N/A[5]	Yes

1. Traditionally sensitive land uses (residential/institutional) were determined to be compatible with PV/Industrial land use designations as PVs would be a passive/non-noise producing industrial use of the land.
2. Use of land is limited due to historical landfill activities.
3. The Proposed Action associated with Alternative 4 would not impact existing land use designations; the reclaimed water line would be constructed within existing ROW and open space.
4. Alternative 6 includes Net Zero sites within Alternatives 1, 2, 3 and 5, including 3 additional sites (Highway 115, Fremont and COARNG). The Gate 19 site, although previously considered in Alternatives 1 and 2, would potentially involve a larger footprint for future Net Zero PV projects.
5. Alternative 7 includes infrastructure efficiency upgrades at existing facilities throughout the Installation, including industrial, training, administrative, and residential facilities. The alternative also involves behavioral changes, which would have no impact on land use designations.

COARNG = Colorado Army National Guard; E = East; N = North; N/A = not applicable; PV = photovoltaic; ROW=right-of-way; S = South; SWMU = Solid Waste Management Unit; W = West

Additional alternative-specific impacts to land use compatibility and land use change are discussed in Sections 3.2.2.2.2 through 3.2.2.2.8.

3.2.2.2.2 Alternative 1

Construction and operation of Alternative 1 would not impact land use compatibility or result in land use changes on-Post beyond what is displayed in Table 3.2-1. The nearest sensitive receptors are over 0.5 miles away and separated from the Installation by I-25. Approximately 60 to 120 trucks/day would deliver waste to the plant during operations; however, this would not cause significant noise or traffic impacts and in turn would not impact off-Post sensitive receptors (see Sections 3.4 and 3.10).

During operations, waste would be kept in an indoor receiving area at a slight negative pressure to prevent odors, and odor from the waste would not be noticeable to sensitive receptors off-Post. Fencing would be installed to control blowing trash debris during unloading. An up to 200-foot tall stack would be installed and would emit a plume that could be visible to sensitive receptors off-Post, depending on ambient weather conditions (i.e., temperature, humidity, and wind speed). The plume is more persistent and most visible during winter months when cold and damp conditions typically occur. During typical operating days, however, the visible plume would disperse and evaporate after traveling only a short distance. This stack and associated plume could result in a minor disruption to the viewshed to the residences adjacent (approximately 3,420 feet east) to the Gate 19 area; however, this would not be a significant change from existing conditions as surrounding areas off-Post are highly developed and represent a mix of residential, industrial, and urban land uses. Section 3.11.2.2.3 discusses potential adverse impacts to BAAF.

3.2.2.2.3 Alternative 2

Construction of Alternative 2 would not impact land use compatibility or result in land use changes on-Post beyond what is displayed in Table 3.2-1. Adjacent land use conflicts under Alternative 2a would be similar to Alternative 1 because construction would be at the same location (i.e., Gate 19); however, only 15-25 trucks/day would be required to operate the plant. Construction of Alternatives 2b and 2c would not impact land use compatibility or result in land use changes on-Post beyond what is discussed in Section 3.2.2.2.1. Additionally, Alternatives 2b and 2c would be constructed within the Main Post area, but would not be sited near on-Post residences and is not anticipated to impact on-Post sensitive receptors. Adverse impacts from construction would be minor. Alternatives 2a, 2b, and 2c would be constructed away from off-Post sensitive receptors and would not result in adjacent off-Post impacts.

During operations, biomass would be stored outdoors in covered piles or wind rows to reduce blowing material. Overall, adverse impacts under Alternative 2 would be minor and similar to the discussion in Section 3.2.2.2.1. Operation of the biomass plant under Alternative 2c, however, would require an additional 16.5 acres of land beyond the current footprint of the existing CEP. This additional acreage would represent a compatible land use as the site is currently utilized for the CEP and would not represent a loss in training land or impact operations at WRC. Alternative 2c would also be sited within 1 mile of recreation areas on-Post, including the West Haynes Wildlife Conservation Area, the Wildlife Demonstration Area, and the Haynes reservoir (see Figure 1-1); however, no impacts to these areas would be anticipated. Section 3.11.2.2.3 discusses potential adverse impacts to BAAF.

3.2.2.2.4 Alternative 3

Construction of Alternative 3 would not result in land use changes on-Post beyond what is displayed in Table 3.2-1. Operation of the PV panels at the SWMU sites (i.e., SWMU 1-170; SWMU sites 1 and 2) would represent a beneficial change to land use as this land is currently underutilized due to development restrictions imposed on these former landfill sites (see Section 3.13 regarding coordination with CDPHE for site utilization procedures). Placement of PV panels on the SWMU sites would allow for the best and highest long-term use of these currently underutilized sites.

Depending on the positioning and angling of the PV panels, short instances of glint and glare could occur. Such glint or glare would be most acute during the early morning or late evening hours, and during summer months (Solargen, 2010). PV panels, however, are designed to absorb rather than reflect sunlight and the glare and glint would be comparable to that of an office building or a lake (NREL, 2011a). PV panels currently exist on-Post at the corner of Titus Boulevard and Butts Road with no ill effects having been reported; therefore, impacts from operations of Alternative 3 are anticipated to be negligible to minor.

According to the City of Colorado Springs Comprehensive Plan, Colorado Springs plans to annex land off-Post adjacent to the Gate 2 area for residential use; single family residential homes have already been constructed off-Post within the vicinity of Gate 2. Existing and future planned development, including residential sensitive receptors, would potentially occur within the viewshed of PV panels; however, impacts would be negligible to minor and similar to those described above.

The Chiles site is adjacent to a recreational field and on-Post housing; however, this would represent a minor disruption to the current viewshed of these sensitive receptors.

3.2.2.2.5 Alternative 4

Construction of the expanded irrigation reservoir and reclaimed water distribution lines could result in temporary disruptions to the golf course and Sports Complex as areas are trenched and reclaimed water distribution lines are installed. These disruptions would represent a short-term, minor impact to these facilities and their users.

Increasing the capacity of the irrigation reservoir (i.e., increasing the size of the golf course pond) would not represent a considerable change in current land use at the golf course or require additional land. Operations of the reclaimed distribution system would not impact current land use at the facility. In addition, Alternative 4 would be constructed and operated on the Installation away from off-Post sensitive receptors and would not result in off-Post impacts.

3.2.2.2.6 Alternative 5

Construction of Alternative 5 would not impact land use compatibility or result in land use changes on-Post beyond what is displayed in Table 3.2-1. Construction of Alternative 5 would not result in adjacent off-Post land use conflicts.

Although operation of Alternative 5 considers 50 acres of training land for siting turbines to achieve necessary spacing from one another to reduce turbulence effects between the turbines, each turbine would have a physical foot print of less than 1 acre. Therefore, this land could continue to be used for training purposes. As a result, operations of Alternative 5 would potentially only represent a loss of up to eight acres of ground training land and would result in negligible impacts to on-Post land use.

Wind turbines during certain times of day and of year with low sun angles have the potential to cause shadows or flicker to be cast on nearby residences (up to ½ mile or less from the turbine). Due to the distance to the nearest residence (approximately 2 miles to the south) and likely orientation of the proposed turbines, shadow flicker and glint are not anticipated to impact any residences.

The turbines would have a height of up to 393 feet (including the blade length) and likely would be visible to sensitive receptors off-Post. Based on the maximum turbine height and surrounding terrain, if turbines were located at the southern half of the Wildhorse site, the turbines would potentially be visible to areas off-Post. From the south and west, the turbines would potentially be visible to receptors extending from Pumpkin Hollow (approximately 3 miles west of the southeast corner of the Installation), and eastward to communities located south and east of the Installation. If the turbines were located within the northern half of the Wildhorse site, terrain would likely obstruct views to receptors located south of the eastern boundary of the Installation; however, the turbines would remain visible to communities located east of the Installation boundary. The primary community that would have views of the turbines is the City of Pueblo. Figures 3.2-1 through 3.2-3 illustrate representative visual impacts from unobstructed views of turbines from 2/3rd-mile, 2 miles, and 6 miles. These viewshed impacts would represent a minor disruption to the viewshed and minor adverse impacts to land use as a result of operations.

Figure 3.2-1. Unobstructed View of Wind Turbines, 2/3rd of a Mile Away.

Figure 3.2-2. Unobstructed View of Wind Turbines, 2 Miles Away.

Figure 3.2-3. Unobstructed View of Wind Turbines, 6 Miles Away.

3.2.2.2.7 Alternative 6

Fort Carson would utilize the environmental screening criteria that have been developed and considered within this EA (see Appendix B) to assist in deciding the placement of the PV systems and GSHP units prior to construction during the siting process. Construction of GSHPs would be incorporated within building footprints of future projects and would not specifically or individually require a land use change. Impacts from the construction of PV panels would be similar to that under Alternative 3, with additional potential impacts to motorists driving near the Highway 115 and Fremont sites (see Figure 2-3).

GSHPs would operate underneath or directly adjacent to future buildings, and would not represent a potential conflict with land use compatibility on-Post and would not affect off-Post land uses. Impacts from the operations of PV panels would be negligible to minor and similar to those discussed in Section 3.2.2.2.4. The primary impact would be from potential glint and glare to motorists, pilots, or other sensitive receptors at certain times of day and year. In addition to potential sites discussed under Alternative 3, impacts could occur to sensitive receptors located adjacent to the Highway 115 and Fremont sites, specifically users of the Beaver Creek State Wildlife Area. These impacts could be reduced by the following:

- Installing sun screens to minimize or block a specific reflection (NREL, 2011a)
- Adjusting the tilt and positioning of PV panels to reduce impacts on sensitive receptors (NREL, 2011a)
- Utilizing anti-reflective coating in PV design

3.2.2.2.8 Alternative 7

Implementation of Alternative 7 would have negligible impacts on land use and land use compatibility. Modifications and upgrades to existing infrastructure would be compatible with existing uses. Behavioral and conservation measures regarding waste, water, and energy would not be anticipated to impact land use.

3.2.3 CUMULATIVE EFFECTS

No projects identified in Table 3.1-2, when combined with the impacts discussed in this section, are anticipated to contribute significantly to cumulative impacts to land use compatibility, land use change, or land use conflicts off-Post. Proposed on-Post projects would be consistent with existing land use designations and would not contribute adversely to the minor adverse impacts resulting from land use conversions as part of the Proposed Action Alternatives. Continued development within Fort Carson's Main Post area and downrange areas as a part of CAB stationing and other military construction projects would continue to alter the viewshed within Fort Carson. Implementation of the Proposed Action Alternatives would be anticipated to contribute to minor adverse viewshed impacts in combination with the other on-going and future development activities proposed on-Post. Additionally, no projects have been identified off-Post and adjacent to the proposed Net Zero sites that would be anticipated to contribute adverse impacts from implementation of the Proposed Action Alternatives.

3.2.4 PROPOSED IMPACT REDUCTION MEASURES

3.2.4.1 Mitigation

No potential for adverse significant impacts are anticipated; therefore, no mitigation would be required. While no significant impacts are anticipated the following measure may still be implemented depending on the aspect of the site.

Previous screenings of the proposed Net Zero sites and technologies have included criteria to minimize impacts to land use and Fort Carson's mission. In order to reduce potential adverse impacts from PV panel installation, Fort Carson could include the following measures in PV design and operations:

- Installing sun screens to minimize or block a specific reflection (NREL, 2011a);
- Adjusting the tilt and positioning of PV panels to reduce impacts on sensitive receptors (NREL, 2011a); and
- Utilizing anti-reflective coating in PV design.

3.3 Air Quality and Greenhouse Gases

3.3.1 AFFECTED ENVIRONMENT

3.3.1.1 National Ambient Air Quality Standards and Attainment Status

EPA Region 8 and CDPHE regulate air quality in Colorado. The Clean Air Act (CAA) (42 U.S.C. 7401–7671q), as amended, gives EPA the responsibility to establish the primary and secondary National Ambient Air Quality Standards (NAAQS) (40 CFR Part 50) that set acceptable concentration levels for seven criteria pollutants: particulate matter less than 10 microns (PM_{10}), particulate matter less than 2.5 microns ($PM_{2.5}$), sulfur dioxide (SO_2), carbon monoxide (CO), oxides of nitrogen (NO_x), ozone (O_3), and lead (Pb). Short-term standards (i.e., 1-, 8-, and 24-hour periods) have been established for pollutants contributing to acute health effects, while long-term standards (i.e., annual averages) have been established for pollutants contributing to chronic health effects. Each state has the authority to adopt standards stricter than those established under the Federal program; however, the State of Colorado accepts the Federal standards.

Federal regulations designate air quality control regions (AQCRs) that have one or more criteria pollutants that exceed the NAAQS as nonattainment areas. Federal regulations designate AQCRs with levels below the NAAQS as attainment areas. Maintenance areas are AQCRs that have previously been designated as nonattainment and have been redesignated to attainment for a probationary period through implementation of maintenance plans. According to the severity of the pollution, nonattainment areas can be categorized as marginal, moderate, serious, severe, or extreme.

Fort Carson is within the San Isabel Intrastate AQCR (40 CFR 81.12). The majority of Fort Carson is located within El Paso County, with portions in Fremont and Pueblo counties. Both Fremont and Pueblo counties are classified as attainment for all criteria pollutants (EPA, 2012a). The Colorado Springs Urbanized Area in El Paso County is in attainment for all NAAQS criteria pollutants; however, it is classified as a maintenance area for CO due to a violation of the 8-hour CO standard in 1988. This CO maintenance area includes the majority of Fort Carson's Main Post area including areas north of Titus Boulevard and Specker Avenue. This designation is currently set to run through 2015 when the area is expected to become full attainment for CO. (CDPHE, 2009). In December 2009, the CDPHE approved a *Revised Carbon Monoxide Attainment/Maintenance Plan* for the Colorado Springs Attainment/Maintenance Area, which is the current State Implementation Plan (SIP) for the area (CDPHE, 2009).

Existing ambient conditions near Fort Carson can be estimated from measurements conducted at air quality monitoring stations close to the Installation (Table 3.3-1). With the exception of the 8-hour O_3 NAAQS, most recent air quality measurements are below the NAAQS. The reported measurement for the 8-hour O_3 level exceeds the NAAQS of 0.075 parts per million (ppm). The 3-year average of the fourth highest daily maximum 8-hour average O_3 concentrations over each year, however, has not exceed 0.08 ppm, hence the attainment status. The region, however, is likely to become an O_3 nonattainment area in the future. NO_2 and SO_2 are not expected to be pollutants of concern in this region and are not monitored.

Table 3.3-1. Air Quality Standards and Monitored Data near Fort Carson

Pollutant	Air Quality Standards[a]	Monitored Data near Fort Carson[b]
CO		
1-Hour Maximum[c] (ppm)	35	3
8-Hour Maximum[c] (ppm)	9	1
NO_2		
1-Hour (ppb)	100	*<no data>*
O_3		
8-Hour Maximum[d] (ppm)	0.075	0.075
SO_2		
1-Hour Maximum[c] (ppb)	75	*<no data>*
24-Hour Maximum[c] (ppb)	140	*<no data>*
$PM_{2.5}$		
24-Hour Maximum[e] ($\mu g/m^3$)	35	18
Annual Arithmetic Mean[f] ($\mu g/m^3$)	15	5.6
PM_{10}		
24-Hour Maximum[c] ($\mu g/m^3$)	150	45

a. Source: 40 CFR 50.1-50.12.
b. Source: EPA, 2012b.
c. Not to be exceeded more than once per year
d. The 3-year average of the fourth highest daily maximum 8-hour average O_3 concentrations over each year must not exceed 0.08 ppm.
e. The 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor must not exceed 35 $\mu g/m^3$.
f. The 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from must not exceed 15 $\mu g/m^3$.
CO = carbon monoxide; NO_2 = nitrogen dioxide; O_3 = ozone; $PM_{2.5}$ = particulate matter less than 2.5 microns; PM_{10} = particulate matter less than 10 microns; ppb = parts per billion; ppm = parts per million; $\mu g/m^3$ = micrograms per cubic meter; SO_2 = sulfur dioxide

3.3.1.2 Installation-Wide Emissions

Title V of the CAA requires states to establish an air operating permit program (40 CFR Part 70). The permits required by these regulations are often referred to as Title V or Part 70 permits. Based on the Installation's potential to emit (PTE), Fort Carson is a major source of air emissions for NO_x, CO, and CO_2 equivalents (CO_2e[1]). Additionally, Fort Carson contains one of the special categories (fossil fuel

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1 CO_2e is the amount of CO_2 by weight emitted into the atmosphere that would produce the same estimated radiative forcing as a given weight of another radiatively active gas. CO_2e are computed by multiplying the weight of the gas being measured (for example, methane) by its estimated global warming potential (which is 21 for methane). See section 3.3.1.4 regarding CO_2e and GHGs.

burning boilers that total more than 250 million British thermal units [MMBtu] per hour) identified in the Prevention of Significant Deterioration (PSD) provisions subject to a 100 tpy major source threshold. Stationary sources of air emissions at Fort Carson include boilers, generators, paint booths, engine testing, and landfills. An Installation-wide Title V permit (No. 95OPEP110) was issued in July 2007, which is currently in the process of being renewed. The Title V permit limits the amount of pollutants from significant emission sources, depending on the source type (e.g., restricting operating hours, fuel type, throughput amount, and emission rates). In addition, the permit limits use of smoke munitions and the generation of fog oil smoke for training exercises, activities that are typically unique to the military. As part of the Title V permit requirements, Fort Carson must complete a comprehensive emissions statement annually. Table 3.3-2 summarizes the 2010 Installation-wide actual emissions and PTE of criteria pollutants, hazardous air pollutants (HAPs), and GHGs at Fort Carson.

Table 3.3-2. Criteria Pollutants and Greenhouse Gas Emissions at Fort Carson

	Criteria Pollutants and HAPs						
Emissions (tpy)	**SO_2**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**VOC**	**Total HAPs**
Actual Emissions	1.1	536.9	77.3	77.3	61.9	19.6	7.8
PTE	72.5	733.2	162.1	162.1	335.8	145.4	18.5
	GHGs						
				CO_2e			**Total CO_2e**
Emissions (tpy)	**CO_2**	**N_2O**	**CH_4**	**CO_2**	**N_2O**	**CH_4**	
Actual Emissions	50,187.7	0.9	1,083.2	185659.3	936.8	24934.1	211,517.711
PTE	306,454.2	6.8	1,093.3	306,454.2	2,011.3	25,146.1	333,465.5

Source: U.S. Army Fort Carson, 2012d.

CH_4 = ammonia; CO = carbon monoxide; CO_2 = carbon dioxide; CO_{2e} = carbon dioxide-equivalent; GHG = greenhouse gas; HAP = hazardous air pollutant; N_2O = nitrous oxide; NO_x = nitrogen oxides; O_3 = ozone; $PM_{2.5}$ = particulate matter less than 2.5 microns; PM_{10} = particulate matter less than 10 microns; PTE = potential to emit; SO_2 = sulfur dioxide; tpy = tons per year; VOC = volatile organic compound

3.3.1.3 Overview of Permitting Requirements

CDPHE oversees programs for permitting the construction and operation of new or modified stationary source air emissions in Colorado. Colorado air permitting is required for many industries and facilities that emit regulated pollutants. Based on the size of the emissions units and type of pollutants emitted (criteria pollutants or HAPs), CDPHE sets permit rules and standards for emissions sources. This section outlines the primary Federal and State permitting regulations. A discussion of how they apply under the individual alternatives is discussed in Section 3.3.2, Environmental Consequences.

The air quality permitting process begins with the application for a construction permit. The biomass plant and the WTE plant would require permits to construct in one form or another. There are three types of construction permits available through the CDPHE for the construction and temporary operation of new emissions sources: PSD permits in Attainment Areas; Major Source Construction Permits in Nonattainment Areas (Nonattainment New Source Review [NNSR]); and Minor New Source

Construction Permits. Notably, no other components of any of the alternatives such as PV arrays, GSHP systems, and wind turbines would require air permits. If the area would become nonattainment under the new O_3 standard, it is possible that the Installation would be required to obtain more than one construction permit (i.e., PSD and NNSR) depending on which pollutants exceed the threshold outlined below.

PSD and NNSR permits are both part of the CDPHE permitting program. Thresholds that determine the type of construction permit that might be required depend on both the quantity and type of emissions. Any net increase of criteria pollutants that would result in a "major modification" would subject Fort Carson to the PSD review requirements (40 CFR §52.21). Thresholds requiring either an NNSR or a PSD permit for a modification to an existing major source at Fort Carson are outlined in Table 3.3-3. Notably NNSR major modification thresholds for NO_x and VOCs would apply if or when El Paso County were to become a nonattainment area under the 2008 O_3 standard.

Table 3.3-3. Major Modification Thresholds of Criteria Pollutants at Fort Carson

Pollutant	Major Modification Threshold (tpy)	
	PSD[a]	**NNSR**[a]
CO	100	
NO_x	40	(40)
SO_2	40	
PM	25	
PM_{10}	15	
$PM_{2.5}$	15	
VOCs	40	(40)
CO_2e	75,000	

Source: 5 CCR 1001-5 and 40 CFR Part 52

a. NNSR major modification thresholds for NO_x and VOC would apply if the region were to become a nonattainment area under the 2008 O_3 standard.

CCR = Code of Colorado Regulations; CFR = Code of Federal Regulations; CO = carbon monoxide; CO_{2e} = carbon dioxide-equivalent; NO_x = nitrogen oxides; NNSR = Nonattainment New Source Review; O_3 = ozone; $PM_{2.5}$ = particulate matter less than 2.5 microns; PM_{10} = particulate matter less than 10 microns; PSD = Prevention of Significant Deterioration; SO_2 = sulfur dioxide; tpy = tons per year; VOC = volatile organic compound

Prevention of Significant Deterioration. The PSD regulations, found under Rule 5 Colorado Code of Regulations (CCR) 1001-5 Part D., specify that major new stationary sources or major expansion projects to an existing major source within an air quality attainment area must undergo PSD review. The PSD process would apply to all pollutants for which the region is in attainment (all criteria pollutants, HAPs, and GHGs). The PSD permitting process typically takes 18–24 months to complete. Sources subject to PSD review are typically required to complete the following:

- Best Available Control Technology (BACT) review for each criteria pollutant and GHG
- Maximum Achievable Control Technology (MACT) review for regulated HAPs and designated categories
- Predictive air dispersion modeling
- Establishing procedures for measuring and recording emissions and/or process rates
- Meeting the New Source Performance Standards (NSPS) and National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements
- A public involvement process

Nonattainment New Source Review. NNSR permits are required for any major new sources or major modifications to existing major sources intended to be constructed in an area designated as nonattainment. Currently, when undergoing a physical or operational change, a source determines major New Source Review applicability through a two-step analysis. First, determine if the increased emissions from a particular proposed project alone are above the thresholds. If the emissions increase is below the threshold, a NNSR permit would not be required. If the emissions of the nonattainment pollutants increase are above the threshold, then determine through a procedure called "netting" if the project's net emissions plus all combined increases and decreases in the previous 5 years at the source are above the thresholds. If this determination results in an increase that is lower than the threshold, a NNSR permit would not be required. For example, if a new boiler plant was to be constructed and the total emissions were less than that of an old, decommissioned boiler plant, it is possible a NNSR could be avoided.

NNSR permits are legal documents that specify allowable types of construction; emissions limits that must not be exceeded; reporting, recordkeeping, and monitoring requirements; and often how the source can be operated. The NNSR permitting process typically takes 18–24 months. Specifically, typical requirements for a NNSR permit can include the following:

- BACT review for qualifying attainment criteria pollutants
- Lowest Achievable Emissions Rate review for qualifying nonattainment pollutants
- MACT review for HAPs
- Predictive air dispersion modeling
- Acquiring emissions offsets for all contemporaneous emissions increases that have occurred or are expected to occur
- A public involvement process

Most notably, NNSR requires the acquisition of emissions offsets (purchase of credits) for new major sources in nonattainment areas. If no emissions offsets are available, for example in a brand-new nonattainment area such as El Paso County, it is possible that the NNSR permit to construct would not be granted. This determination would be made during the permitting process.

Minor New Source Review. A Minor Source Construction Permit would be required to construct minor new sources, minor modifications of existing sources, and major sources not subject to NNSR or PSD permit requirements. The Minor New Source Review permitting process typically takes 6–8 months to complete. Sources subject to Minor New Source Review could be required to complete the following:

- BACT review for each criteria pollutant
- MACT review for regulated HAPs and designated categories
- Predictive air dispersion modeling upon request by CDPHE
- Establish procedures for measuring and recording emissions and process rates

Operation Permits. Under CDPHE's Title V Facility Permit regulations (5 CCR 1001-5 I.B.32), a Title V Significant Permit Modification is required for facilities whose emissions increases exceed the emissions thresholds outlined in Table 3.3-3. In addition, a Significant Permit Modification would be required if it became necessary to establish Federally-enforceable limitations to reduce potential emissions below these thresholds. A minor permit modification would be required if emissions were below these thresholds and a Federally-enforceable limit was not necessary. Submission of an application for these permit modifications would be required within one year of the first operation of a new emissions source.

In addition to the permitting requirements to construct and operate new or modified emissions sources, NSPS and NESHAPs set emissions control standards for categories of new stationary emissions sources of both criteria pollutants and HAPs. The NSPS process requires EPA to list categories of stationary sources that cause or contribute to air pollution that might reasonably be anticipated to endanger public health or welfare. The NSPS program sets uniform emissions limitations for many industrial sources.

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

3.3.1.4 Overview of Greenhouse Gases

Gases that trap heat in the atmosphere are often called GHGs. GHGs contribute to an increase in the temperature of the earth's atmosphere trapping heat from the sun. The principal GHGs that enter the atmosphere due to human activities are:

- ***Carbon Dioxide (CO_2).*** CO_2 enters the atmosphere through the burning of fossil fuels (oil, natural gas, and coal), solid waste, trees and wood products, and also as a result of other chemical reactions (e.g., manufacture of cement). CO_2 is also removed from the atmosphere (or "sequestered") when it is absorbed by plants as part of the biological carbon cycle.
- ***Methane***. Methane is emitted during the production, transport, and combustion of coal, natural gas, and oil. Methane emissions also result from livestock and other agricultural practices and by the decay of organic waste in MSW landfills.
- ***Nitrous Oxide***. Nitrous oxide is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste.
- ***Fluorinated Gases***. Hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are synthetic, powerful GHGs that are emitted from a variety of industrial processes. Fluorinated gases are sometimes used as substitutes for O_3-depleting substances. These gases are typically emitted in smaller quantities, but because they are potent GHGs, they are sometimes referred to as High Global Warming Potential gases.

Regulatory Review and Permitting. Currently, EPA has promulgated two regulations that 1) require the reporting of GHG emissions annually, and 2) require an assessment of BACT for new or modified sources that occur after January 2, 2011. The final rules apply to fossil fuel suppliers and industrial gas suppliers, direct GHG emitters, and manufacturers of heavy-duty and off-road vehicles and engines. The rule does not require control of GHGs, rather it requires only that sources above certain threshold levels monitor and report emissions. In addition, EPA also recently promulgated the Tailoring Rule that established a CO_2e threshold for permitting purposes (i.e., construction and operation) of 75,000 tpy for modifications and 100,000 tpy for new sources. This rule "tailors" the major source permitting rules outlined in Section 3.3.2.2.1 (i.e., PSD and NNSR) to apply to GHGs.

Executive Order (EO) 13514. EO 13514 *Federal Leadership in Environmental, Energy, and Economic Performance* expands on the energy reduction and environmental performance requirements for Federal agencies identified in EO 13423, *Strengthening Federal Environmental, Energy, and Transportation Management.* The goal of EO 13514 is *to establish an integrated strategy towards sustainability in the Federal Government and to make reduction of GHG emissions a priority for Federal agencies*. The GHG emissions generated directly and indirectly by an entity such as a Federal agency can be classified into "scopes," based on the source of the emissions:

- Scope 1 emissions are direct GHG emissions from sources that are owned or controlled by the entity. Scope 1 includes emissions from fossil fuels burned on site, emissions from owned or leased vehicles, and other direct sources.
- Scope 2 emissions are indirect GHG emissions resulting from the generation of electricity, heating and cooling, or steam generated off site but purchased by the entity, and the transmission and distribution losses associated with some purchased utilities.
- Scope 3 emissions include indirect GHG emissions from sources not owned or directly controlled by the entity but related to the entity's activities. Scope 3 GHG emissions sources currently

required for Federal GHG reporting includes employee travel and commuting, contracted solid waste disposal, and contracted wastewater treatment.

In response to EO 13514, DoD has set the goal to reduce Scope 1 and 2 GHGs by 34 percent and Scope 3 GHGs by 13.5 percent by FY 2020.

3.3.2 ENVIRONMENTAL CONSEQUENCES

The environmental consequences for air quality include an overview of the General Conformity Rule (GCR) followed by a discussion of the direct and indirect effects and a regulatory review for each alternative. As stated in Section 3.1, an impact to air quality would be considered significant if it:

- Violates NAAQS, which may threaten the attainment status of the region
- Generates substantial GHG emissions (>75,000 tons CO_2e per year)
- Violates the Title V Operation Permit

3.3.2.1 No Action Alternative

The No Action Alternative would result in continued deterioration of air quality from the failure to implement cleaner technologies. Levels of GHG emissions would continue to increase at present rates under the status quo.

3.3.2.2 Proposed Action Alternatives

3.3.2.2.1 General Conformity

To determine whether the GCR applies, all direct and indirect sources of emissions were estimated and combined for the Proposed Action Alternatives within the CO maintenance area. Direct emissions are emissions that would be caused or initiated by a Federal action and occur at the same time and place as the action. Indirect emissions are defined as reasonably foreseeable emissions that would be caused by the action, but could occur later in time or be farther removed in distance from the action itself. More specifically, project-related construction and operational emissions were estimated for alternative sites located within the CO maintenance area:

- **Alternative 2b:** Construct and Operate an up to 13MW biomass plant in Bravo North Site 2
- **Alternative 3:** Construction and Operation of Photovoltaic Systems at Gate 2 North and South, Chiles, Bravo North Site 1, SWMU 5 (Sites 1 and 2), Magrath Avenue, and Titus/Signal Hill.
- **Alternative 4:** Expansion of the Existing Reclaimed Water System
- **Alternative 6:** Implement Future Renewable Energy Development within Net Zero Footprints Identified by the Army
- **Alternative 7:** Maximum Conservation and Re-Use

Upper bound assumptions were made to estimate emissions during the year of maximum construction. Construction activities including the use of construction equipment, worker vehicles (e.g., bulldozers, backhoes) were included in the analysis. The analysis determined that the total construction emissions of CO during the maximum year of construction would be substantially less than the applicability thresholds (Table 3.3-4). Small changes in the siting of these facilities, the final design, and moderate changes in the quantity and types of equipment used would not have a substantial influence on the emission estimates, and would not change this applicability determination under the GCR.

If Alternative 2b (Construct and Operate a 13MW biomass plant in Bravo North Site 2) were selected, operational emissions of CO in any given year would be more than the applicability thresholds. If this alternative were ultimately selected, however, it would be exempt from the GCRs as it includes modified stationary sources that would require a permit under the PSD program (40 CFR 93-153(d)(1)). Therefore, a formal conformity demonstration would not be required.

All other alternatives would have either no operational emissions or they are located outside the CO maintenance area. Therefore, for all alternatives, the general conformity requirements do not apply, and no formal conformity determination is required. Detailed methodologies for estimating air emissions and a draft Record of Non-applicability are provided in Appendix C, Attachment B.

Table 3.3-4. Total Annual Emissions Subject to the General Conformity Rule

Activity	Estimated Annual CO Emissions Within the CO Maintenance Area (tpy)	Applicability Threshold (tpy)	Exceeds Applicability Threshold?
Construction[a]	35	100	No
Operational			
Alternative 2b: Construct and Operate an up to 13MW Biomass Plant in Bravo North Site 2	152	100	**Yes**
All other alternatives	None		No

Sources: EPA, 1995; CARB, 2007; and NREL, 2010.
a Upper bound estimate of year of maximum construction
CO = carbon monoxide; MW = megawatt; tpy = tons per year

Under the GCR, only reasonably foreseeable emissions are to be accounted for. Reasonably foreseeable emissions are projected future indirect emissions that are identified at the time the conformity determination is made; the location of such emissions is known and the emissions are quantifiable (40 CFR 93.152). An ongoing net decrease in CO emissions is expected after the construction phase due to the reduction in off-site fossil fuel combustion to generate electricity for the Installation. As the exact location of these emissions is unknown, they are not considered reasonably foreseeable under the GCR and have been excluded from this analysis.

3.3.2.2.2 Alternative 1

Alternative 1 would have both short-term minor and long-term moderate adverse impacts on air quality. Short-term impacts would be due to air emissions generated during construction, and long-term impacts would be due to operational emissions from the proposed WTE plant. Implementing Alternative 1 would constitute an overall net decrease in both criteria pollutants and GHGs due to reduction in the use of off-Post fossil-fuel-based electricity. These indirect reductions in emissions would be appreciably greater than direct operational emissions from the proposed WTE plant; however, because the proposed plant would in and of itself constitute a major stationary source of air emissions, effects to air quality are considered moderately adverse. Although there would be overall net decrease in both criteria pollutants and GHGs due to reduction in the use of off-Post fossil-fuel-based electricity, this decrease in emissions is of no direct benefit to Fort Carson for the purposes of netting or other permitting strategies. The PTE for the proposed WTE plant would exceed the major modification threshold for the Installation and PSD review would be required.

Direct Effects. Mobile and stationary equipment would be used for the construction of the proposed plant. Several pieces of construction equipment would generate emissions due to the combustion of diesel fuel and gasoline. PM in the form of fugitive dust may occur during site grading and construction activities. The impacts on the environment during construction would be minimal, localized, and temporary. These adverse effects would be minor.

Depending on the characteristics of the MSW and combustion conditions in the WTE plant, PM, metals, acid gases (hydrochloric acid [HCl]), CO, NO_x, and toxic organics would be emitted; with some levels potentially occurring over the major source threshold. A brief discussion on each of the pollutants is provided below and is followed by a discussion of pollutant control technologies.

- ***Particulate Matter.*** The amount of PM emitted depends on the waste characteristics, the physical nature of the combustor design, and its operation. Under normal combustion conditions, solid fly ash particulates formed from inorganic, noncombustible constituents in MSW are released into the flue gas.
- ***Metals.*** Metals are present in a variety of MSW streams, including paper, newsprint, yard wastes, wood, batteries, and metal cans. The metals are emitted in association with PM (e.g., arsenic [As], cadmium [Cd], chromium [Cr], and Pb) and as vapors, such as mercury (Hg). Due to the variability in MSW composition, metal concentrations are highly variable.
- ***Acid Gases.*** The chief acid gas of concern is HCl. Hydrogen fluoride, hydrogen bromide, and sulfur trioxide are also generally present, but at much lower concentrations. Concentrations of HCl flue gases directly relate to the chlorine and sulfur content in the waste. The major sources of chlorine in MSW are paper and plastics. Sulfur is contained in many constituents, such as asphalt shingles, gypsum wallboard, and tires.
- ***Carbon Monoxide (CO).*** CO emissions result when not all of the carbon in the waste is oxidized to CO_2. High levels of CO indicate that the combustion gases were not held at a sufficiently high temperature in the presence of oxygen for a long enough time to convert CO to CO_2.
- ***Oxides of nitrogen (NO_x).*** NO_x are products of all fuel/air combustion processes. Nitric oxide is the primary component of NO_x; however, NO_2 and N_2O are also formed in smaller amounts. Because of the relatively low temperatures at which WTE facilities operate, 70 to 80 percent of NO_x formed is associated with nitrogen in the waste.
- ***Organic Compounds.*** A variety of organic compounds, including chlorinated dibenzo-p-dioxin/chlorinated dibenzofurans, 2,3,7,8-tetrachlorodibenzo-p-dioxin, and dibenzofurans (CDDs/CDFs), chlorobenzene, polychlorinated biphenyls, chlorophenols, and polyaromatic hydrocarbons are present in MSW or can be formed during the combustion and post-combination processes. Organics in the flue gas can exist in the vapor phase or can be condensed or absorbed on fine particulates.

The toxics generated by MSW combustion facilities are tightly regulated by the MACT standards under the Clean Air Act. April 28, 2006, the USEPA adopted revised emission limits in its NSPS and emission guidelines for large municipal waste combustors units. A wide variety of control technologies are used to control emissions from WTE plants. The control of PM, along with metals that have adsorbed onto the PM, is most frequently accomplished through the use of electrostatic precipitators (ESP) or fabric filters (FF). Although other PM control technologies (e.g., cyclones, electrified gravel beds, and venturi scrubbers) are available, they are seldom used on existing systems, and it is anticipated that they would not be frequently used in future systems. The control of acid gas emissions (i.e., SO_2 and HCl) is most frequently accomplished through the application of acid gas control technologies such as spray drying or dry sorbent injection, followed by a high-efficiency PM control device. Some facilities use a wet scrubber to control acid gases. It is anticipated that dry systems (spray drying and dry sorbent injection) would be more widely used than wet scrubbers on future systems. A brief discussion on each of the pollutants and corresponding control technologies is in Appendix C.

Table 3.3-5 outlines the estimated PTE from the WTE plant using the above controls alone or in combination. The WTE plant is in the preplanning stages and these emissions are estimates using EPA's *AP-42 - Compilation of Air Pollutant Emission Factors, Section 2.1 Refuse Combustion.* Emission calculations, including uncontrolled emissions estimations are shown in Appendix C, Attachment A.

During the permitting process detailed emission calculations would be required based on the final design and controls.

Table 3.3-5. Estimated Controlled Potential to Emit from the Proposed WTE Plant

	ESP	DSI/ESP	SD/ESP	DSI/FF	SD/FF	Major Modification Threshold	Exceeds Major Modification Threshold
Pollutant	**Emissions (tpy)**						
PM	35.3	9.9	11.8	30.1	10.4	25	No
SO_2	581.9	159.9	109.8	240.5	93.2	40	**Yes**
NO_x w/SNCR	389.2	389.2	389.2	389.2	389.2	40	**Yes**
CO	77.9	77.9	77.9	77.9	77.9	100	No
Pb	0.5045	0.4877	0.1539	0.0499	0.0439	0.6	No
HAPs							
As	0.0036	0.7349	0.0023	0.0017	0.0007	10	No
Cd	0.1086	0.0149	0.0126	0.0039	0.0046	10	No
Cr	0.0190	0.0052	0.0436	0.0336	0.0050	10	No
Hg	0.9418	0.6660	0.5483	0.3700	0.3700	10	No
Ni	0.0188	0.0054	0.0454	0.0240	0.0087	10	No
HCl	1,076.3	46.8	77.0	107.0	35.5	10	**Yes**
CDD/CDF	2.81E-04	1.97E-04	1.04E-04	2.69E-05	1.11E-05	10	No
Total HAPs	1,077.4	48.2	77.7	107.4	35.9	25	**Yes**
GHGs							
CO_2	319,533.5	319,533.5	319,533.5	319,533.5	319,533.5	75,000	**Yes**

Source: EPA, 1996.

As = Arsenic; Cd = cadmium; CDD/CDF = total tetra- through octa- chlorinated dibenzo-p-dioxin/chlorinated dibenzofurans, 2,3,7,8-tetrachlorodibenzo-p-dioxin, and dibenzofurans; CO = carbon monoxide; CO_2 = carbon dioxide; Cr = chromium; HAP = hazardous air pollutant; HCl = hydrochloric acid; Hg = mercury; Ni = nickel; Pb = lead; NO_x = nitrogen oxides; DSI/ESP = Duct Sorbent Injection/Electrostatic Precipitator; DSI/FF = Duct Sorbent Injection/Fabric Filter; ESP = Electrostatic Precipitator; SD/ESP = Spray Dryer/Electrostatic Precipitator; SD/FF = Spray Dryer/Fabric Filter; SNCR = selective non-catalytic reduction; WTE = Waste-to-Energy

Permitting and Regulatory Review. Permitting scenarios may vary based on the final design, timing of the project, and the types of controls ultimately selected. These may differ in specific features from the ones described in this EA. During the final design stage and the permitting process either 1) the actual equipment, controls, or operating limitations would be selected to reduce the PTE below the major source threshold, 2) NNSR permitting process would require emission offsets be obtained from other previously decommissioned sources within the region, or 3) the PSD permitting process would ensure the NAAQS was not exceeded and the emissions from the projects would be included in the regional emissions inventory ensuring the it would not interfere with the ability of the state to maintain the NAAQS. This cap-and-trade type system is inherent to Federal and state air regulations, and leads to a forced reduction in regional emissions in nonattainment areas or the preservation of clean air in attainment regions. Therefore, regardless of the ultimate permitting scenario, effects would be less than significant.

Permitting requirements for proposed stationary sources are based on their overall PTE of criteria pollutants. The PTE of NO_x, and SO_2 would exceed the PSD threshold (Table 3.3-5). Therefore, PSD review would be required. In addition, the PTE of NO_x would exceed the NNSR major modification thresholds and NNSR may become required if the region were to become a nonattainment area under the 2008 O_3 standard. A Title V Significant Permit Modification would be required within one year of the first operation of the proposed WTE plant.

The proposed WTE plant would meet the NSPS requirements outlined in 40 CFR Part 60 Subpart Eb - Standards of Performance for Large Municipal Waste Combustors for Which Construction is Commenced After September 20, 1994 or for Which Modification or Reconstruction is Commenced After June 19, 1996. The subpart Eb standards establish requirements for metals (PM, Cd, Pb, Hg, opacity), organics (dioxins/ furans), acid gases (SO_2, HCl), operating practices (CO, flue gas temperature, load level), NO_x, and plant siting requirements. The standards also require control of fugitive ash emissions.

GHGs. Net GHG emissions consist of GHG emissions from the transportation, processing, and combustion of the MSW in the WTE plant minus GHG emissions avoided from the reduction in the use of fossil fuel-based electricity and gas emissions from landfilling the MSW. EPA Waste Reduction Model (WARM) was used to calculate the life-cycle GHG emissions of the baseline landfill scenario and the WTE scenario outlined under Alternative 1. The total GHG emissions of the baseline landfill scenario were estimated to be 427,558 tpy CO_2e. The total reduction of GHG emissions associated with the WTE scenario outlined under Alternative 1 was estimated to be 60,989 tpy CO_2e. Therefore, implementation of Alternative 1 would constitute a net decrease of 488,547 tpy CO_2e of Scope 2 GHG emissions. These GHG emissions savings are primarily due from the reduction of off-site fossil-fuel-based generation of electricity and CH_4 produced from the landfills. This is equivalent to removing the annual GHG emissions from 81,176 passenger vehicles or 2,314 railway cars of coal. These effects would be moderately beneficial, and would allow the Installation to fully meet its 34 percent reduction goals under EO 13514.

Although there would be a net reduction in GHG emissions due to Alternative 1, the proposed WTE plant would directly emit 319,534 tpy of Scope 1 GHG emissions. This would be greater than the major modification threshold of 75,000 tpy under the Tailoring Rule; therefore, a PSD and BACT review for GHG would be required. BACT for GHG is rapidly evolving. In the final design stages and the permitting process, extra care would be taken to insure compliance with all GHG permitting regulations.

Indirect Effects. The Emissions & Generation Resource Integrated Database is a comprehensive inventory of environmental attributes of electric power systems which provides a detailed emissions profile, covering NO_x, SO_2, and GHG broken down by state and region. Energy grid-based emission factors are not available for other criteria pollutants. Because of the required air pollution controls, emissions of criteria pollutants from WTE plants are generally lower than those generated by fossil fuel based power plants (Table 3.3-6). There would be additional indirect long-term beneficial effects from reductions in the use of fossil-fuel based electricity. The primary reductions would be from NO_x and SO_2 emissions; however, similar reductions would be likely for all criteria pollutants.

Table 3.3-6. Potential Indirect Emissions Reductions from a 40MW WTE Plant

	Emissions (tpy)		
Pollutant	**Fossil Fuel Combustion**	**Proposed WTE Plant**	**Potential Reductions**
NO_x	473.6	389.2	84.4
SO_2	438.4	93.2	345.2

Source: EPA, 2011; and EPA, 1996.
MW = megawatt; NO_x = nitrogen oxide; SO_2 = sulfur dioxide; tpy = tons per year; WTE = Waste-to-Energy

Best Management Practices. BMPs would be required for both construction and operational emissions associated with the WTE plant. The construction project would be accomplished in full compliance with Colorado regulatory requirements, through the use of compliant practices or products. These requirements appear in 5 CCR 1001-1**,** Air Quality Control Commission (AQCC) regulations. They include the following:

- Odor Emission (5 CCR 1001-4)
- Open Burning, Prescribed Fire, and Permitting (5 CCR 1001-11)
- Control of Emission of Ozone Depleting Compounds (5 CCR 1001-19)

In addition to those outlined above, no person shall handle, transport, or store any material in a manner which may allow unnecessary amounts of air contaminants to become airborne. During construction reasonable measures may be required to prevent unnecessary amounts of PM from becoming airborne, including:

- Use of water for control of dust, the grading of roads, or the clearing of land;
- Paving of roadways and maintaining them in a clean condition;
- Covering open equipment for conveying or transporting material likely to create objectionable air pollution when airborne; and
- Promptly removing spilled or tracked dirt or other materials from paved streets.

BMPs associated with operation of the proposed WTE plant would include:

- BACT review for each criteria pollutant and GHGs
- MACT review for regulated HAPs and designated categories
- Predictive air dispersion modeling
- Establishing procedures for measuring and recording emissions and/or process rates
- Meeting the NSPS and NESHAP requirements
- A public involvement process

This listing is not all-inclusive; Fort Carson and any contractors would comply with all applicable Colorado air pollution control regulations.

3.3.2.2.3 Alternative 2

Alternatives 2a, 2b, and 2c would have both short- and long-term minor adverse impacts on air quality. Short-term impacts would be due to air emissions generated during construction, and long-term impacts would be due to operational emissions from the proposed biomass plant. Implementing Alternative 2a, 2b, and 2c would constitute an overall net decrease in both criteria pollutants and GHGs due to the reduction in the use of off-Post fossil-fuel-based electricity. These indirect reductions in emissions would be appreciably greater than operational emissions from the proposed biomass plant; however, because the proposed plant would in and of itself constitute a new stationary source of air emissions, effects to air quality are considered minor. The PTE for the proposed 13MW biomass plant would exceed the major modification threshold for the Installation and PSD review would be required.

Direct Effects. Mobile and stationary equipment would be used for the construction of the proposed plant. Several pieces of construction equipment would generate emissions due to the combustion of diesel fuel and/or gasoline. PM in the form of fugitive dust may occur during site grading and construction activities. The impacts on the environment during construction would be minimal, localized, and temporary. These adverse effects would be minor.

Table 3.3-7 summarizes the potential operational emissions of criteria air pollutants and HAPs for a 13 and a 2.5MW biomass plant. The following emission sources were accounted for in the analysis:

- Woody Biomass Grate Boiler

- Woody Biomass Handling and Processing
- Fly Ash Handling and Boiler Support Material Handling
- Portable Wood Chipper Combustion Emissions
- Additional Emergency Equipment (generators, etc.)

Table 3.3-7. Estimated Potential to Emit from the Proposed Biomass Plant

	Alternative 2a and 2b - 13MW Plant			Alternative 2c - 2.5MW Plant		
Pollutant	**Emissions (tpy)**	**Major Modification Threshold**	**Exceeds Major Modification Threshold**	**Emissions (tpy)**	**Major Modification Threshold**	**Exceeds Major Modification Threshold**
PM	52	25	**Yes**	10	25	**No**
PM_{10}	43	15	**Yes**	8	15	**No**
$PM_{2.5}$	39	15	**Yes**	8	15	**No**
SO_2	22	40	**No**	4	40	**No**
NO_x	100	40	**Yes**	19	40	**No**
CO	152	100	**Yes**	29	100	**No**
Total HAPs	<10	10	**No**	<10	10	**No**
GHGs						
CO_2	156,000	75,000	**Yes**	30,000	75,000	**No**

Source: NREL, 2010.

CO = carbon monoxide; CO_2 = carbon dioxide; GHG = greenhouse gas; HAP = hazardous air pollutant; MW = megawatt; NO_2 = nitrogen dioxide; $PM_{2.5}$ = particulate matter less than 2.5 microns; PM_{10} = particulate matter less than 10 microns; SO_2 = sulfur dioxide; tpy = tons per year

The actual emissions would vary based on the fuel type and combustion type (e.g., biomass moisture and heating value) and combustion technique being utilized (e.g., stoker or fluidized bed boiler). For example, a fluidized bed boiler is more efficient at combusting woody biomass than a stoker boiler. To offset this, a stoker boiler may be required to implement pollution control equipment with higher removal efficiencies. The emission estimates reflect a general estimate of potential emissions from a 13 and a 2.5MW biomass plant utilizing a stoker boiler design versus a fluidized bed boiler design, and reflect a boiler heat input design of approximately 175 and 33 MMBTU per hour with ESP for particulate removal, and selective non-catalytic reduction for NO_x reductions. A grate type boiler (i.e., stoker) would typically not combust woody biomass as efficiently as a fluidized bed boiler, thus emissions of CO would be higher. Therefore, the emissions reflect an oxidation catalyst to further reduce CO emissions.

Permitting and Regulatory Review. As with the WTE plant, permitting scenarios may vary based on the final design, timing of the project, and the types of controls ultimately selected. Due to their relative size Alternatives 2a and 2b would have a greater adverse effect than Alternative 2c. Regardless of the ultimate permitting scenario, effects would be less than significant. Notably,

- **Alternative 2a and 2b.** The PTE of all attainment pollutants except SO_2 (NO_x, CO, and PM) would exceed the PSD threshold (Table 3.3-7); therefore, PSD review would be required. In addition, the PTE of NO_x would exceed the major modification thresholds; therefore, NNSR may become required if the region were to become a nonattainment area under the 2008 O_3 standard. A Title V Significant Permit Modification would be required within one year of the first operation of the proposed biomass plant.

- **Alternative 2c.** The PTE of all attainment pollutants would be below the PSD threshold (Table 3.3-7); therefore, PSD review would not be required. In addition, the PTE of NO_x would not exceed the major modification thresholds; therefore, NNSR would not be required if the region were to become a nonattainment area under the 2008 O_3 standard. A Title V Minor Permit Modification would be required within one year of the first operation of the proposed biomass plant.

EPA has also developed NSPS and MACT emission standards for criteria pollutants and HAPs that restrict the level of emissions from biomass facilities. Included in these standards are emissions limits for NO_x, SO_2, PM, and selected HAPs. The NSPS apply to boilers within heat inputs in excess of 100 MMBTU per hour and the MACT standards apply to sources with potential HAP emissions that exceed 10 tpy for a single HAP or 25 tpy for all HAPs combined. During the final design stages, Fort Carson would comply with all applicable NSPS and MACT emission standards.

GHGs. Net GHG emissions consist of GHG emissions from the transportation, processing, and combustion of the wood waste in the biomass plant minus GHG emissions avoided from the reduction in the use of fossil-fuel-based electricity. The CO_2 emissions from burning of biomass are considered part of the Earth's natural carbon cycle and the electrical power generation from this project would displace CO_2 and other GHGs from other electrical generation sources. The EPA WARM model was used to calculate GHG emissions of Alternative 2.

- **Alternative 2a and 2b.** The net decrease of Scope 2 GHG emissions from the 13MW biomass plant was estimated to be 48,066 tpy CO_2e. This reduction is equivalent to removing the annual GHG emissions from 8,698 passenger vehicles. These GHG emissions savings are primarily due from the reduction of off-site fossil-fuel-based generation of electricity. These effects would have a minor beneficial impact, and would help the Installation to partially meet its 34 percent reduction goals under EO 13514. Although there would be a net reduction in GHG emissions, the proposed 13MW biomass plant would directly emit approximately 156,000 tpy of Scope 1 GHG emissions. This would be greater than the major modification threshold of 75,000 tpy under the Tailoring Rule; therefore, a PSD and BACT review for GHG would be required.
- **Alternative 2c.** The net decrease of Scope 2 GHG emissions from the 2.5MW biomass plant was estimated to be 9,243 tpy CO_2e. The reduction from the plant is equivalent to removing the annual GHG emissions from 1,672 passenger vehicles. These effects would be minor beneficial, and would help the Installation to partially meet its 34 percent reduction goals under EO 13514. The proposed 2.5MW biomass plant would directly emit approximately 30,000 tpy of Scope 1 GHG emissions. This would be less than the major modification threshold; therefore, a PSD and BACT review for GHG would not be required.

Indirect Effects. Because of the required air pollution controls, emissions of criteria pollutants from biomass plants are generally lower than those generated by fossil-fuel-based power plants (Table 3.3-8). There would be additional long-term beneficial effects from indirect reductions of the use of fossil-fuel-based electricity. The primary reductions would be from NO_x and SO_2 emissions; however, similar reductions would be likely for all criteria pollutants. Notably, this analysis is based on the Colorado-wide mix of electricity sources.

Table 3.3-8. Potential Indirect Emissions Reductions from a 13MW and 2.5MW Biomass Plant

	Emissions (tpy)		
Pollutant	**Fossil Fuel Combustion**	**Proposed Biomass Plant**	**Potential Reductions**
13MW Plant			
NO_x	154	100	54
SO_2	143	22	121
2.5MW Plant			
NO_x	30	19	11
SO_2	27	4	23

Source: EPA, 2011; and EPA, 1996.

MW = megawatt; NO_x = nitrogen oxides; SO_2 = sulfur dioxide; tpy = tons per year

Best Management Practices. BMPs would be required for both construction and operational emissions associated with the biomass plant. The construction projects would be accomplished in full compliance with Colorado regulatory requirements, through the use of compliant practices or products. These requirements are identical to those outlined under Alternative 1 in Section 3.3.2.2.2.

BMPs associated with operation of the proposed 13MW biomass plant under Alternatives 2a and 2b would include:

- BACT review for each criteria pollutant and GHG
- MACT review for regulated HAPs and designated categories
- Predictive air dispersion modeling
- Establishing procedures for measuring and recording emissions and/or process rates
- A public involvement process

Regardless of which alternative is ultimately selected, the biomass plant would need to meet all NSPS and NESHAP requirements. This listing is not all-inclusive; Fort Carson and any contractors would comply with all applicable Colorado air pollution control regulations.

BMPs associated with the operation of the proposed 2.5MW biomass plant under Alternative 2c would include complying with the existing best practices within the Installation’s Title V permit.

3.3.2.2.4 Alternative 3

Short-term minor adverse and long-term moderate beneficial effects on air quality would be anticipated with Alternative 3. The short-term minor adverse effects would be from air emissions during construction and installation of the PV systems, and long-term beneficial effects from indirect reductions in the use of fossil-fuel-based electricity (Table 3.3-9).

Table 3.3-9. Potential Indirect Emissions Reductions from Photovoltaic Arrays

Site Location	Description/Name	Acres	Annual Power (MWh)	Indirect Emissions Reductions (tpy)		
				NO_x	SO_2	CO_2
Main Post	Gate 2 North	3	4,350	5.9	5.4	4,146
Main Post	Gate 2 South	7.6	11,020	14.9	13.8	10,502
Main Post	Chiles	12.7	18,415	24.9	23.0	17,550
SWMU	SWMU 1-170	86.9	126,005	170.3	157.6	120,087
SWMU	SWMU 5 (Site 1)	14.3	20,735	28.0	25.9	19,761
SWMU	SWMU 5 (Site 2)	41.9	60,755	82.1	76.0	57,901
Training Area	Bravo North (Site 1)	71.5	103,675	140.1	129.7	98,805
Training Area	Butts Road	89.4	129,630	175.2	162.2	123,541
Training Area	Magrath Avenue	19.5	28,275	38.2	35.4	26,947
Training Area	Wildhorse	361.1	523,595	707.7	655.1	499,002
Training Area	Titus/Signal Hill	31.9	46,255	62.5	57.9	44,082
Training Area	Ray Nixon	146.8	212,860	287.7	266.3	202,862
Training Area	Tent City	97.1	140,795	190.3	176.1	134,182
	Total	**983.7**	**1,426,365.0**	**1,927.9**	**1,784.5**	**1,359,369**

Source: EPA, 2011.

CO_2 = carbon dioxide; MWh = megawatt-hour; NO_x = nitrogen dioxide; PV = photovoltaic; SO_2 = sulfur dioxide; SWMU = Solid Waste Management Unit; tpy = tons per year

Permitting and Regulatory Review. Alternative 3 would not include any new stationary sources of air emissions. Air permits, however, may be required for land disturbance areas (5 CCR 1001-5). The construction projects would be accomplished in full compliance with Colorado regulatory requirements, through the use of compliant practices or products. These requirements are identical to those outlined under Alternative 1 in Section 3.3.2.2.2.

This listing is not all-inclusive; Fort Carson and any contractors would comply with all applicable Colorado air pollution control regulations.

GHGs. Alternative 3 would constitute a net decrease in Scope 2 GHG emissions up to 1.36 million tpy of CO_2. These would be indirect GHGs resulting from the reduction of generation of electricity off-site but purchased by the Installation. There would be no direct ongoing GHG emissions from operation of the PV arrays.

3.3.2.2.5 Alternative 4

Short-term minor adverse effects on air quality would be anticipated from Alternative 4. The short-term effects would be from air emissions during construction and installation of the expanded non-portable water system and the pump station. Long-term effects would be negligible as there would be no ongoing sources of operational emissions.

Permitting and Regulatory Review. Alternative 4 would not include any new stationary sources of air emissions. Air permits, however, may be required for land disturbance areas (5 CCR 1001-5). The construction projects would be accomplished in full compliance with Colorado regulatory requirements, through the use of compliant practices or products identical to those outlined under Alternative 1 in Section 3.3.2.2.2.

GHGs. There would be no direct ongoing GHG emissions from operation of the expanded non-portable water system.

3.3.2.2.6 Alternative 5

Short-term minor adverse and long-term moderate beneficial effects on air quality would be anticipated from Alternative 5. The short-term effects would be from air emissions during construction and installation of the wind turbines, and long-term effects from reductions of indirect emissions due to the decrease use of fossil-fuel based electricity. Potential indirect emissions reductions of NO_x, SO_2, and CO_2 from Alternative 5 are outlined in Table 3.3-10.

Table 3.3-10. Potential Indirect Emissions Reductions from Wind Turbines

	Size of Units	Number of Units	Annual Power (MWh)	Indirect Emissions Reductions (tpy)		
				NO_x	SO_2	CO_2
Lower Bound	1.5	3	39,420	53.3	49.3	37,568
Upper Bound	3	5	131,400	177.6	164.4	125,228

Source: EPA, 2011.

CO_2 = carbon dioxide; MWh = megawatt-hour; NO_x = nitrogen oxide; SO_2 = sulfur dioxide; tpy = tons per year

Permitting and Regulatory Review. Alternative 5 would not include any new stationary sources of air emissions. Air permits, however, may be required for land disturbance areas (5 CCR 1001-5). The construction projects would be accomplished in full compliance with Colorado regulatory requirements, through the use of compliant practices or products identical to those outlined under Alternative 1 in Section 3.3.2.2.2.

GHGs. Alternative 5 would constitute a net decrease in Scope 2 GHG emissions ranging from 37,568 to 125,228 tpy CO_2e. These would be indirect GHG resulting from the reduction of generation of electricity off site but purchased by the Installation. There would be no direct ongoing GHG emissions from operation of the wind turbines.

3.3.2.2.7 Alternative 6

Short-term minor adverse and long-term moderate beneficial effects on air quality would be anticipated from Alternative 6. The short-term effects would be from air emissions during construction and installation of the future GSHPs and solar projects, and long-term effects from reductions of indirect emissions due to the decreased use of fossil-fuel based electricity from these projects. Since the exact scope of these projects is in the preplanning stages, the reductions of indirect emissions due to the decreased use of fossil-fuel based electricity cannot be estimated; however, they would be similar in magnitude to those outlined under Alternative 3 in Section 3.3.2.2.4.

Permitting and Regulatory Review. Alternative 6 would not include any new stationary sources of air emissions. Air permits, however, may be required for land disturbance areas (5 CCR 1001-5). The construction projects would be accomplished in full compliance with Colorado regulatory requirements, through the use of compliant practices or products identical to those outlined under Alternative 1 in Section 3.3.2.2.2.

GHGs. Alternative 6 would constitute a net decrease in Scope 2 GHG emissions similar in magnitude to those outlined under Alternative 3. These would be indirect GHG emissions resulting from the reduction of generation of electricity off site but purchased by the Installation. There would be no direct ongoing GHG emissions from operation of the future ground-source heating and cooling or solar projects.

3.3.2.2.8 Alternative 7

Short-term minor adverse and long-term beneficial effects on air quality would be anticipated from Alternative 7. The short-term effects would be from air emissions during maintenance and installation of infrastructure upgrades, and long-term effects from reductions of indirect emissions due to the decrease use of electricity from behavioral and energy conservation measures enacted.

Permitting and Regulatory Review. Alternative 7 would not include any new stationary sources of air emissions. Air permits, however, may be required for land disturbance areas (5 CCR 1001-5). Any projects would be accomplished in full compliance with Colorado regulatory requirements, through the use of compliant practices or products identical to those outlined under Alternative 1 in Section 3.3.2.2.2.

GHGs. Alternative 7 would constitute a net decrease in Scope 2 GHG emissions. These would be indirect reduction of GHG emissions resulting from improved efficiencies in equipment and the reduction of electricity use from conservation and behavioral measures enacted by the Installation.

3.3.3 CUMULATIVE EFFECTS

The Proposed Action would have short-term minor and long-term moderate adverse cumulative effects on air quality and beneficial cumulative effects regarding GHGs. By directly inventorying all emissions in a nonattainment region and monitoring concentrations of criteria pollutants in attainment regions, the state of Colorado takes into account the effects of all past and present emissions in the state. This is done by putting a regulatory structure in place designed to prevent air quality deterioration for areas that are in attainment with the NAAQS and to reduce common or criteria pollutants emitted in nonattainment areas to levels that would achieve compliance with the NAAQS (EPA, 2010a). This structure of rules and regulations are contained in the SIP. SIPs are the regulations and other materials for meeting clean air standards and associated CAA requirements. SIPs include:

- State regulations that EPA has approved;
- State-issued, EPA-approved orders requiring pollution control at individual companies; and
- Planning documents, such as area-specific compilations of emissions estimates and computer simulations (modeling analyses) demonstrating that the regulatory limits assure that the air would meet air quality standards (EPA, 2010b).

The SIP process applies either specifically or indirectly to all activities in the region. Regardless of which alternative(s) is ultimately selected, regional growth and contemporaneous actions would continue, including CAB and Grow the Army actions at Fort Carson. These activities would introduce new stationary and mobile sources of air emissions at Fort Carson. These actions would have some level of impact to air quality that has been evaluated in separate NEPA documents. Neither these or any other large-scale projects or proposals, however, have been identified that, when combined with the Proposed Action Alternatives, would threaten the attainment status of the region, would have substantial GHG emissions, or would lead to a violation of any Federal, state, or local air regulation.

Estimated emissions from Alternatives 1 or 2 would be appreciable. Therefore, these alternatives would have moderate adverse cumulative effects on air quality. Although there would be an increase in Fort Carson's emissions due to the construction and operation of either a WTE plant or a biomass plant, implementing either would constitute an overall net decrease in the ROI of both criteria pollutants and GHG due to indirect reduction in the use of off-Post fossil-fuel-based electricity. These indirect reductions in emissions would be appreciably greater than operational emissions from the proposed WTE plant. Therefore, in the context of regional air quality or global warming, the cumulative effects would be beneficial.

Alternatives 3, 5, 6, and 7 would also be anticipated to result in beneficial cumulative impacts to air quality as they would offset or reduce traditional energy production and associated criteria pollutant and GHG emissions with solar or wind energy production furthering regional reductions of these pollutants. Additionally, the ground-source heating and cooling component of Alternative 6 would provide similar regional reductions of criteria pollutant and GHG emissions from replacing traditional boiler or electrical methods currently used at the Installation. Alternative 4 would have negligible cumulative adverse impacts to air quality.

3.3.4 PROPOSED IMPACT REDUCTION MEASURES

3.3.4.1 Mitigation

Mitigation measures for air quality may be required to reduce impacts to less than significant in compliance with existing regulations, necessary permits, and plans. The direct, indirect, and cumulative effects associated with air quality for all alternatives would be mitigable to less than significant.

For Alternatives 1 and 2, BMPs would be required for both construction and operational emissions associated with plant construction and operations. These projects would be accomplished in full compliance with Colorado regulatory requirements, through the use of compliant practices or products. These requirements appear in 5 CCR 1001-1, AQCC Regulations and would serve to reduce significant adverse air quality impacts.

For all Proposed Action Alternatives, reasonable measures may be required to prevent unnecessary amounts of PM from becoming airborne including but not limited to:

- Use of water for control of dust, the grading of roads, or the clearing of land;
- Paving of roadways and maintaining them in a clean condition;
- Covering open equipment for conveying or transporting material likely to create objectionable air pollution when airborne; and
- Promptly removing spilled or tracked dirt or other materials from paved streets.

These measures would serve to reduce the level of adverse impacts during construction.

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3.4 Noise

3.4.1 AFFECTED ENVIRONMENT

3.4.1.1 Noise Overview and Regulatory Review

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

Sound varies in intensity and frequency. Sound pressure levels (SPL), described in decibels (dB), are used to quantify sound intensity. The decibel is a logarithmic unit that expresses the ratio of a SPL to a standard reference level. The Hertz is used to quantify sound frequency. The human ear responds differently to different frequencies. *A-weighting*, described in A-weighted decibels (dBA), approximates this frequency response to express better the perception of sound by humans. Generally, a change in noise level of three dBA is barely perceptible to most listeners. A scale relating sounds encountered in daily life to their approximate dBA values is provided in Table 3.4-1.

Table 3.4-1. Common Sounds and Their Levels

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

Source: Harris, 1998
dBA = A-weighted decibel

The dBA noise metric describes steady noise levels. Although very few noises are, in fact, constant; therefore, a noise metric, Day-night Sound Level (DNL) has been developed. DNL is defined as the average sound energy in a 24-hour period with a 10-dB penalty added to the nighttime levels (10 P.M. to 7 A.M.). DNL is a useful descriptor for noise because (1) it averages ongoing yet intermittent noise, and (2) it accounts for the total sound energy over a 24-hour period. In addition, Equivalent Sound Level (L_{eq}) is often used to describe the overall noise environment. L_{eq} is the average sound level in dB.

The Noise Control Act of 1972 (P.L. 92-574) directs Federal agencies to comply with applicable Federal, state, interstate, and local noise control regulations. In 1974, the EPA provided information suggesting that continuous and long-term noise levels in excess of DNL 65 dBA are normally unacceptable for noise-sensitive land uses such as residences, schools, churches, and hospitals. The El Paso County Noise Ordinance (02-1, Section §30-15-401) maintains the following noise levels as shown in Table 3.4-2 and

Table 3.4-3 by land use and vehicle class. Notably, construction activities are subject to the sound level permitted for industrial areas only for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period to complete the project. At any other time, construction activities are subject to the sound level for the areas indicated residential, commercial, industrial, or non-specified.

Table 3.4-2. El Paso County Maximum Noise Levels by Land Use

	Maximum Sound Level (dBA)	
Land Use	**7:00 a.m.-7:00 p.m.**	**7:00 p.m.-7:00 a.m.**
Residential property or commercial area	55	50
Industrial area or construction activities	80	75
Non-specified areas	55	50

Source: El Paso County §30-15-401

Note: In the hours between 7:00 a.m. and 7:00 p.m., the noise levels permitted by this section may be exceeded by ten (10) dBA for a period not to exceed fifteen (15) minutes in any one (1) hour period.

dBA = A-weighted decibel

Table 3.4-3. El Paso County Maximum Noise Levels for Vehicles

Vehicle Class Manufacturer's GVWR	Maximum Noise in Speed Limit 35 mph or Less Zone (dBA)	Maximum Noise in Speed Limit over 35 mph Zone (dBA)
GVWR over 10,000 pounds (4,536 kilograms) or any combination of vehicles towed by such motor vehicle.	86	90
Any other motor vehicle or combination of vehicles towed by any other motor vehicle, including automobiles, vans, light trucks or motorcycles.	80	84

Source: El Paso County §30-15-401

dBA = A-weighted decibel; GVWR = gross vehicle weight rating; kg = kilogram

3.4.1.2 Existing Noise Environment

Existing sources of noise associated with Fort Carson include aircraft and traffic as well as large- and small-caliber weapons training. The primary sources of noise are the firing of weapons, specifically large-caliber weapons such as artillery and tank main guns, as well as the operation of military aircraft at BAAF. Secondary sources of noise include motor vehicle traffic, consisting of cars, trucks, and tracked vehicles.

To protect the public from noise hazards associated with military activities in the interest of their health, safety, and general welfare, and to prevent degradation of mission capability due to encroachment, the Army has established an Environmental Noise Management Program. By examining the effects of noise on an installation's adjacent communities, the program establishes a background for evaluating land use noise levels. The program then assesses noise zones from Army-generated operations to identify areas affected by noise and to describe each area's land use compatibility. The Installation maintains an Installation Operational Noise Management Plan that outlines all the efforts to minimize noise. These measures include complaint management and investigation, community outreach and education, pre-notification for unusually loud events, and the Installation Compatible Use Zone Program (USACHPM, 2006).

Background noise levels (DNL and L_{eq}) were estimated for the proposed areas and surrounding areas using the techniques specified in the *American National Standard Quantities and Procedures for Description and Measurement of Environmental Sound Part 3: Short-term measurements with an observer present.* Table 3.4-4 outlines the closet Noise Sensitive Areas (NSAs) such as residents, schools, churches, and hospitals, and the estimated existing noise levels at each location. Notably, the proposed reclaimed water expansion associated with Alternative 4 would be throughout the western parts of the Main Post area, and there would be residences along the roadways throughout the project area.

Table 3.4-4. Noise Sensitive Areas and Estimated Background Noise Levels at Proposed Sites

	Closest NSA				Estimated Existing Sound Levels (dBA)		
Site	**Distance (feet)**	**Direction**	**Type**	**Land Use Category**	**DNL**	**Leq (Daytime)**	**Leq (Nighttime)**
Proposed WTE Site (Alternative 1)							
Gate 19	3,420	East	Residential	Quiet Commercial, Industrial, and Normal Urban Residential	55	53	47
Proposed Biomass Sites (Alternative 2)							
Bravo North	4,315	Northeast	Residential	Quiet Commercial, Industrial, and Normal Urban Residential	55	53	47
CEP Biomass	5,600	Northeast	Residential				
Gate 19	3,420		Residential				
Proposed PV Array Sites (Alternative 3)							
Chiles	100	West	Multi-Family Residential	Quiet Commercial, Industrial, and Normal Urban Residential	55	53	47
SWMU 1-170	2,550	North	Hospital				
SWMU 5 (Site 1)	1,870	North	Residential				
SWMU 5 (Site 2)	2,525	North	Residential				
Bravo North	4,280	Northeast	Residential				
Butts Road	5,565	Northeast	Residential				
Magrath Avenue	2,150	East	Residential				
Gate 2 North	100	North/East /South	Residential	Quiet Suburban (Semi-Urban) Residential	50	48	42
Gate 2 South	100	North/East /South	Residential				
Wildhorse	10,700	South	Residential				
Titus/Signal Hill	520	West	Residential				
Ray Nixon	11,700	East	Multi-Family Residential				
Tent City	3,970	West	Residential				

Table 3.4-4. Noise Sensitive Areas and Estimated Background Noise Levels at Proposed Sites

Site	Closest NSA			Land Use Category	Estimated Existing Sound Levels (dBA)		
	Distance (feet)	Direction	Type		DNL	Leq (Daytime)	Leq (Nighttime)
Proposed Wind Turbine Site (Alternative 5)							
Wildhorse	10,700	South	Residential	Quiet Suburban (Semi-Urban) Residential	50	48	42
Additional Future Net Zero Energy Sites (Alternative 6)							
Highway 115	1,100	Northwest	Residential	Quiet Suburban (Semi-Urban) Residential	50	48	42
Fremont	5,500	North	Residential				
COARNG	6,130	North	Residential				

CEP = Central Energy Plant; COARNG = Colorado Army National Guard; dBA = A-weighted decibel; DNL = day-night sound level; L_{eq} = equivalent sound level; NSA = noise sensitive area; PV = photovoltaic; SWMU = Solid Waste Management Unit

3.4.2 ENVIRONMENTAL CONSEQUENCES

This section provides a discussion of potential impacts to the noise environment that could result from the alternatives described in Section 2.4. As stated in Section 3.1, a significant impact to noise would (1) result in the violation of applicable Federal, state, or local noise ordinance, (2) create incompatible land uses for areas with sensitive noise receptors outside the Installation boundary, or (3) would be loud enough to threaten or harm human health.

3.4.2.1 No Action Alternative

Selecting the No Action Alternative would result in no impact to the ambient noise environment. Ambient noise conditions would remain as described in Section 3.4.1.

3.4.2.2 Proposed Action Alternatives

3.4.2.2.1 Noise Effects Common to All Proposed Action Alternatives

Implementation of any of the Proposed Action Alternatives would have some form of construction noise primarily from the temporary use of heavy equipment. Individual pieces of construction equipment typically generate noise levels of 80 to 90 dBA at a distance of 50 feet (Table 3.4-5). With multiple items of construction equipment operating concurrently, noise levels can be relatively high during daytime periods at locations within several hundred feet of active construction sites. The zone of relatively high construction noise levels typically extends to distances of 400 to 800 feet from the site of major equipment operations. Locations more than 800 feet from construction sites seldom experience appreciable levels of construction noise. Specific effects associated with construction noise at individual sites are outlined in the alternatives below.

Although construction-related noise impacts would be minor and temporary, regardless of which alternatives were ultimately selected, the following BMPs would be performed to reduce further any realized noise impacts:

- Construction would primarily occur during normal weekday business hours in areas adjacent to noise sensitive land uses such as residential areas, and
- Construction equipment mufflers would be properly maintained and in good working order.

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

Table 3.4-5. Noise Levels Associated with Outdoor Construction

Construction Phase	dBA L_{eq} at 50 feet from Source
Ground Clearing	84
Excavation, Grading	89
Foundations	78
Structural	85
Finishing	89

Source: EPA, 1971

dBA = A-weighted decibel; L_{eq} = equivalent sound level

3.4.2.2.2 Alternative 1

Alternative 1 would have minor increases in noise from the temporary use of heavy equipment during construction, and the use of solid waste delivery trucks and potential industrial noise from operation of the proposed plant. In general, the potential for noise effects due to construction would be similar to those described in Section 3.4.2.2.1. Specific to the Gate 19 site, however, there are no NSAs within 800 feet of the proposed site (Table 3.4-4); therefore, impacts from construction would be negligible.

The proposed WTE plant is in the preliminary design stage. Therefore, a complete equipment list and associated manufacturers specifications are not finalized. In general, the turbines would dominate the noise producing equipment associated with the proposed plant. Turbines, spun via steam from combusted municipal waste, would be the loudest component of the plant. In addition, there would be some level of noise associated with the tipping area where trucks would dump waste for sorting.

In addition, there may be other noise producing activities and equipment associated with the plant. Although the equipment would be enclosed in the plant, engine intakes and exhausts may be open to the exterior of the buildings. Depending on the wind conditions, the plant could be audible to nearby residences and other NSAs. This would be true more so at night when background noises were more limited. Based on the best available information, mitigation in the form of reductions by design (i.e., silencers, enclosures, and other engineering controls) would be required. Mitigation measures are outlined in Section 3.4.4.1 that would result in less than significant adverse impacts.

The proposed WTE plant would potentially require 60-120 trucks/day for operations which would involve hauling feedstock to the plant from Fort Carson and the surrounding Colorado Springs area. Off-Post vehicles would access the Installation from I-25. Existing traffic along I-25 ranges from 38,000 to 112,000 vehicles per day in areas near the Installation (CDOT, 2010). Because noise is measured on a logarithmic scale, doubling traffic volumes increases the noise level by approximately 3 dBA. The additional trucks would constitute only a minute incremental change in the existing traffic along I-25 and would have no perceptible change on the existing noise environment. There would be a barely perceptible change due to traffic noise along Wilderness Road, Military Reservation Boundary Road, Santa Fe Avenue, and Charter Oak Ranch Road as trucks access the proposed plant from areas both on- and off-Post; however, there are no NSAs along these roadways. As a result, sound levels combined from the existing and proposed facilities during operation, therefore, are expected to be only slightly greater than existing conditions at the nearest residential community. These adverse effects would be minor.

3.4.2.2.3 Alternative 2

Alternative 2 would have minor increases in noise from the temporary use of heavy equipment during construction, and the use of delivery trucks and potential industrial noise from operation of the proposed plant. In general, noise effects due to construction would be similar to those described in Section 3.4.2.2.1. There are no NSAs within 800 feet of any of the proposed sites (Table 3.4-4); therefore, short-term effects from the construction noise would be negligible.

The proposed biomass plant is in the preliminary design stage. Therefore, a complete equipment list and associated manufacturers specifications are not finalized. As with the WTE plant, and for similar reasons, the biomass plant could be audible to nearby NSAs. Regardless of which alternative is ultimately selected, mitigation in the form of reductions by design (i.e., silencers, enclosures, and other engineering controls) would be required. Mitigation measures are outlined in Section 3.4.4.1 would avoid adverse significant impacts.

Alternative 2a and 2c. The proposed biomass plants would potentially require 15-25 trucks/day for operations which would involve hauling wood chips to the plant from sources at distances of up to 120 miles away. Off-Post vehicles would access the Installation from I-25 or SH 115. As with the WTE plant, and for similar reasons, the additional trucks would constitute only a minute incremental change in the existing traffic along these roadways and would have no perceptible change on the existing noise environment. There would be a barely perceptible change due to traffic noise along Wilderness Road, Military Reservation Boundary Road, Santa Fe Avenue, and Charter Oak Ranch Road as trucks access the proposed plant; however, there are no NSAs along these roadways. These adverse effects would be minor.

Alternative 2b. The proposed biomass plants would potentially require 15-25 trucks/day for operations. Off-Post vehicles would access the Installation from I-25 via South Academy Boulevard or Magrath Avenue. Existing traffic along I-25 ranges from 38,000 to 112,000 vehicles per day and existing traffic along Academy Bowler ranges from 45,000 to 74,000 vehicles per day in areas near the Installation (CDOT, 2010). As with the WTE plant and for similar reasons, the additional trucks would constitute only a minute incremental change in the existing traffic along these roadways and would have no perceptible change on the existing noise environment. There would be a barely perceptible change due to traffic noise along Magrath Avenue as trucks access the proposed plant; however, there are no NSAs along this roadway. These adverse effects would be minor.

3.4.2.2.4 Alternative 3

Alternative 3 would have short-term minor adverse effects on the noise environment. In general, noise effects due to construction would be similar to those described in Section 3.4.2.2.1. There are NSAs within 800 feet of Chiles, Gate 2, and Titus/Signal Hill sites that may experience appreciable levels of construction noise (Table 3.4-4). Therefore, short-term effects from the construction noise would be minor. There would be no noise from the operation of the PV arrays, and there would be no long-term changes in the noise environment. Noise would not exceed standards as determined by the Federal, state, and/or local government.

3.4.2.2.5 Alternative 4

Alternative 4 would have short-term minor adverse effects on the noise environment. In general, noise effects due to construction would be similar to those described in Section 3.4.2.2.1. There are NSAs within 800 feet of the proposed reclaimed water expansion project footprint that may experience appreciable levels of construction noise. Therefore, short-term effects from the construction noise would be minor. All equipment associated with the VFD booster would be fully enclosed in any noise sensitive locations. It is not expected that noise would travel beyond the immediate area the VFD booster equipment. These effects would be negligible. There would be no noise from the operation of the reclaimed water expansion components, and there would be no long-term changes in the noise environment. Noise would not exceed standards as determined by the Federal, state, and/or local government.

3.4.2.2.6 Alternative 5

Alternative 5 would have short- and long-term minor adverse effects on the noise environment. In general, noise effects due to construction would be similar to those described in Section 3.4.2.2.1. There are no NSAs within 800 feet of the proposed wind turbine site; therefore, short-term effects from the construction noise would be negligible.

Operation of the proposed wind turbines could generate disruptive noise levels at sensitive receptors within several hundred feet of the wind turbines. The level of noise generated and distance traveled is dependent upon a combination of factors including wind strength and direction, the rate of turbine spin, and moisture in the air. Due to the distance of the nearest NSA (approximately 2 miles south of the proposed site) and given the predominant wind direction is from the southwest, the possibility that nearby residents would notice a perceptible change in the noise environment is unlikely. To the greatest extent possible noise generated by wind turbine development would be reduced through siting. Less than significant adverse impacts would, therefore, be anticipated.

3.4.2.2.7 Alternative 6

Alternative 6 would have short-term minor adverse effects on the noise environment. In general, noise effects due to construction would be similar to those described in Section 3.4.2.2.1. As with Alternative 3, there are NSAs within 800 feet of Chiles, Gate 2, and Titus/Signal Hill sites that may experience appreciable levels of construction noise (Table 3.4-4). Therefore, short-term effects from the construction noise would be minor. There would be no noise from the operation of the future ground-source heating and cooling projects or PV arrays, and there would be no long-term changes in the noise environment. Noise would not exceed standards as determined by the Federal, state, and/or local government.

3.4.2.2.8 Alternative 7

Implementation of Alternative 7 would have minor adverse short-term impacts on the noise environment. In general, noise effects due to maintenance and installation of infrastructure upgrades would be similar to those described in Section 3.4.2.2.1 and would be anticipated to have no more than a minor adverse impact. Behavioral and conservation measures regarding waste, water, and energy would have no impact on the noise environment.

3.4.3 CUMULATIVE EFFECTS

Alternatives 1, 2, and 5 could add an incremental cumulative increase in noise. These effects would be due additional truck traffic on the I-25 corridor east of the Fort Carson boundary and possibly equipment noise from the operation of the WTE plant, biomass plant, and wind turbines. Both historically and currently, highway noise, and sporadic military activity have been the primary contributors to the noise environment. Despite these activities, the region remains relatively suburban; therefore, the amount of noise sensitive receptors within the region is unlikely to increase within the near future. No large-scale projects or proposals at Fort Carson including CAB and Grow the Army actions have been identified that when combined with the Proposed Action Alternatives would create areas of incompatible land use or violate any Federal, state, or local noise ordinance; therefore, less than significant cumulative impacts to noise would be anticipated.

3.4.4 PROPOSED IMPACT REDUCTION MEASURES

3.4.4.1 Mitigation

As part of the design activities the Army would need to evaluate noise control measures to be implemented at the WTE and biomass plant site for Alternatives 1 or 2. The following mitigation measures would avoid adverse significant impacts:

- Perform a preconstruction noise study to determine a baseline noise level at the closest property line and adjacent buildings.
- Design the facility, through building and other equipment specifications (such as silencers, mufflers, engineered sound enclosures, etc.), to reduce noise levels as measured at the property line adjacent to residential neighbors or at facilities which house patients, to less than 65 dBA between the hours of 6 a.m. and 9 p.m., or 55 dBA between the hours of 9 p.m. to 6 a.m.
- Perform a post-construction sound survey at the site. If the noise attributable to the operation of the plant or wind turbines is not less than 65 dBA between the hours of 6 a.m. and 9 p.m., or 55 dBA between the hours of 9 p.m. to 6 a.m. for locations identified, additional noise controls shall be installed within one-year of the in-service date to meet this level.

These criterion would equate to a noise level of 65 dBA DNL, which is the threshold (i.e. absolute maximum recommended) for noise sensitive land uses.

No mitigation measures would be required for Alternatives 3, 4, 5, 6, or 7.

For all Proposed Action Alternatives, construction would primarily occur during normal weekday business hours in areas adjacent to noise sensitive land uses such as residential areas. Construction equipment mufflers would be properly maintained and in good working order. These measures would serve to reduce the level of adverse impacts during construction.

3.5 Geology and Soils

3.5.1 AFFECTED ENVIRONMENT

3.5.1.1 Geology

Fort Carson is located within two physiographic subsections, the Colorado Piedmont section of the Great Plains Province, and the Rampart Range section of the Southern Rocky Mountains Province. The eastern portion of the Installation is within the Colorado Piedmont section, which is distinguished from the rest of the Great Plains by the lack of Tertiary alluvium, the presence of exposed Cretaceous bedrock, and greater topographic relief, although the topography is less rugged than the Rampart Range section. The western section of the Installation is within the Rampart Range physiographic section, which consists of the portion of the Colorado Front Range between the South Platte River and the Colorado Springs area, which is interspersed with fault-bounded blocks of Precambrian granites, schists, and gneisses bordered on the east by a belt of Paleozoic and Mesozoic rock foothills. The main landforms at Fort Carson include the high plains on the southeastern, west central and western portions of the Installation, the low plains along the eastern border, and the steep terrain of mountain ranges (Timber Mountain, Wild Mountain and Booth Mountain. The elevations at the Installation range from 5,750 feet above sea level at the Main Post, to 6,897 feet at Timber Mountain. The lowest point at Fort Carson is Beaver Creek Valley (~5,400 feet).

The age of the bedrock at Fort Carson ranges from the Upper Cretaceous (146 million years ago) through modern sediment that is deposited by steams. The basal bedrock is the undivided Upper Cretaceous Carlie Shale, Greenhorn Limestone and Graneros Shale. This sequences includes soft, multi-colored shale and thin limestone beds. The next younger formation, the Niobrara contains soft, limey shale and local thin beds of gray and white chalk and limestone. Above the Niobrara is the Pierre Shale, which is extensively present in the northern portion of the Installation. The Pierre shale is soft, gray and greenish-gray, and tan siltstones with fine-grained sandstone (Rowley et al., 2004). Overlain on top of the Cretaceous bedrock is a sequence of unconsolidated Quaternary sediment. The older gravels are dated to the middle Pleistocene (178,000-126,000 years ago), and consist of light-reddish-brown clay sand and pebbly to boulder gravel, and are typically found about 30 to 100 feet above the level of modern streams (Rowley et al., 2004). Finally, modern alluvium has been deposited in areas where the stream levels are slow enough to deposit sediment, typically around the Fountain Creek watershed. Recent wind-blown deposits are also located around the BAAF, and consist of fine to coarse-grained sand and silt, typically as a thin veneer on other superficial deposits. Artificial fill is the waste rock and fill used in the construction of roads, buildings and landfills.

There are three main faults around Fort Carson: Ute Pass Fault, Rampart Range Fault, and Oil Creek Fault. All are located along the western edge of the Installation. These faults are low-angle thrust faults, which bound the eastern edge of the Rampart Range, just west of Fort Carson. Small earthquakes have occurred in the region, and models of earthquake probability show that there is a low probability of a damaging earthquake could occur. Fort Carson is located in Seismic Zone one, which is considered a low seismic risk (Fort Carson, 2007a). Since 1973, 15 earthquakes have been recorded within 60 miles of Fort Carson, most of which were measured at a magnitude of less than 4.0 (USGS, 2012). The largest earthquake in the area recorded was at a magnitude 4.0 at a distance of approximately 75 miles from the center of Fort Carson (USGS, 2012).

3.5.1.2 Soils

Thirty-four soil categories and 65 soil associations have been identified at Fort Carson (Larsen et al., 1979; Larsen, 1981). The most common soil associations are the Penrose-Minnequa Complex, Penrose-Rock Complex, Schamber-Razor Complex, and Razor-Midway Complex. The soils in the Installation are classified as aridisols (dry, desert-like soils) and entisols (soils that do not show any profile development and which are largely unaltered from their parent rock). These types of soils tend to erode easily, form unstable slopes, and form unstable clay profiles (USACE, 2002). Table 3.5-1 presents the list of soil associations that are found at the Proposed Action Alternative project sites (Alternatives 1 through 6), and their limiting soil characteristics. Figure 3.5-1 shows the extent of the soils present at these sites.

There are several types of soil characteristics that could affect construction or influence the soil-specific impacts from the Proposed Action. Fort Carson has documented areas with severe erosion, especially from water runoff in areas with steep topography, and soils that have a greater potential for runoff erosion or wind movement. Soils that present the greatest potential for runoff erosion typically contain clays, silty clays, and clay loams. The soils within the Fountain Creek watershed, along the eastern section of the Installation also tend to erode more easily. Several soils in the alternative sites are considered with the greatest concern for soil loss from erosion includes the Wiley-Kim, Razor-Midway complex, and Schamber-Razor complex (Fort Carson, 2007a). Soil erosion is greatest in areas where vegetation has been removed, so soils which easily erode have increased erosion rates once construction starts. Erosion from water action can strip topsoil and unconsolidated sediment which exposes the bedrock, create incised gullys, and generate unstable slopes. Fort Carson has recognized the greater potential for erosion on the Installation and has implemented an Erosion and Sediment Control Program, which outlines techniques to minimize and mitigate the effects of soil erosion and sedimentation at the Installation (Fort Carson, 1998).

Soils at Fort Carson have high shrink-swell potential where montmorillonitic clays are the primary component of the soil column. The shrink-swell potential relates to the loss or gain of moisture in soil, which causes the potential for soil to change volume. Increasing soil moisture results in increasing volume and the opposite effect results from decreasing soil moisture. Water tends to infiltrate more slowly in soils with high clay contents, which can contribute to greater stormwater runoff in areas with large concentrations of shrink-swell soils. Buildings with improperly engineered foundations also can be damaged by the change in soil volume over time.

The hydrologic soil rating is another categorization method to estimate a soil's potential for erosion, because stormwater runoff is one of the main contributors to topsoil erosion in disturbed soils. The rating is calculated using characteristics of the soil column, including the ease that water can infiltrate the soil, soil surface texture, amount of organic matter, slope, or the depth to bedrock or the high water table. Surface water runoff potential is greatest in soils that primarily consist of clay particles, have shallow depths, or steeper slopes which would prevent water infiltration. There are four hydrogeologic soil groups ranging from A, which consists of sand and gravel textures and high surface water absorption potential, to D, which contains more clay, and a greater potential for shrink-swell characteristics (USDA, 2007). The soils at Fort Carson with the greatest potential for erosion from water runoff would be placed in Group D, and are identified in Table 3.5-1.

Table 3.5-1. Fort Carson Soil Association Type and Descriptions

Map Unit #	Soil Association	Limiting Characteristic[1]	Alternative	Location[2]
12	Bresser sandy loam, 3 to 5 percent slopes	None	3	TCS
30	Fort Collins loam, 0 to 3 percent slopes	None	1, 2a	G19S
31	Fort Collins loam, 3 to 8 percent slopes	None	3	BRS
43	Kim loam, 1 to 8 percent slopes	EE	1, 2a 3	G19S BRS
47	Limon clay, 0 to 3 percent slopes	SS	3	RNS
52	Manzanola clay loam, 1 to 3 percent slopes	SS	3	MAS

Table 3.5-1. Fort Carson Soil Association Type and Descriptions

Map Unit #	Soil Association	Limiting Characteristic[1]	Alternative	Location[2]
53	Manzanola clay loam, 3 to 9 percent slopes	SS	3	BRS
58	Neville-Rednun complex, 3 to 9 percent slopes	None	6	H115S
59	Nunn clay loam, 0 to 3 percent slopes	SS	4	RWEL
74	Razor stony clay loam, 5 to 15 percent slopes	SS	3	G2NS
75	Razor-Midway complex	SS, D	1, 2a 2b 3, 6 4 6	G19S, BNS1, BNS2 BNS1, BRS, CS, G2NS, G2SS, SWMU 1-170, SWMU5S1, SWMU5S2, MAS, RNS, T/SHS, RWEL BNS2, COARNG, FS
79	Satanta loam, 0 to 3 percent slopes	None	3	BRS, TCS
82	Schamber-Razor complex, 8 to 50 percent slopes	SS	1, 2a 2b 2c 3, 6 4, 6	G19S BNS1, BNS2 CBS BNS1, BRS, , RNS, SWMU 1-170, SWMU5S1, TCS, T/SHS RWEL BNS2, COARNG
86	Stoneham sandy loam, 3 to 8 percent slopes	None	1, 2a	G19S
93	Rizozo-Neville complex, 3 to 30 percent slopes	None	6	FS
113	Military impact area, unsurveyed	None	3, 6	RNS
MaB	Manvel silt loam, 1 to 5 percent slopes	EE	3, 5, 6	WH
Mv	Minnequa-Manvel loams	EE	3, 5, 6	WH
PmE	Penrose-Minnequa complex, 1 to 15 percent slopes	EE, D	3, 5, 6	WH
PrF	Penrose-Rock outcrop complex, 25 to 65 percent slopes	EE, D	3, 5, 6	WH
Wk	Wiley-Kim loams	EE	3, 5, 6	WH

Sources: Larsen, 1981; Larsen et al., 1979

1. Limiting Characteristic Codes: EE: Erodes Easily, SS: Shrink-Swell, D: Hydrologic Soil Group D

BNS1 = Bravo North Site 1; BNS2 = Bravo North Site 2; BRS = Butts Road Site; CBS = CEP Biomass Site; COARNG = Colorado Army National Guard; CS = Chiles Site; G19S = Gate 19 Site; G2NS = Gate 2 North Site; G2SS = Gate 2 South Site; H115S = Highway 115 Site; FS = Fremont Site; MAS = Magrath Ave Site; RWEL = Reclaimed water expansion line; RNS = Ray Nixon Site; TCS = Tent City Site; T/SHS = Titus/Signal Hill Site; SWMU = Solid Waste Management Unit; WH: Wildhorse

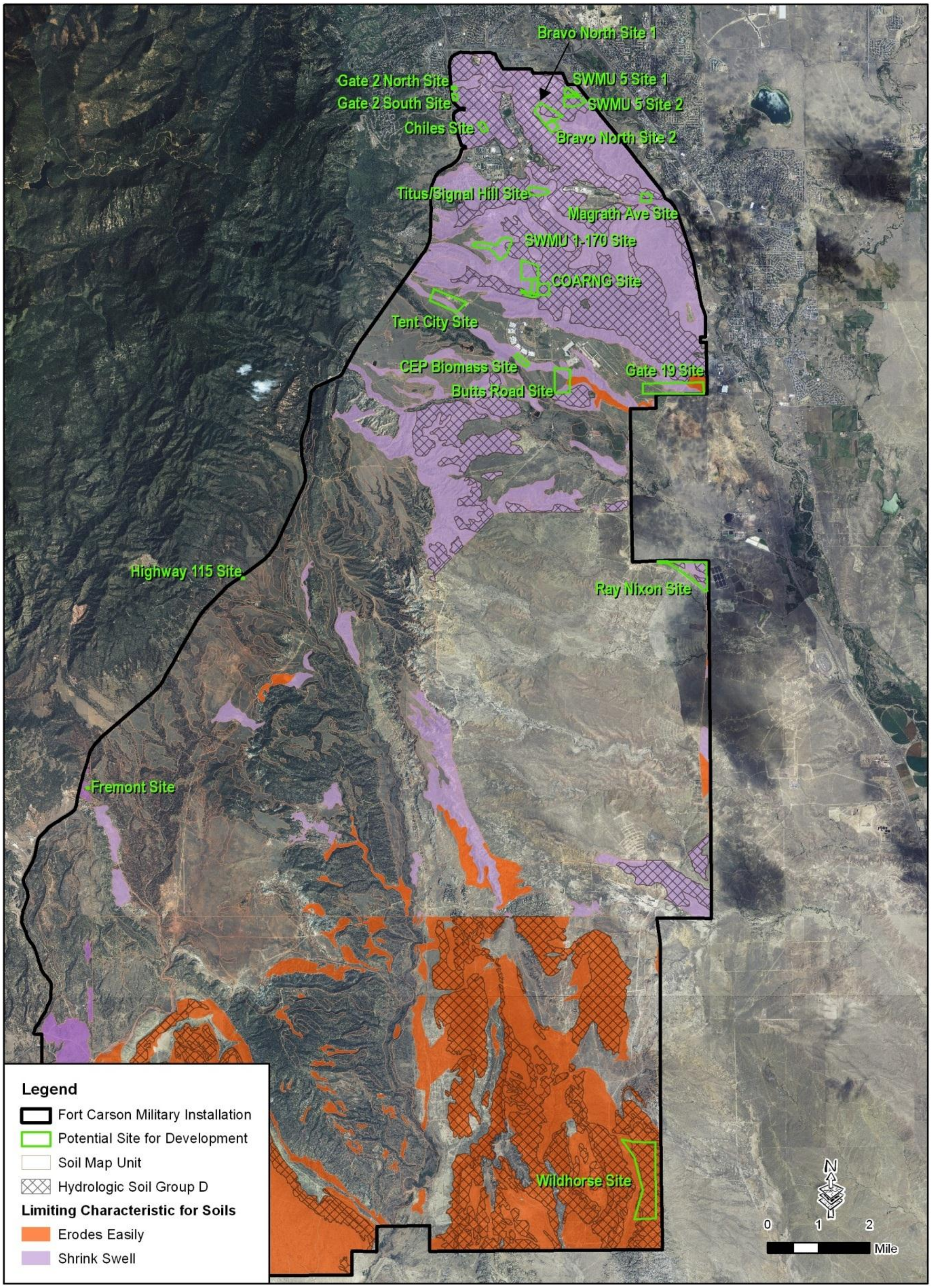

Figure 3.5-1. Map of Soil Associations at Fort Carson

3.5.2 ENVIRONMENTAL CONSEQUENCES

This section provides a discussion of potential impacts to geology and soils that could result from the alternatives described in Section 2.4. As stated in Section 3.1, an impact to geology and soils would be considered significant if it induces wind borne or stormwater related soil erosion beyond the threshold acceptable for the soil type as classified by the NRCS.

3.5.2.1 No Action Alternative

If the No Action Alternative is chosen, then Fort Carson would not implement the Net Zero Initiatives, although the Fort Carson Sustainability Program would continue to operate. None of the proposed facilities would be constructed, so there would be no impacts to the soils or geology if the No Action Alternative is chosen. The Fort Carson Sustainability Program would continue to promote sustainable land use throughout the Installation; therefore, the amount of ground disturbance over the environmental baseline would remain unchanged, so there would be no impacts from soil loss if the No Action Alternative is chosen.

3.5.2.2 Proposed Action Alternatives

3.5.2.2.1 Geology and Soil Impacts Common to All Proposed Action Alternatives

Impacts to Geology

The potential for geologic impacts from the Proposed Action Alternatives at Fort Carson is based on the potential that the Proposed Action would expose people to geologic hazards or remove geologic resources, such as mineral or aggregate deposits, or unique landforms. As discussed in the INRMP, there are two active mining permits for refractive clay in southwest Fort Carson; however, none of the alternatives are in this area, so they would not impact access to these commercial mining activities (Fort Carson, 2007a). There would also be no impacts relating to geologic hazards because all structures would be constructed in accordance with Colorado building standards, which take into account the potential for seismic activity. There would be no impacts to the geologic resources once the Proposed Action is operational.

Increased Potential for Erosion and Loss of Topsoil

The Proposed Action Alternatives would all involve some level of surface disturbance of the soils. During construction, disturbed soils are exposed to wind and water erosion, which would contribute to an overall loss of topsoil at the project sites. Construction equipment at project sites would also contribute to soil compaction, which can reduce the ability of water to infiltrate the soil profile, and prevent plants from establishing strong root systems. Grading and clearing the project sites for construction would result in the loss of vegetative cover, which would also increase the potential for erosion from wind and water action.

The loss of soils from wind erosion would be a temporary minor impact during construction, and would be minimized once construction is complete and native vegetation is reestablished. Soils that contain silt loams tend to erode easily, and the effects can be compounded if the soil profile is shallow. At the project sites, the Kim loam, Manvel silt loam, Minnequa-Manvel loams, Penrose-Minnequa complex, Renrose-Rock outcrop complex and Wiley-Kim loams are all soils that are particularly susceptible to erosion from wind and water. In addition, the Minnequa-Manvel and the Penrose-Minnequa complex are both within Hydrologic Group D, which indicates that they allow less water infiltration and greater stormwater runoff.

Table 3.5-1 presents the list of soils at the project sites with shrink-swell characteristics. Soils with high shrink-swell potential can result in problems with building foundations and stability, and may require additional engineering considerations. Shrink-swell soils can also impede water infiltration, which would increase erosion from additional water runoff.

Fort Carson has previously implemented erosion control plans to minimize soil loss from disturbed areas and excessive gullying. Erosion mitigation BMPs for construction, such as silt fences, topsoil sequestration and reseeding with native vegetation after construction ends, would reduce the amount of soil lost by erosion. The INRMP has included several management goals that if implemented, would reduce sedimentation and soil loss from runoff once the alternatives are constructed (Fort Carson, 2007a). Appendix J of the Stormwater Pollution Prevention Plan (SWPPP) provides additional guidance on the best techniques to control water runoff and erosion during and after construction (Fort Carson, 2010b). In areas with extreme gullying and soil loss, banksloping streambeds, and construction erosion dams can reduce additional loss.

3.5.2.2.2 Alternative 1

Impacts to Geology

The proposed WTE plant that would be constructed under Alternative 1 would be located on recent windblown sand (west), Pleistocene-aged gravel deposits (center), and Pierre Shale (east). The western edge of the site is relatively flat; the site slopes downward to the east and north, with several stream gullies that cut through the alluvium. Construction of the WTE plant would encompass approximately 40 acres, and depending on the location in the site, would include some grading, as the topographic elevation change is 120 feet from the west to the east. There are records of gravel pits directly to the south of the Alternative 1 site on the other side of the Fort Carson border, and 0.7 miles to the southwest of the proposed site. The grading and construction of the WTE plant, however, would reduce the amount of aggregate and gravel in the area by a miniscule amount, and would not result in an impact to access to these sites.

Impacts to Soils

The WTE plant would require up to 40 acres of permanent surface disturbance during construction; soils within this footprint would be permanently lost and covered with impervious surface. The Gate 19 site contains five soil associations throughout the entire site. The largest soil association is Schamber-Razor complex, 8 to 50 percent slopes (40 percent), followed by Fort Collins loam, 0 to 3 percent slopes (25 percent), Stoneham sandy loam, 3 to 8 percent slopes (18 percent), Kim loam, 1 to 8 percent slopes (17 percent), and less than 1 percent of Razor-Midway complex. Depending on where the plant would be located at the Gate 19 site, a combination of these soils would be disturbed during construction.

Of the soil associations at the project site, the Schamber-Razor complex, and Razor-Midway contain large concentrations of clay, which have a high shrink-swell potential, and may require additional engineering consideration. The Razor-Midway complex is within the Hydrologic group D because the soils tend to form in shallow alluvial deposits. The Kim loam is also a soil that erodes easily from wind and water action. The Fort Collins loam, and Stoneham sandy loam (43 percent of the site) do not contain any limiting characteristics. There would be minor impacts from soil loss and increased erosion during construction; however, it would be temporary and reduced with erosion BMPs. Reseeding the temporarily disturbed area and reestablishing native vegetation would reduce soil loss potential after construction is complete. There would be no impact during the operation period; Section 3.12 discusses stormwater management measures which would be taken to prevent excessive runoff from developed/impervious areas minimizing any erosion caused from runoff.

3.5.2.2.3 Alternative 2

Impacts to Geology

The impacts as a result of Alternative 2a would be the same as Alternative 1 because it would be located at the same location, and occupy approximately the same amount of space. If only 20 acres would be needed for the project, then it is likely that less cut and fill would be needed at the project site.

Alternative 2b is primarily located on Pierre Shale, although there may be local deposits of alluvial and gravel deposits. The project site is located on small slopes and hills in the Main Post area, with an elevation ranging from 5,860 to 5,880 feet above sea level. The general topographic slope is to the northeast, towards a small tributary for Fountain Creek. Construction for the biomass plant would require grading within the 20-40 acres that would be used for plant operations. There would be no impacts to geologic sources from this alternative.

Alternative 2c is located on the boundary between the Pierre Shale and older Cenozoic gravels. The topography slopes to the south east, towards Rock Creek. The modifications to the CEP would require an additional 16.5 acres for the biomass delivery and stockpile operations, which would likely require some cut and fill procedures to grade the delivery area. There would be no impacts to geologic resources from this alternative.

Impacts to Soils

The impacts as a result of Alternative 2a would be the same as Alternative 1 because it would be located at the same location. The proposed biomass plant would require up to 40 acres of permanent surface disturbance; soils within this footprint would be permanently lost and covered with impervious surface.

The proposed location for Alternative 2b, Bravo North Site 2, contains almost entirely Schamber-Razor complex, 8 to 50 percent slopes with less than one percent of the area Razor-Midway. Both of these soils have high amounts of clay, which results in shrink-swell characteristics. Similar to Alternative 2a, construction of the biomass plant would require up to 40 acres of permanent surface disturbance and soils within the plant footprint would be permanently lost and covered with impervious surface. Implementation of erosion control BMPs and engineering the plant for shrink-swell soils would minimize the impacts. Reseeding temporarily disturbed areas after construction complete would help to minimize post-construction erosion.

The Alternative 2c site would add biomass combustion capability to the CEP plant. The entire CEP Biomass site location is Schamber-Razor complex, 8 to 50 percent slopes, which contains high levels of clay, and demonstrates shrink-swell characteristics. The project would be constructed on 16.5 acres and soils within this footprint would be permanently lost and covered with impervious surface. Similar to the other alternatives, erosion BMPs outlined in the INRMP would reduce the impact related to topsoil loss and potential for erosion and adverse impacts would be temporary and minor.

3.5.2.2.4 Alternative 3

Impacts to Geology

Table 3.5-2 provides the geologic formation and topographic features for each potential PV site. The Gate 2 North, Gate 2 South, Chiles, and Magrath Avenue sites are all located within the Main Post area, which has been previously been graded and prepared for construction. There is a gravel pit recorded to the south of SWMU-1-10-170. A borrow pit has been recorded to the west of the Tent City site. The size of the PV unit would be constrained by the size of the site location; however the actual disturbance area for construction would be smaller than the site footprint. There are no anticipated impacts to geologic resources from Alternative 3.

Table 3.5-2. Fort Carson Geology at Proposed Photovoltaic Sites

Site Location	Acres	Geologic Formation	Topography
Gate 2 North	3.0	Pierre Shale	Flat, gradual slope to east
Gate 2 South	7.6	Pierre Shale	Flat, gradual slope to east
Chiles	12.7	Pierre Shale	Flat
SWMU 1-170	86.9	Artificial Fill, Pierre Shale	Previously excavated, slopes from southwest to northeast.
SWMU 5 (Site 1)	14.3	Pierre Shale	Sloping gradually southeast to Fountain Creek tributary
SWMU 5 (Site 2)	41.9	Pierre Shale	Sloping gradually northeast to Fountain Creek tributary
Bravo North (Site 1)	71.5	Pierre Shale	Local 20-foot hill
Butts Road	89.4	Pleistocene gravels, Pierre Shale in streambed	80-foot cliff to north, slopes gradually to east
Magrath Avenue	19.5	Pierre Shale, Modern alluvium	Gradual slope to southeast
Wildhorse	361.1	Niobrara Formation, southwest corner is Carlie Shale, Greenhorn Limestone and Graneros Shale	Central hill, 240-foot drainage cliff on eastern edge
Titus/Signal Hill	31.9	Pierre Shale	80-foot hill to the northeast of Titus Boulevard
Ray Nixon	146.8	Pierre Shale	Slope to southeast
Tent City	97.1	Cenozoic alluvium	Gradual slope to southeast

Source: Tweto, 1979.
SWMU = Solid Waste Management Unit

Impacts to Soils

Table 3.5-3 presents the soil associations and percentages for each of the PV site locations. In general, the Razor Stoney clay loam and Razor-Midway complex are found at the majority of the location sites. The following soils have shrink-swell characteristics: Limon clay, Manzanola clay loam, 1 to 3 percent slopes and 3 to 9 percent slopes, Razor stony clay loam, 5 to 15 percent slopes, Razor-Midway complex, and Schamber-Razor complex, 8 to 50 percent slopes. These soils have a lower water infiltration rate, and the change of soil volume can require additional engineering accommodations. The Razor-Midway complex is also part of Hydrologic Group D, which has a lower water infiltration rate. The Kim loam Penrose-Minnequa complex, Penrose-Rock outcrop complex, Manvel silt loam, Wiley-Kim loams, and Minnequa-Manvel loams have the "erodes easily" characteristic, and are susceptible to increased erosion from wind and water. In addition, the Minnequa-Manvel and the Penrose-Minnequa complex are both within Hydrologic Group D, which indicates that they allow less water infiltration and greater stormwater runoff.

Table 3.5-3. Alternative 3 Soil Association Locations

Site Location	Soil Association	Percent of Site
Gate 2 North	Razor stony clay loam, 5 to 15 percent slopes	71
	Razor-Midway complex	29
Gate 2 South	Razor-Midway complex	100
Chiles	Razor-Midway complex	100
SWMU 1-170	Razor-Midway complex	10
	Schamber-Razor complex, 8 to 50 percent slopes	90
SWMU 5 Site 1	Razor-Midway complex	100
	Schamber-Razor complex, 8 to 50 percent slopes	<1[1]
SWMU 5 Site 2	Razor-Midway complex	100
Bravo North Site 1	Razor-Midway complex	55
	Schamber-Razor complex, 8 to 50 percent slopes	45
Butts Road	Fort Collins loam, 3 to 8 percent slopes	44
	Kim loam, 1 to 8 percent slopes	6
	Manzanola clay loam, 3 to 9 percent slopes	18
	Razor-Midway complex	1
	Satanta loam, 0 to 3 percent slopes	<1[1]
	Schamber-Razor complex, 8 to 50 percent slopes	30
Magrath Ave	Manzanola clay loam, 1 to 3 percent slopes	41
	Razor-Midway complex	59
Wildhorse	Manvel silt loam, 1 to 5 percent slopes	7
	Minnequa-Manvel loams	<1[1]
	Penrose-Minnequa complex, 1 to 15 percent slopes	88
	Penrose-Rock outcrop complex, 25 to 65 percent slopes	2
	Wiley-Kim loams	2
Titus/Signal Hill	Razor-Midway complex	13
	Schamber-Razor complex, 8 to 50 percent slopes	87
Ray Nixon	Military impact area, unsurveyed	28
	Limon clay, 0 to 3 percent slopes	8
	Razor-Midway complex	35
	Schamber-Razor complex, 8 to 50 percent slopes	29
Tent City	Bresser sandy loam, 3 to 5 percent slopes	14
	Satanta loam, 0 to 3 percent slopes	54
	Schamber-Razor complex, 8 to 50 percent slopes	32

Sources: Larsen, 1981; Larsen et al., 1979

1. Less than 1 percent

SWMU = Solid Waste Management Unit

During construction of the PV sites, surface soils would be temporarily disturbed within the project site boundaries presented in Table 3.5-3. The disturbed soils would have a greater potential for increased erosion and soil loss. Erosion BMPs, such as silt fencing, wind breaks, topsoil segregation, and reseeding once construction is complete would minimize the potential for impacts from the surface disturbance.

During operations, the potential exists for concentrated runoff from the panels to cause localized erosion. The establishment of vegetation following construction activities would help in preventing this occurrence. If erosion is found at a PV site, design modifications could be conducted to include installation of gutters, splash plates, or additional rock placed beneath the drip line of the panels. Overall, minor to negligible adverse impacts would be anticipated from operations.

3.5.2.2.5 Alternative 4

Impacts to Geology

The expansion of the existing reclaimed water system would cross Pierre Shale deposits. The construction would occur entirely within the Main Post area, alongside existing roads and buildings. Therefore, there would be no impact to geologic resources during construction or operation.

Impacts to Soils

The expansion of the existing reclaimed water system would be entirely located within the Main Post area, alongside existing roads and buildings. The pipeline and construction buffer area would cross three separate soil complexes: Nunn clay loam, 0 to 3 percent slopes, Razor-Midway complex, and Schamber-Razor complex, 8 to 50 percent slopes. The Razor-Midway complex is the most common soil association, occupying 60 percent of the corridor. The Nunn clay loam consists of 31 percent of the corridor, and Schamber-Razor is located along 9 percent. All of these soils contain high levels of clay, which can dramatically change size when the water content changes. Additional engineering planning may be required to ensure pipeline integrity. The impacts from soil loss and increased erosion would be minor and temporary, because the use of erosion BMPs would be used during construction. There would be no impacts to the soil resources once construction is complete and the pipeline is in use.

3.5.2.2.6 Alternative 5

Impacts to Geology

The proposed wind turbines would be constructed in the Wildhorse site, which is described in Section 3.5.2.2.4. The likeliest locations for the turbines would be through the north-south center of the site, along a ridge, which is primarily the Niobrara formation. Each turbine would create approximately 1 acre of disturbance for construction and placement of the turbine. Some grading would likely be required to build the stable turbine footings. There would be no impacts to geologic resources from construction or operation of Alternative 5.

Impacts to Soils

Up to eight turbines would be located on the Wildhorse site, which contains five soil associations that are described in Tables 3.5-1. The Penrose-Minnequa complex, 1 to 15 percent slopes, is the largest soil association (88 percent), with lesser amounts of Penrose-Rock outcrop complex, Manvel silt loam, 1 to 5 percent slopes (7 percent), 25 to 65 percent slopes (2 percent), Wiley-Kim loams (2 percent), and less than 1 percent of Minnequa-Manvel loams. All of these soils have easily erodible characteristics, and would be especially susceptible to erosion along the stream-inscribed hills on the western edge of the project site. Each of the turbines would require a construction footprint disturbance of up to one acre, which includes the turbine pedestal, supporting structures, and construction laydown areas. Construction of the wind turbines would have a minor, temporary impact to the soils at the Wildhorse site, because of the erosion control measures and erosion BMPs that would minimize soil loss during construction and minimize erosion during operations. Minor permanent adverse impacts would occur in areas where the wind turbines are anchored into the ground (less than 1 acre per turbine).

3.5.2.2.7 Alternative 6

Impacts to Geology

Most of the potential PV sites in Alternative 6 were previously discussed in Section 3.5.2.2.4, with no impacts predicted for geologic resources. The Highway 115 site is located on bedrock which consists of the Fountain Formation, a Carboniferous-age sandstone and conglomerate. The Fremont site contains the Lykins Formation, which consists of sandstone, mudstones and limestones, and the Lyons Sandstone (Tweto, 1979). They are both located in relatively flat locations alongside Highway 115. The COARNG site is located on Pierre Shale, on a slope that grades downslope to the east-northeast. Therefore, there would be no impacts to geologic resources constructing PV installations at these sites.

The projected GSHP units would be located near existing buildings. Although they transfer heat energy to and from the crust, the amount of energy they would use is miniscule in relation to the total heat output from the crust. Therefore, there would be no impacts as a result of these projects.

In addition to the impacts described in this section, the checklist in Appendix B would help Fort Carson determine the potential for geologic impacts from any unique situation as a result of this alternative.

Impacts to Soils

Most of the potential PV sites in Alternative 6 were previously discussed in Section 3.5.2.2.4, with minor impacts predicted for from increased soil erosion. The entire Highway 115 site contains Neville-Redrun soil complex, with 3 to 9 percent slopes. This soil complex has no limiting characteristics that would require additional engineering procedures. The majority of the Fremont site is the Rizozo-Neville complex with 3 to 30 percent slopes, which covers 92 percent of the site. The rest is the Neville fine sandy loam with 3 to 8 percent slopes (8 percent) (Larsen, 1981). The COARNG site contains 58 percent Schamber-Razor complex, 8 to 50 percent slopes and 43 percent of Razor-Midway complex, both of which have shrink-swell characteristics. The Razor-Midway complex is also in Hydrologic Group D, which tends to have greater surface runoff. The Highway 115 and Fremont sites do not contain any limiting characteristics that were described in Section 3.5.1.2. Construction of the PV projects would require some grading and surface disturbance, although the footprints of the PV panels would be small percentage of the overall project site. The two sites are both approximately 1 acre in size, so the impacts to soil loss and increased erosion would be minor and temporary. To minimize the impacts from increased erosion and soil loss, erosion BMPs would be implemented during the construction phase. Silt fences, preserving topsoil during excavation, and reseeding the disturbed areas post-construction would minimize erosion during construction. During operations, as necessary, design modifications as discussed under Alternative 3, could be implemented to minimize erosion from runoff.

The ground-source heating and cooling projects would be located near existing buildings, which are surrounded by previously disturbed soils. Each disturbance footprint would also be very small, at 7 to 14 feet in diameter. Construction and post-construction erosion BMPs would minimize the amount of additional soil loss from the additional ground-source heating and cooling projects. Therefore, the impacts to soils from the projects would also be minor.

In addition to the impacts described in this section, the checklist in Appendix B would help Fort Carson determine the potential for geologic impacts from any unique situation as a result of this alternative.

3.5.2.2.8 Alternative 7

Implementation of Alternative 7 would have minor adverse short-term impacts on soils from those infrastructure upgrades requiring ground disturbance. In general, the potential for adverse soil impacts due to maintenance and installation of infrastructure upgrades would be similar to those described in Section 3.5.2.2.1 and would be anticipated to have no more than a minor adverse impact. Behavioral and conservation measures regarding waste, water, and energy would have no impact on soils. No adverse impacts would be anticipated for geological resources.

3.5.3 CUMULATIVE EFFECTS

As shown in Table 3.1-2, there are multiple projects already planned in the Main Post area, so there would be a slightly greater cumulative impact from increased soil erosion if the Main Post project sites in Alternatives 2b, 3, 4 or 6 are selected (e.g., Bravo North Sites 1 and 2, Magrath Avenue site). Additional development associated with the CAB, including garrison support facilities at the WRC and just west of BAAF would also result in a slightly greater cumulative impact from increased soil erosion if project sites in Alternatives 2c or 3 and 6 are selected (including Tent City and Butts Road sites). The CAB development activities include several hundred acres of ground disturbance; however, this action was determined to have potentially significant but mitigable impacts. Development projects considered within this analysis would permanently disturb soils, converting them into developed/impervious land which would cause an incremental adverse impact to soil resources on Fort Carson. In addition, during construction of these projects, the potential would exist for both wind-borne and runoff erosion potential in temporarily disturbed sites. In addition, training activities and related ground-disturbing activities from the CAB stationing would potentially result in an overall long-term increase in cumulative adverse impacts to soils.

Less than significant adverse cumulative impacts to soil resources would, however, be anticipated. Intensity of cumulative impacts during construction would be reduced through timing of construction projects (i.e., it is unlikely that all construction projects would occur concurrently) and through utilization of BMPs for erosion control during construction. Cumulative impacts during operations would be reduced through adherence to existing stormwater plans; as necessary, sites would be developed to control stormwater runoff, preventing runoff erosion potential. In addition, all development projects in soils with shrink swell potential containing foundations would be properly engineered to avoid adverse impacts to the proposed infrastructure and to soils.

3.5.4 PROPOSED IMPACT REDUCTION MEASURES

3.5.4.1 Mitigation

No potential for adverse significant impacts are anticipated for the Proposed Action; therefore, no mitigation would be required. While no significant impacts are anticipated, as stated in Section 3.5.2.2.1, Installation-specific BMPs would be implemented to control water runoff and soil loss from erosion for all Proposed Action Alternatives. Soil loss after construction would also be reduced by reestablishing permanent vegetative cover through reseeding. The Fort Carson INRMP includes management goals to minimize soil erosion and loss around existing structures and training areas. The new facilities would be managed under the same BMPs and guidance from the INRMP. Alternatives 1 and 2 may require additional engineering considerations as the region contains shrink-swell soils that could impact design (also see Table 3.5-1 for specific sites). Alternatives 3 and 6 could require design modifications such as the installation of gutters, splash plates, or additional rock placed beneath the drip line of PV panels to minimize site erosion.

3.6 Water Resources

3.6.1 AFFECTED ENVIRONMENT

The following sections describe the surface waters and floodplains (Section 3.6.1.1), surface water quality (Section 3.6.1.2), groundwater and aquifers (Section 3.6.1.3), and wetlands (Section 3.6.1.4) within the study area. The ROI for water resources is defined in Table 3.1-1 and encompasses watersheds, USACE jurisdictional "waters of the U.S.," or state-designated stream segments associated with Fort Carson, including the alternative site-specific study areas.

3.6.1.1 Surface Waters and Floodplains

Surface water systems are typically defined in terms of watersheds. A watershed divides the landscape into hydrologically defined areas whose biotic and abiotic components function interactively. The watershed boundary will more or less follow the drainage divide or the highest ridgeline around the stream channels, which will meet at the bottom or lowest point of the land where water flows out of the watershed, commonly referred to as the mouth of the waterway. Any activity that affects water quality, quantity, or rate of movement at one location within a watershed has the potential to affect the characteristics of locations downstream.

> A ***watershed*** is a land area bounded by topography that drains water to a common destination. Watersheds drain, capture, filter, and store water and determine its subsequent release.

Fort Carson lies within the Arkansas River basin and Fountain Creek is the major surface drainage feature in the northeastern portion of the Installation. Streams flow from the northwest to the southeast. The northern and eastern portions of the Installation drain eastward into Fountain Creek and the southern and western portions of the Installation drain into the Arkansas River to the south (Fort Carson, 2007a). The streams entering and originating on Fort Carson are perennial, intermittent, and ephemeral. A majority of the stream flows consist of runoff from precipitation, although groundwater seepage to streams occurs in some areas. Some reaches of the streams only retian flow for short periods between April and September during the year (USGS, 2000).

Surface water gauging stations exist on several Fort Carson streams and reservoirs for continuous monitoring of the water flow. The average water flow on and near Fort Carson is approximately two to five cubic feet per second. This information is utilized by both the Installation and the Colorado Department of Water Resources to evaluate the quantity of water flow diverted for use by the Installation and the amount of water recharge and release (Fort Carson, 2007a).

Surface waters (such as streams and creeks) that are periodically subject to flooding during intervals of overbank flow create a relatively broad and flat valley area immediately adjacent to the waterbody known as a floodplain. Floodplain areas are divided into 2 types: 100-year floodplains and 500-year floodplains. The 100-year floodplain is regulated by the Federal Emergency Management Agency (FEMA) and is defined as typically dry land that has a 1 percent or greater chance of flooding each year; the 500-year floodplain is defined as land that has a 0.2 percent chance of a flooding each year (FEMA, 2012).

Floodplain management is achieved under the Clean Water Act (CWA) Section 401/404 permit process. Permit decisions are made by the USACE. Section 401 water quality certification indicates that a project is consistent with the state's water quality standards. Short- and long-term impacts to water quality and water-related uses are evaluated in the Section 401 certification review.

EO 11988, *Floodplain Management*, directs Federal agencies to avoid, to the extent possible, adverse impacts associated with the modification of floodplains and to avoid support of floodplain development when there is a practicable alternative. The EO specifies that, in situations where alternatives are impractical, the agency must minimize potential harm to or within the floodplain and take appropriate steps to notify the public. Although FEMA-regulated 100-year floodplains have been mapped and effective flood hazard data is available in counties which Fort Carson lies, floodplains within Fort Carson have not been delineated. Fort Carson, however, is delineating floodplain maps which are anticipated for completion by the end of calendar year 2012.

3.6.1.2 Surface Water Quality

Water quality standards are issued by the CDPHE Water Quality Control Division and by the EPA under the Federal Safe Drinking Water Act (SDWA) and the CWA. Section 303(d) of the CWA requires states to identify and develop a list of impaired waterbodies where technology-based and other required controls have not provided attainment of water quality standards. Section 305(b) of the CWA requires states to assess and report the quality of their waterbodies. The state of Colorado has combined their 303(d) and 305(b) lists into one report referred to as the Integrated Report. This report displays the health of all waterbodies within each state.

The Integrated Report identifies those waterbodies that are impaired and do not meet designated uses and establishes total maximum daily loads (TMDLs) for the pollutants of concern. The TMDL process establishes allowable pollutant loadings or parameters for a waterbody and allows water quality controls to be developed to reduce pollution and to restore and maintain water quality. The allowable load established by a TMDL suggests stream water quality would improve over time at such a level to maintain the stream's designated use. No water impairments/TMDLs currently exist on Fort Carson. The Installation does recognize two constituents of concerns: selenium which is naturally occurring, and ecoli which source is not known.

The quality of surface and groundwater on Fort Carson is good. Water from most streams and aquifers on the western portion of the Installation is suitable for irrigation and would be potable if treated. Surface water runoff flowing across the Installation can be degraded due to the interaction with surface soils. As surface water flows eastward across Fort Carson it picks up sediments (i.e., dissolved solids) that are then concentrated through evaporation. Water from the eastern portion of Fort Carson is still suitable for irrigation with proper management practices. Water from bedrock aquifers would be potable if treated to reduce the concentration of some chemical constituents (Leonard, 1984).

3.6.1.3 Groundwater and Aquifers

Drinking water supplies are monitored and protected under the National Primary Drinking Water Regulations, 40 CFR §141; National Secondary Drinking Water Regulations, 40 CFR §143; and the CDPHE, Safe Drinking Water Program. Through the SDWA, EPA sets standards for public water systems to provide safe drinking water to its consumers by limiting the levels of contaminants in drinking water. The SDWA also allows EPA to establish regulations and guidelines for protecting precious drinking water resources. In order to comply with provisions outlined in the SDWA and the Primary Drinking Water Regulations, Fort Carson conducts sampling of all drinking water supply systems.

AR 200-1 ensures the availability, conservation, and protection of water resources and ensures that drinking water provided by the Army meets standards specified in the SDWA and in applicable state and local regulations. AR 200-1 establishes policies, procedures, and standards for the conservation, management, and restoration of land and natural resources.

Groundwater at Fort Carson exists in both alluvial and bedrock aquifers. Alluvial aquifers are formed from unconsolidated deposits of stream alluvium and residuum derived from Pierre Shale that are moderately permeable. The alluvial aquifers can provide well yields from 10 to more than 100 gpm (Leonard, 1984). In much of the Arkansas River Basin, hydraulic heads are lower in the deep bedrock aquifers than those in the shallow formations, indicating that deep bedrock aquifers are not in communication with shallow formations. The primary bedrock aquifer at Fort Carson is the Dakota-Purgatoire aquifer, which is estimated to yield between 10 gpm to 200 gpm with augmentation. The bedrock aquifers are recharged though precipitation and stream flow infiltration. Discharge occurs mostly from well pumping and leakage through overlying formations (Leonard, 1984).

Groundwater monitoring wells have been installed throughout the Main Post area to assess groundwater quality with types and concentrations of contaminants (if any) and to determine if there are contaminated sites impacting groundwater (Fort Carson, 2007a). Groundwater quality on Fort Carson is good. Water from aquifers on the western portion of the Installation is suitable for irrigation and if treated would be a suitable potable source. Water from bedrock aquifers would also be potable if treated to reduce the concentration of some chemical constituents (Leonard, 1984).

3.6.1.4 Wetlands

The USACE defines wetlands as, "Those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas." (USACE, 1987). Wetlands are protected under Section 404 of the CWA [33 U.S. Code (USC) §1251 et seq. (1972)], which requires permitting of certain activities (i.e., the placement of structures and/or fill material) occurring within the boundaries of wetlands meeting certain criteria and confers regulatory authority to the USACE. USACE has regulatory authority over wetlands adjacent to surface waters considered "traditional navigable waters," as well as wetlands adjacent to non-navigable tributaries to traditional navigable waters that are relatively permanent where the tributaries typically flow year-round or have seasonal continuous flow (e.g., typically for 3 months) (EPA, 2007).

Wetlands are afforded regulatory protection because they serve many beneficial functions, including the storage and slow release of surface water, rain, snowmelt, and seasonal floodwaters to surface waters. Additionally, wetlands provide wildlife habitat, sediment stabilization/retention functions, and perform an important role in the nitrogen cycle. They also help to maintain stream flow during dry periods, and provide groundwater recharge functions. Wetlands are among the most productive ecosystems in the world, comparable to rain forests and coral reefs. Many species of wildlife, including a large percentage of threatened and endangered species, depend on wetlands for their survival.

Wetlands on Fort Carson have been mapped according to the USFWS Classification of Wetlands and Deepwater Habitats of the U.S. (Cowardin et al., 1979) using remote mapping methods (Fort Carson, 2012e). The objective of NWI maps is to produce graphic representations of the type, size, and location of surface waters. NWI maps are meant to be used on a reconnaissance level only and are useful for planning purposes. Delineation of wetlands and coordination with the USACE Regulatory Office is normally required prior to ground disturbance activities. Any impacts to wetlands greater than or equal to one acre require coordination with USACE through the wetland permitting process.

3.6.2 ENVIRONMENTAL CONSEQUENCES

This section provides a discussion of the possible environmental impacts to water resources that could result from the alternatives described in Section 2.4, Alternatives Carried Forward for Consideration. Section 3.1.2, Approach for Analyzing Impacts, describes the overall approach for analyzing impacts and defines each impact rating. As shown in Table 3.1-1, a significant impact to water resources would result if degradation of water quality results in long-term impacts (chemical, physical, or biological effects) causing an exceedance of TMDLs or a change in surface water impairment status, or would result in unpermitted direct impacts to waters of the U.S.

3.6.2.1 No Action Alternative

Under the No Action Alternative, impacts to water resources from current ongoing training activities would persist within the current Installation boundary as described in Chapter Section 2. No land development activities would occur within the study areas, and therefore, surface water quality would remain unchanged. There would be no new adverse impacts to the watershed, surface waters, and associated floodplains, groundwater, or wetlands within the Installation.

3.6.2.2 Proposed Action Alternatives

Table 3.6-1 provides a summary comparison of water resources for Proposed Action Alternatives 1 through 6, followed by Figures 3.6-1 and 3.6-2, which display a visual comparison of water resources for each of these alternatives. As presented in Section 3.6.2.2.8, direct impacts to surface water features due to the nature of Alternative 7 are unlikely, and therefore, Alternative 7 has been omitted from Table 3.6-1. Impacts to water resources by alternative are detailed in Sections 3.6.2.2.2 through 3.6.2.2.8.

Table 3.6-1. Surface Water Features by Proposed Action Alternative

Surface Water Type	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Perennial Stream/Creek (miles)	0	0	0	0	0	0.1
Intermittent Stream/Creek (miles)	0	0	2.9	2[1]	1.3	3.3
Canal/Ditch	0	0	0	1	0	0
Total (miles)	**0**	**0**	**2.9**	**N/A**	**1.3**	**3.4**
Wetlands (acres)	0	0	2.5	0	0.8	2.5
Pond/Lake (acres)	0	0	1.3	0	0.6	1.3

Source: Fort Carson, 2012e; USGS, 2011.

1: Alternative 4 is a pipeline; therefore, the surface waters displayed in the Table represents the number of surface waters that the pipeline would cross.

N/A = not applicable

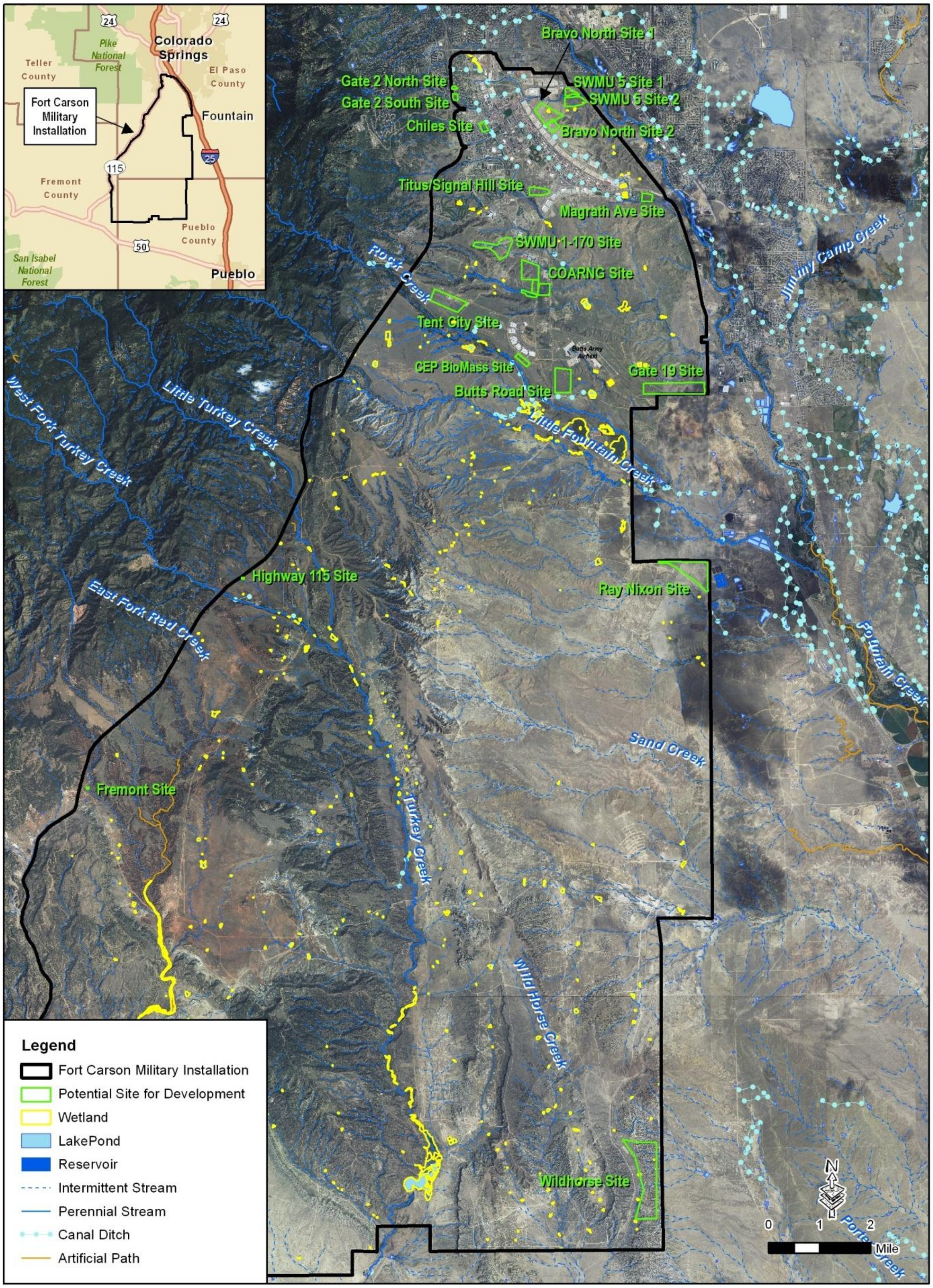

Figure 3.6-1 Existing Surface Water Features at Fort Carson Net Zero Sites

Figure 3.6-2. Alternative 4 Existing Surface Water Features

3.6.2.2.1 Water Resource Impacts Common to All Proposed Action Alternatives

Impacts to Surface Waters, Floodplains, and Wetlands

Stormwater and wastewater discharges are regulated by the EPA, under Sections 401 and 402 of the CWA (permitting requirements) through the National Pollution Discharge Elimination System (NPDES). As there would be over 1 acre of disturbance for any Proposed Action Alternatives, a NPDES General Permit from EPA would be required prior to construction activities. In addition, Fort Carson must comply with Section 438 of the EISA of 2007, which directs Federal agencies sponsoring development or redevelopment of over 5,000 square feet in size to use site planning, design, construction, and maintenance strategies for the property to maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to the temperature, rate, volume, and duration of water flow. Section 3.12 discusses impacts to stormwater management in relation to requirements of this Act.

Initial construction activities would consist of clearing vegetation and leveling areas, which would result in the disturbance and exposure of soils. Exposed soils would be more susceptible to erosion from stormwater runoff, which could result in increased sedimentation and turbidity to receiving waterbodies. Additionally, potential surface water contamination from hazardous spills could occur during construction activities. To minimize potential impacts to water resources, the General Permit requires the preparation of a SWPPP. This plan includes BMPs for erosion control and pollution prevention requirements including specific construction standards, material specifications, planning principles, and procedures. BMPs for minimizing the potential for spills would also be outlined in the construction-phase SWPPP. After construction, all temporarily disturbed areas would be seeded with indigenous species to re-establish vegetative cover. The following is a list of typical BMPs that could be implemented to further minimize the potential impacts to surface waters, where applicable:

- Re-seed areas of bare soil with vegetation, layer mulch, gravel, or wood chips to minimize bare soil available for sediment transport during storm events.
- Place a protective layer (e.g., rubber mats) on top of temporary access roads utilized during construction to prevent or reduce erosion in areas of highly erodible soils or sensitive areas, such as wetlands.
- Maximize use of existing roads in planning site access.
- Locate equipment, maintenance, and fueling areas away from surface waters.

With implementation of BMPs as a condition of the NPDES General Permit, it is anticipated that impacts to surface waters during construction would be temporary and minor. Table 3.6-1 summarizes the number of surface waterbodies that could be potentially impacted by the implementation of the Proposed Action Alternatives.

During the initial design stages of the sites requiring electric distribution lines (Alternatives 1, 2, 3, 5, and 6), specific routes for the electrical tie-ins would be determined. Siting of the lines would likely follow existing ROW and would avoid, to the greatest extent possible, direct impacts to surface waters. If the distribution lines are buried, trenching methods would likely be used for installation. Potential surface water impacts from trenching could include stream diversion/piping flows around the crossing, increased turbidity and sedimentation during streambed disturbance, and removal of streambank vegetation. To minimize potential impacts to water resources, a General Permit would require the preparation of a SWPPP. This plan includes BMPs for erosion control and pollution prevention requirements. The BMPs would reduce temporary impacts by controlling sedimentation and turbidity and restoring stream crossings to their original grade to stabilize streambanks post construction.

Potential operational impacts would largely consist of surface water runoff from new impervious cover and potential spills (e.g., fuel, chemicals, grease, etc.). Mitigation of runoff and pollution prevention measures would reduce or eliminate the potential for operational impacts to surface water resources.

Adherence to applicable laws, regulations, policies, standards, and BMPs would also help to avoid and minimize potential adverse operational impacts to surface waters. With adherence to the SWPPP and Spill Prevention Control and Countermeasures (SPCC) Plan, spills would be avoided and quickly contained, therefore, negligible adverse impacts would be anticipated. Also, as previously stated, floodplain delineation has not been finalized; however, this mapping should be available before construction. DPW-ED would be consulted regarding the Proposed Action and potential for impacts to locations prone to flooding and impacts to floodplains would be avoided to the greatest extent practicable.

Impacts to Groundwater

During construction, there would be a minor potential for groundwater contamination to occur from the operation and maintenance of construction vehicles and equipment (e.g., accidental fuel spills). The potential for contamination to occur would be minimized through the implementation of Fort Carson's SWPPP and SPCC Plan. Any potential impacts associated with the leaking of substances (i.e., fuels, oils, and other lubricants) into soils and entering groundwater aquifers would be avoided through the use of BMPs to prevent spills or leaks; therefore, negligible adverse impacts would be anticipated.

Construction activities would require water from Fort Carson's existing water sources for concrete work and washing machinery and tools. Water for construction could be either trucked to the site as needed or obtained from existing potable water sources throughout the Installation. This water use would have short-term and minor impacts to groundwater levels within the existing aquifers.

3.6.2.2.2 Alternative 1

Impacts to Surface Waters, Floodplains, and Wetlands

As displayed in Table 3.6-1 and Figure 3.6-1, no surface waters, or wetlands occur within the Gate 19 parcel, and therefore, no direct impacts are expected during construction or operation of the WTE plant. Once constructed the WTE plant would increase the amount of impervious surface in the Gate 19 area which in turn would increase the amount of stormwater runoff (also see Section 3.12 regarding stormwater).

Impacts to Groundwater

Potential minor impacts are expected to occur during construction as described in Section 3.6.2.2.1. The daily potable water demand from the WTE plant, when it is operational would be limited to the needs of a workforce of 30 permanent employees (approximately 840 gpd) which could have a minor impact on groundwater resources.

During operations, water in the boiler would be converted to steam, which would drive a steam turbine to produce electricity or would be used for various heating applications. The water in the boiler could be supplied by the water utility or possibly by subsurface streams or tributaries. The operation of the WTE plant would require 70,000 gpd (79 acre-feet per year). Groundwater aquifers in the area are generally an abundant resource, however, ongoing drought and establishment of wells west of Highway 115 have recently stressed groundwater resources. Therefore, operations of the WTE plant could have adverse effects on groundwater levels if this water resource was chosen to support this alternative. Although this alternative would not further Fort Carson in meeting Net Zero water goals due to additional water requirements of plant operations, this alternative would assist the Installation in achieving Net Zero energy goals. Expansion of the reclaimed water system under Alternative 4 and the general water conservation measures as a part of Alternative 7 would help offset additional groundwater requirements under this alternative, if implemented, and overall impacts would be less than significant.

Wastewater, which is generated as blowdown from the boiler feedwater, would be collected and reused within the process, and therefore, is not expected to impact groundwater (also see Section 3.12 for a discussion on wastewater). While operational, there would also be a chance for accidental spills to occur, however, as stated under Section 3.6.2.2.1 the potential for contamination to occur would be minimized through the implementation of Fort Carson's SWPPP and SPCC Plan; therefore, a minor potential for groundwater contamination to occur would be expected.

3.6.2.2.3 Alternative 2

Impacts to Surface Waters, Floodplains, and Wetlands

As displayed in Table 3.6-1 and Figure 3.6-1, no surface waters or wetlands occur within any of the three parcels under consideration for a biomass plant. Therefore, no direct impacts are expected during construction or operation of the plant. Once constructed the biomass plant would increase the amount of impervious surface which in turn would increase the amount of stormwater runoff (see Section 3.12 regarding stormwater management).

Impacts to Groundwater

Potential minor impacts are expected to occur during construction as described in Section 3.6.2.2.1. The daily potable water demand from the biomass plant, when it is operational would be limited to the needs of a workforce of 30 employees (approximately 840 gpd) which would have a minor impact on groundwater resources.

During operations water in the boiler would be converted to steam which would drive a steam turbine to produce electricity or would be used for various heating applications. The water in the boiler could be supplied by the water utility or possibly by subsurface streams or tributaries. Operation of the biomass plant would require up to 187,200 gpd (210 acre-feet per year) of water; the majority of which would exit the system as steam and the remaining would be recycled within the process. Groundwater aquifers in the area are generally an abundant resource; however, ongoing drought and establishment of wells west of Highway 115 have recently stressed groundwater resources. Therefore, operations of the biomass plant could have adverse effects on groundwater levels if this water resource was chosen to support this alternative. Although this alternative would not further Fort Carson in meeting Net Zero water goals due to additional water requirements of plant operations, this alternative would assist the Installation in achieving Net Zero energy goals. Expansion of the reclaimed water system under Alternative 4 and the general water conservation measures as a part of Alternative 7 would help offset additional groundwater requirements under this alternative if implemented and overall impacts would be less than significant.

Wastewater, which is generated as blowdown from the boiler feedwater, would be collected and reused within the process, and therefore, is not expected to impact groundwater (also see Section 3.12 regarding wastewater). While operational, there is also a chance for accidental spills to occur; however, as stated under Section 3.6.2.2.1 the potential for contamination to occur would be minimized through the implementation of Fort Carson's SWPPP and SPCC Plan; therefore, a minor potential for groundwater contamination to occur would be expected.

3.6.2.2.4 Alternative 3

Impacts to Surface Waters, Floodplains, and Wetlands

Fort Carson would pursue the construction, operation, and maintenance of PV systems for energy generation on Fort Carson. Alternative 3 contains 13 sites throughout Fort Carson (see Figure 3.6-1). The PV systems would vary in scale based on available land area and terrain (requiring flat to low-sloping areas); acreage of the proposed sites area would be scaled to suitable land availability and terrain. Table 3.6-2 below displays the existing surface waters and wetlands within each of the 13 sites considered under Alternative 3.

Table 3.6-2. Surface Waters within Proposed Photovoltaic Sites

Proposed PV Site	Total Acres	Existing Surface Waters
Gate 2 North	3.0	0
Gate 2 South	7.6	0.1 miles/intermittent steam
Chiles	12.7	0.1 miles/intermittent steam
SWMU 1-170	86.9	0.8 miles/intermittent steam
SWMU 5 (Site 1)	14.3	0
SWMU 5 (Site 2)	41.9	0.3 miles/ intermittent stream 0.3 acres wetlands
Bravo North (Site 1)	71.5	0
Butts Road	89.4	0.2 miles/intermittent steam
Magrath Avenue	19.5	0.1 miles/intermittent steam
Wildhorse	361.1	1.3 miles/intermittent stream 0.6 acre/ponds 0.8 acres wetlands
Titus/Signal Hill	31.9	0.1 acre/pond
Ray Nixon	146.8	0
Tent City	97.1	0.6 acre/reservoir

Source: Fort Carson, 2012e; USGS, 2011.
SWMU = Solid Waste Management Unit

Proposed PV sites Gate 2 North, SWMU 5 (Site 1), Bravo North (Site 1), and Ray Nixon would have no impact to surface waters as none exist within the parcels. For the remaining parcels, Fort Carson would avoid placing PV systems within any existing surface water and would consult with DPW-ED for avoiding areas prone to flooding. Minor temporary impacts would be expected as implementation of the BMPs, regulations, and standards described previously in Section 3.6.2.2.1 would minimize potential impacts to surface waters during construction. Upon completion of any construction work, it is expected that disturbed areas would be re-vegetated to reduce or eliminate any long-term effects to water quality.

Normal operations of the PV systems would generally not affect surface water resources. Conversion of undeveloped land to land that would be covered by PV systems could increase the amount of runoff and pollutants into receiving surface waters resulting in minor impacts. The PV systems, however, would be spaced allowing stormwater to travel to the ground allowing infiltration below the PV systems. To the extent practicable, stormwater drainage at the proposed PV system sites would continue to direct runoff along pre-construction drainage patterns. See Section 3.12 for a full discussion of possible stormwater impacts.

Proposed sites SWMU 5(Site 2) and Wildhorse both contain less than one percent of wetlands as per NWI mapping. As discussed in Section 3.6.1.4, NWI maps produce graphic representations of the type, size, and location of surface waters and are meant to be used on a reconnaissance level only. NWI mapping suggests that these wetland features are isolated and non-regulated, however, before any work is done on either site these assumptions would be confirmed through a field assessment. No PV systems would be placed within wetlands, and therefore, no impact is expected.

Impacts to Groundwater

Potential minor impacts are expected to occur during construction as described in Section 3.6.2.2.1. The PV systems would vary in scale based on available land area and terrain. Utility scale PV systems typically require a maximum water usage of 33 gal/MWh, primarily from spraying activities to clean dirty panels (e.g., accumulation of pollen, dirt, dust, leaves, and other debris) (NREL, 2011a). Overall, minor impacts would be expected to groundwater and the aquifer to be used as a result of water usage rates during operation of the PV systems. Operation of the PV systems would not require any additional personnel from what currently exists on Fort Carson. Overall potable water usage would remain the same, as would withdrawal rates from the aquifer system.

3.6.2.2.5 Alternative 4

Impacts to Surface Waters, Floodplains, and Wetlands

Fort Carson would expand the existing reclaimed water system. The construction of new utility lines would potentially result in temporary adverse impacts to surface waters. The probability of impacts to occur would increase the closer construction activities are located to the surface water resources, with the greatest probability for impact occurring when utilities cross a surface water resource. See Table 3.6-1 for a list of surface water crossings that would occur as a result of utility construction. See Figure 3.6-2 for the location of the utility corridor.

Non Potable Water Pipelines

The proposed reclaimed water pipelines as displayed in Figure 3.6-2 would cross two intermittent streams and one canal ditch (Ditch "U", known as the Central Unnamed Ditch). None of the activities associated with Alternative 4 would be expected to result in the construction of structures that would divert flood flows to an extent that would alter floodplains. Therefore, overall, negligible impacts on the floodplains' abilities to absorb flood flows would be expected, assuming all surface water crossings are constructed according to applicable regulations utilizing applicable BMPs.

As the largest stream to be crossed would be less than 80 feet in width, trenching methods would be used to install the reclaimed water line. Potential surface water impacts during construction of the reclaimed water line crossings using trenching methods could include stream diversion/piping flows around the crossing, increased turbidity and sedimentation during streambed disturbance, and removal of streambank vegetation.

Construction conducted near surface water resources could indirectly create sedimentation from runoff and turbidity of waters. To minimize potential impacts to water resources, a General Permit would require the preparation of a SWPPP. This plan includes BMPs for erosion control and pollution prevention requirements. The BMPs would reduce temporary impacts by controlling sedimentation and turbidity and restoring stream crossings to their original grade to stabilize streambanks post construction.

Hydrostatic Testing

The construction of new reclaimed pipelines would require hydrostatic testing of the lines to certify their material integrity before they go into operation. These tests consist of pressurizing the pipelines with water and checking for pressure losses due to pipeline leakage. Hydrostatic testing would be performed in accordance with state Department of Transportation pipeline safety regulations.

Hydrostatic testing water could be obtained from the irrigation reservoir to be expanded at the golf course. The water could be trucked to the points of testing. No chemical additives would be introduced to the water used to hydrostatically test the new pipelines, and no chemicals would be used to dry the pipelines after the hydrostatic testing. No hydrostatic testing water would be discharged directly to surface waters. After use for hydrostatic testing, the water would be reused as practicable for other construction purposes, such as dust suppression. Hydrostatic testing water that could not be reused would be collected and hauled by tanker truck for disposal at the wastewater treatment plant. The daily volumes of discharge would have a minor impact on the capacity of the treatment plant during the hydrostatic testing phase.

Normal operations of the reclaimed pipelines would generally not affect surface water resources or floodplains. Occasional maintenance may require access to buried portions of the utilities; however, BMPs, such as strategic placement of silt fencing and temporary drainage controls, would be used to avoid any indirect impacts (e.g., sedimentation and turbidity) to adjacent surface waters. Therefore, negligible adverse impacts to surface water resources would be anticipated.

Impacts to Groundwater

Potential minor impacts are expected to occur during construction as described in Section 3.6.2.2.1. Alternative 4 does not include additional personnel; therefore, there would be no effects to groundwater and aquifers beyond what currently exists.

3.6.2.2.6 Alternative 5

Impacts to Surface Waters, Floodplains, and Wetlands

Fort Carson would pursue the construction, operation, and maintenance of up to eight utility-scale wind turbines in the southeastern corner of the Installation in Training Area 48 (Wildhorse site) (see Figure 3.6-1). Each wind turbine would require less than an acre footprint, however, the turbines have to be spaced far apart to reduce turbulence effects between turbines. As displayed in Table 3.6-1, the Wildhorse site contains a total of 1.3 miles of intermittent streams, 0.6 acres of ponds, and 0.8 acres of wetlands within the 361.1 acre site. Fort Carson would place the proposed turbines to avoid surface water resources. Minor temporary impacts would be expected as implementation of the BMPs, regulations, and standards, described previously in Section 3.6.2.2.1, would minimize potential impacts to surface waters during construction. Upon completion of any construction work, it is expected that disturbed areas would be re-vegetated to reduce or eliminate any long-term effects to water quality.

The proposed Wildhorse site contains less than one percent of wetlands as per NWI mapping. As discussed in Section 3.6.1.4, NWI maps produce graphic representations of the type, size, and location of surface waters and are meant to be used on a reconnaissance level only. NWI mapping suggests that these wetland features are isolated and non-regulated; however, before any work is done on either site these assumptions would be confirmed through a field assessment. No utility-scale wind turbines would be placed within wetlands and therefore no impact is expected.

Normal operations of the wind turbines would generally not affect surface water resources. Conversion of undeveloped land to impervious land would increase the amount of runoff and pollutants into receiving surface waters resulting in minor impacts. To the extent practicable, the stormwater drainage system at the proposed wind turbine sites would continue to direct runoff along pre-construction drainage patterns.

Impacts to Groundwater

Minor short-term impacts to groundwater are possible during construction as described in Section 3.6.2.2.1. Operation of the wind turbines under Alternative 5 would require no water for operation and would not require additional personnel from what currently exists; therefore, overall water usage would remain the same, as would withdrawal rates from the aquifer system. No impact to groundwater or aquifers is expected from operation of the wind turbines.

3.6.2.2.7 Alternative 6

Impacts to Surface Waters, Floodplains, and Wetlands

Alternative 6 involves future ground-source heating and cooling or additional solar energy Net Zero projects at Fort Carson on a programmatic level. This alternative includes developing energy Net Zero projects on sites identified within previous alternatives in addition to sites the Highway 115, Fremont and COARNG sites (see Figure 3.6-1). As under Alternative 3, the PV systems would vary in scale based on available land area and terrain (requiring flat to low-sloping areas); acreage of the proposed sites would be scaled to suitable land availability and terrain. Fort Carson would also pursue the construction, operation, and maintenance of GSHP units for use in heating and cooling buildings on Fort Carson. Table 3.6-3 displays the existing surface waters and wetlands within each of the sites identified under Alternative 6.

Table 3.6-3. Net Zero Energy Sites

Proposed Net Zero Energy Sites	Total Acres	Existing Surface Waters
Gate 2 North	3.0	0
Gate 2 South	7.6	0.1 miles/intermittent steam
Chiles	12.7	0.1 miles/intermittent steam
SWMU 1-170	86.9	0.8 miles/intermittent steam
SWMU 5 (Site 1)	14.3	0
SWMU 5 (Site 2)	41.9	0.3 miles/intermittent stream 0.3 acres wetlands
Gate 19	163.2	0
CEP Biomass	16.5	0
Bravo North (Site 1)	71.5	1.4 acres wetlands
Bravo North (Site 2)	22.6	0.1 miles/intermittent steam
Butts Road	89.4	0.2 miles/intermittent steam
Magrath Avenue	19.5	0.1 miles/intermittent steam
Wildhorse	361.1	1.3 miles/intermittent stream 0.6 acre/ ponds 0.8 acres wetlands
Titus/Signal Hill	31.9	0.1 acre/pond
Ray Nixon	146.8	0
Tent City	97.1	0.6 acre/reservoir
Highway 115	1.0	0
Fremont	1.0	0
COARNG	131.4	0.1 miles/perennial steam 0.4 miles intermittent

Source: Fort Carson, 2012e; USGS, 2011.

CEP = Central Energy Plant; COARNG = Colorado Army National Guard; SWMU = Solid Waste Management Unit

Proposed Net Zero sites Gate 2 North, SWMU 5(Site 1), Gate 19, CEP Biomass, Ray Nixon, Highway 115, and Fremont would have no impact to surface waters or floodplains as none exist within the parcels. For the remaining parcels, Fort Carson would utilize the environmental screening criteria that have been developed and considered within this EA (see Appendix B) to assist in deciding the placement of the PV systems and GSHP units. The PV systems and GSHP units would not be placed within any existing surface water or floodplain. Minor temporary impacts would be expected as implementation of the BMPs, regulations, and standards, described previously in Section 3.6.2.2.1, would minimize potential impacts to surface waters during construction. Upon completion of any construction work, it is expected that disturbed areas would be re-vegetated to reduce or eliminate any long-term effects to water quality.

Proposed Net Zero sites SWMU 5 (Site 2), Bravo North (Site 1), and Wildhorse all contain a minor amount of wetlands as per NWI mapping. As discussed in Section 3.6.1.4, NWI maps produce graphic representations of the type, size, and location of surface waters and are meant to be used on a reconnaissance level only. NWI mapping suggests that these wetland features are isolated and non-regulated; however, before any work is done on any of these sites, assumptions would be confirmed through a field assessment. No PV systems or GSHP units would be placed within wetlands, and therefore, no impact is expected.

Normal operations of the PV systems and GSHP units would generally not affect surface water resources. Conversion of undeveloped land to land that would be covered by PV systems could increase the amount of runoff and pollutants into receiving surface waters resulting in minor impacts. The PV systems, however, would have spaces between them allowing stormwater to travel to the ground allowing infiltration below the PV systems. To the extent practicable, stormwater drainage at the proposed PV system sites would continue to direct runoff along pre-construction drainage patterns. See Section 3.12 for a full discussion of possible stormwater impacts.

Impacts to Groundwater

Potential minor impacts are expected to occur during construction of the PV systems and the GSHP units as described in Section 3.6.2.2.1. Potential impacts to groundwater and aquifers during operation of the PV systems are described in Section 3.6.2.2.4.

GSHP unit wells would typically be constructed to vertical depths of approximately 400 feet below the surface. There would be no direct interaction between groundwater and water within the piping (should a GSHP unit technology requiring fluid within the pipes be chosen). The system would be equipped with safety features such as an automated pressure sensitive valve, which would automatically shutdown the system if there is a pressure change indicating a leak. In addition, all of the in-ground thermal exchange piping would be solidly grouted into the well hole further reducing the chance of leaks. Therefore, unless a failure of the piping system and associated safety features occurs, no impacts to groundwater resources would occur as a result of the GSHP units. While leaks are possible, they are typically small in volume. Furthermore, the potential liquids (e.g., water and inhibited propylene glycol) that could be utilized within the piping system are considered non-toxic by the Food and Drug Administration and EPA.

At this time, the ground-source heating and cooling technology to be employed has not been decided. Table 3.6-4 displays the varying water usage rates for each type of ground-source heating and cooling technology.

Table 3.6-4. Ground-Source Heating and Cooling Technologies Water Consumption (gal/MWh)

Fuel Type	Cooling	Technology	Median	Minimum	Maximum
Thermal	Tower	Dry Steam	1,796	1,796	1,796
		Flash (Freshwater)	10	5	19
		Flash (Geothermal Fluid)	2,583	2,067	3,100
		Binary	3,600	1,700	3,963
		EGS	4,784	2,885	5,147
	Dry	Flash	0	0	0
		Binary	135	0	270
		EGS	850	300	1,778
	Hybrid	Binary	221	74	368
		EGS	1,406	813	1,999

Source: NREL, 2011a
EGS = enhanced geothermal system; gal/MWh = gallons per megawatt-hours

Water use during operation of the GSHP units would depend on the type of ground-source heating and cooling technology to be employed. Overall, minor impacts would be expected to groundwater and the aquifer to be used as a result of increased water usage rates during operation of the GSHP units.

3.6.2.2.8 Alternative 7

Impacts to Surface Waters, Floodplains, and Wetlands

Implementation of Alternative 7 would have minor adverse short-term impacts on surface water resources for those infrastructure upgrades requiring ground disturbance and would be similar to those described in Section 3.6.2.2.1. As these projects would primarily occur within previously disturbed areas (building interiors, developed portions of building exteriors and modifications to existing utility infrastructure), no direct impacts to water resources are anticipated. No impacts to floodplains or wetlands would be anticipated.

Impacts to Groundwater

Potential minor impacts could occur during construction as described in Section 3.6.2.2.1. Behavioral and conservation measures regarding water would have long-term beneficial impacts to groundwater resources from reductions of water consumption and use. Acre-feet usage of groundwater resources per user (household, commercial entity) is commonly reduced by up to 75 percent in locations where water conservation is followed or enforced (City of Santa Fe, 2001).

3.6.3 CUMULATIVE EFFECTS

Although the Proposed Action is not expected to degrade surface water quality directly, indirect impacts from the Proposed Action, the development of other projects, and general development anticipated to occur in the surrounding region could incrementally impact surface water quality. In particular, the development activities associated with the CAB at the WRC in the Rock Creek and Little Fountain Creek watersheds in conjunction with Net Zero sites located within the same watersheds (Tent City, CEP Biomass, and Butts Road), could cause a cumulative adverse impact to water quality within the watershed. The aggregate increase in impervious surface areas associated with these developments, combined with new roads and commercial establishments would increase the amount of stormwater distributed to surface water channels and would potentially increase the frequency and severity of high-flow events. The increased impervious area would also contribute to the degradation of water quality through the increase in the quantity of pollutants attributable to runoff. These impacts would be minor to moderate. Short-term minor adverse cumulative effects to water quality would be expected as a result of the planned construction throughout Fort Carson. Exposed soils during construction would be more susceptible to flow with stormwater runoff, which could result in increased sedimentation and turbidity to receiving waterbodies. As previously stated, floodplain delineation has not been finalized; however, this mapping should be available before construction. DPW-ED would be consulted regarding the Proposed Action and potential for impacts to locations prone to flooding and impacts to floodplains would be avoided to the greatest extent practicable.

Each of the reasonably foreseeable projects identified for inclusion in this analysis would cause some degree of sedimentation to water resources, aside from implementation of the Pikes Peak Sustainability Plan. The probability of impacts to occur would increase the closer construction activities are located to the surface water resources, with the greatest probability for impact occurring when utilities cross a surface water resource. Upon completion of any construction work, it is expected that disturbed areas would be re-vegetated to reduce or eliminate any long-term effects to water quality. Construction of the new Elementary School, Mini Mall, Commissary, and Banana Belt Area Redevelopment would all cause temporary erosion and sedimentation during construction activities. These impacts would be managed in a similar manner by Fort Carson as discussed for the Proposed Action in this EA. Cumulatively, these projects, in combination with the temporary minor soil erosion and sedimentation to result from the Proposed Action, would not result in significant cumulative impacts.

The Pikes Peak Sustainability Plan would cumulatively improve the watersheds on Fort Carson by addressing a variety of water resource issues including water consumption, landscaping, and water re-use. This Plan would work toward sustainability, benefiting the entire watershed.

Implementation of the Net Zero Waste, Water, and Energy at Fort Carson would be expected to cause minor impacts to local groundwater resources primarily resulting from minimal amounts of potable and process water requirements to be supplied through the existing water supply system. In comparison to the anticipated demands on the Fort Carson water system from proposed projects such as the new Elementary School and Mini Mall, the incremental demand of the Proposed Action Alternatives would be negligible. Therefore, cumulative impacts would not be substantially greater as a result of the implementation of the Net Zero Waste, Water, and Energy at Fort Carson. A SWPPP would be implemented for each project to reduce the potential for stormwater runoff contaminated with toxic materials to infiltrate into the groundwater. Any potential impacts associated with the leaking of substances (i.e., fuels, oils, and other lubricants) into soils and entering groundwater aquifers would be avoided through the use of BMPs to prevent spills or leaks.

As limited development and growth is foreseen at Fort Carson, the potential to impact groundwater resources would be low. The Installation is not projected to see substantial population increases, and therefore, cumulative groundwater impacts would not be anticipated regardless of the alternative chosen.

Each of the reasonably foreseeable projects could cause the degradation of wetland resources, primarily through sedimentation; however, Army land ecosystem management activities would likely have a long-term beneficial impact of conserving and enhancing existing wetland habitats. Overall, cumulative adverse effects to wetlands would be negligible.

3.6.4 PROPOSED IMPACT REDUCTION MEASURES

3.6.4.1 Mitigation

Regardless of Proposed Action Alternative, no potential for adverse significant impacts are anticipated; therefore, no mitigation would be required. While no significant impacts are anticipated the following measure may still be implemented. In order to prevent water quality deterioration, for all Proposed Action Alternatives, temporary construction-related footprint disturbances would be restored with appropriate vegetation. In addition, a NPDES General Permit would be required prior to construction activities where the disturbance totals more than one acre. To minimize potential impacts to water resources, a General Permit would require the preparation of a SWPPP. This plan includes BMPs for erosion control and pollution prevention requirements. The BMPs would reduce temporary impacts by controlling sedimentation and turbidity and restoring stream crossings to their original grade to stabilize streambanks post construction. In addition, during project siting, Fort Carson DPW-ED would be consulted regarding potential for impacts to locations prone to flooding and areas prone to flooding would be avoided from construction and operation activities.

For Alternatives 1 and 2, procedures within Fort Carson's SWPPP and SPCC Plan would be implemented during operations to prevent the potential for indirect surface water or groundwater contamination by minimizing potential for substances (i.e., fuels, oils, and other lubricants) to leak or spill and providing quick response procedures for any accidental spills. In addition, storm water runoff from new impervious surfaces would be managed through site design as appropriate including the creation of upland release points, as necessary. These measures would reduce the potential for indirect adverse impacts to surface waters from runoff during operations.

For Alternatives 3, 5 and 6, project footprints and access roads would be sited to avoid impacts to wetland and surface water resources. Prior to construction, and surface waters or wetlands would be field-located.

For Alternative 6, future GSHPs would be equipped with safety features such as an automated pressure sensitive valve, which would automatically shutdown the system if there is a pressure change indicating a leak. In addition, all of the in-ground thermal exchange piping would be solidly grouted into the well hole further reducing the chance of leaks.

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3.7 Biological Resources

3.7.1 AFFECTED ENVIRONMENT

3.7.1.1 Vegetation

Fort Carson is located within the upper regions of the Prairie Grasslands Plant Zone. The area is characterized by openness and generally treeless terrain primarily dominated by plants belonging to the grass family (Fort Carson, 2007a).

Grasslands comprise about 48 percent of Fort Carson and are usually classified as shortgrass prairie. Grasslands are located primarily in the eastern, east-central, and southwestern portions of Fort Carson. Major grasses include blue grama (*Bouteloua gracilis*), western wheatgrass (*Pascopyrum smithii*), galleta (*Pleuraphis jamesii*), sideoats grama (*Bouteloua curtipendula*), dropseed (*Sporobolus sp.*), buffalo grass (*Bouteloua dactyloides*), little bluestem (*Schizachyrium scoparium*), and needle and thread grass (*Hesperostipa comate*). Various shrubs scattered throughout the grasslands are prickly pear cactus (*Opuntia polyacantha*), cholla cactus (*Opuntia sp.*), yucca (*Yucca sp.*), four-winged saltbush (*Atriplex canescens*), rabbitbrush (*Chrysothamnus sp.*), and skunkbush sumac (*Rhus trilobata*) (Fort Carson, 2007a).

Shrublands, typically with a grassy understory, comprise about 15 percent of Fort Carson. Coniferous shrubland, dominated by pinyon pine (*Pinus edulis*) and one-seed juniper (*Juniperus monosperma*) (which may be classified as shrub or trees depending on growth form), is found throughout Fort Carson. Deciduous shrubland, whose species include Gambel oak (*Quercus gambelii*), salt cedar (*Tamarix chinensis, T. parviflora, and T. ramosissima*), and willow (*Salix sp.*), is found along major drainageways (Fort Carson, 2007a).

Forest/Woodlands constitute approximately 37 percent of Fort Carson. Ponderosa pine (*Pinus ponderosa*), pinyon pine, and one-seed juniper are the dominant species of higher elevation woodlands on rocky and steeper slopes, and cottonwood (*Populus sp.*), willow, and cherry (*Prunus sp.*) dominate woodlands of drainageways (Fort Carson, 2007a). Figure 3.7-1 shows the biological resources within the Net Zero sites.

3.7.1.1.1 Noxious Weeds

There are 22 noxious weeds known to occur on Fort Carson. Only one, myrtle spurge (*Euphorbia myrsinites*) is considered a List A species in Colorado. List A species are those considered so potentially damaging (and not yet widespread throughout the state) that they are designated for eradication (Fort Carson, 2009).

List B weed species are species for which state management plans are developed to stop their continued spread. There are 13 known List B weed species on Fort Carson. They are Canada thistle (*Cirsium arvense*), common teasel (*Dipsacus fullonum*), diffuse knapweed (*Centaurea diffusa*), hoary cress (*Cardaria draba*), houndstongue (*Cynoglossum officinale*), leafy spurge (*Euphorbia esula*), musk thistle (*Carduus nutans*), redstem filaree (*Erodium cicutarium*). Russian olive (*Elaeagnus angustifolia*), salt cedar, scotch thistle (*Onopordum acanthium*), spotted knapweed (*Centaurea maculosa*), perennial pepperweed (*Lepidium latifolium*), and yellow toadflax (*Linaria vulgaris*) (Fort Carson, 2009).

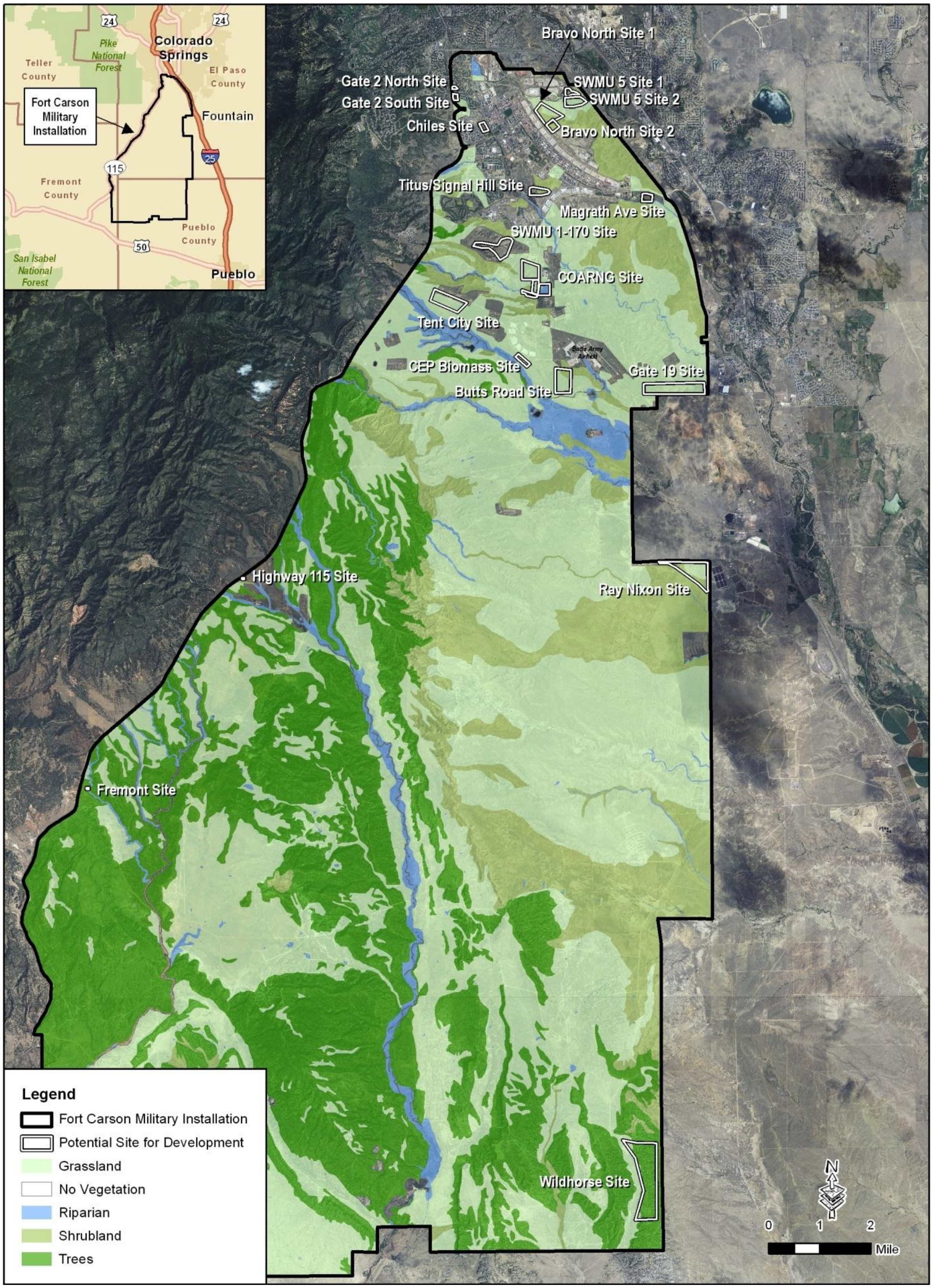

Figure 3.7-1. Biological Resources Within the Proposed Net Zero Sites

List C weed species are species for which the Colorado Department of Agriculture Commissioner, in consultation with the state noxious weed advisory committee, local governments, and other interested parties, would develop and implement state noxious weed management plans designed to support the efforts of local governing bodies to facilitate more effective integrated weed management on private and public lands. The goal of such plans would not be to stop the continued spread of these species but to provide additional education, research, and biological control resources to jurisdictions that choose to require management of List C species. There are eight List C weed species known to occur at Fort Carson which include: common burdock (*Arctium minus*), common mullein (*Verbascum thapsus*), common St. Johnswort (*Hypericum perforatum*), downy brome (*Bromus tectorum*), field bindweed (*Convolvulus arvensis*), jointed goatgrass (*Aegilops cylindrica*), poison hemlock (*Conium maculatum*), and puncturevine (*Tribulus terrestris*). List C species are those that have become so widespread that eradication is impossible and species-specific control would be extremely difficult if not impossible. Therefore, measures for control of these species apply to all weeds in general and are geared towards education and BMPs to help suppress populations. On Fort Carson, the weed species of most concern are myrtle spurge, dalmation and yellow toadflax, leafy spurge, and scotch thistle (Fort Carson, 2009).

Noxious weed control at Fort Carson utilizes an Integrated Vegetation Management Strategy using two or more of the following techniques in combination (listed in priority of use): physical/mechanical methods, biological control, chemical methods, cultural methods, and educational tools. Site-specific actions consider the most economic and effective method(s) of containing or controlling undesirable plant species, the current scientific evidence and technology, the developmental status (phenology) of target species, the impacts on the military mission, and the potential ecological consequences (Fort Carson, 2007a).

3.7.1.2 Wildlife and Aquatic Life

Dominant terrestrial habitat types on Fort Carson are grasslands, shrublands, and woodlands. Aquatic habitats on Fort Carson are very limited and consist of wetlands, riparian corridors, and open water (Fort Carson, 2009).

Common large mammals include mule deer (*Odocoileus hemionus*), white-tailed deer (*Odocoileus virginianus*), elk (*Cervus elaphus*), pronghorn (*Antilocapra americana*), mountain lion (*Felis concolor*), coyote (*Canis latrans*), and black bear (*Ursus americanus*). Many of these species are more common in mountainous areas, but all were native to the Great Plains at one time and have been extirpated from large areas. There a number of fairly common smaller mammals present, such as raccoon (*Procyon lotor*) and house mouse (*Mus musculus*). There are several bat species known to occur on Fort Carson, including: Townsend’s big-eared bat (*Corynorhinus townsendii*), big free-tailed bat (*Nyctinomops macrotis*), eastern pipistrelle (*Pipistrellus subflavus*), fringed myotis (*Myotis thysanodes*), pallid bat (*Antrozous pallidus*), big brown bat (*Eptesicus fuscus*), hoary bat (*Lasiurus cinereus*), and Yuma myotis (*Myotis yumanensis*) (Fort Carson, 2009).

Numerous bird species are known to occur on Fort Carson. Twenty-seven species of hawks and owls are known to use Fort Carson, including the Mexican spotted owl (*Strix occidentalis lucida*), bald eagle (*Haliaeetus leucocephalus*), and peregrine falcon (*Falco peregrines*). Of these, 17 species breed on Fort Carson and19 species are winter residents. Raptors on Fort Carson have a wide range of ecological tolerances and requirements. Currently, the golden eagle (*Aquila chrysaetos*) is the most vulnerable nesting species on Fort Carson; recreation, construction, maintenance projects, and dismounted training constitute the greatest risk to nesting eagles. The prairie falcon (*Falco mexicanus*), ferruginous hawk (*Buteo regalis*), and Swainson’s hawk (*Buteo swainsoni*) are sensitive species and are relatively rare as nesting species on Fort Carson. They can be impacted by the same threats as for the golden eagle (Fort Carson, 2009).

The status of reptiles and amphibians on Fort Carson is generally not well documented. Western rattlesnake (*Crotalus viridis*), triploid checkered whiptail (*Cnemidophorus neotesselatus*), and western coachwhip (*Masticophis flagellum testaceus*) are typical reptiles found on Fort Carson. Wetlands support several reptile and amphibian species, including plains leopard frog (*Rana blairi*), northern leopard frog (*Rana pipiens*), and painted turtle (*Chrysemys picta bellii*) (Fort Carson, 2009).

Native and non-native fish can be found in 12 reservoirs on Fort Carson, 8 of which are managed for sport fishing for species such as rainbow trout (*Salmo gairdneri*) and channel catfish (*Ictalurus punctatus*). Historically, other reservoirs have supported populations of native fish, and streams, especially spring-fed streams, also support native fish species on Fort Carson. Species such as creek chub (*Semotilus atromaculatus*) and brook stickleback (*Culaea inconstans*) are native (Fort Carson, 2009).

3.7.1.3 Protected Species

Federally-listed threatened and endangered plant and animal species are protected under the Endangered Species Act. The MBTA provides protections for migratory birds. Bald and golden eagles are protected by the Bald and Golden Eagle Protection Act. Other sensitive wildlife species include those listed by the CPW, Colorado Natural Heritage Program (CNHP), USFWS Birds of Conservation Concern, Partners in Flight, and the Central Shortgrass Prairie Ecoregional Assessment and Partnership Initiative (now called the Shortgrass Prairie Partnership). Sensitive plant species include those identified by the CNHP as Colorado Species of Concern.

3.7.1.3.1 Federal Endangered Species Act Listed Species

The Endangered Species Act defines an endangered species as any species in danger of extinction throughout all or a major portion of its range. A threatened species is one that is likely to become endangered in the foreseeable future. Candidate species are those that the USFWS is considering for listing as endangered or threatened, but a proposed regulation has not yet been published in the *Federal Register*. Until a final rule is published, species considered candidates are not afforded any legal protections. Table 3.7-1 presents Federally-listed endangered, threatened, and candidate species for counties in which Fort Carson is located (El Paso, Pueblo, and Fremont Counties) for which suitable habitat may be present at the Installation. Critical habitat for these species does not occur on Fort Carson.

Table 3.7-1. Federal Endangered Species Act Protected Species with the Potential to Occur at Fort Carson

Common Name	Scientific Name	Species Type	Federal Status	Distribution on Fort Carson
Arkansas darter	*Etheostoma cragini*	Fish	C	Introduced at multiple locations.
Greenback cutthroat trout	*Oncorhynchus clarki stomias*	Fish	T	Historically, was introduced into Lytle Pond, but do not presently occur in the pond.
Black-footed ferret	*Mustela nigripes*	Mammal	E	Not known to occur.
Preble's meadow jumping mouse	*Zapus hudsonius preblei*	Mammal	T	Not known to occur.
Mexican spotted owl	*Strix occidentalis*	Bird	T	Winter resident.
Ute ladies'-tresses	*Spiranthes diluvialis*	Plant	T	Not known to occur.

Source: Fort Carson, 2009
Note: Species for which no reasonably suitable habitat exists on Fort Carson are not included.
E=Federal Endangered, T=Federal Threatened, C=Federal Candidate for protection

The following two species addressed in Table 3.7-1 are known to occur at Fort Carson (Fort Carson, 2011a):

- **Mexican spotted owl**. Nests in rugged forested canyons west of the Fort Carson boundary. It is a rare winter resident on Fort Carson and known to have occurred only on and adjacent to Booth Mountain. The species is not suspected to breed on Fort Carson. It is not known to occur within any proposed project disturbance areas.
- **Arkansas darter**. Federal candidate for listing as a threatened species. It is found at a few sites on the Installation. It is not known to occur within any proposed project disturbance areas.

3.7.1.3.2 Colorado Protected Species and Species of Concern

Appendix D presents the special status wildlife species that have been observed on Fort Carson. These species are tracked by CPW, CNHP, USFWS, Partners in Flight, and the Shortgrass Prairie Partnership. State threatened and endangered wildlife species are protected by Colorado state law, but Species of Concern are identified for planning purposes only. The species described in Appendix D are known to occur on Fort Carson, but are not all known to occur at the project sites. Those special status species known to occur in the general project areas include (Fort Carson, 2009 and 2007a):

- **Golden eagle**. Listed as a Species of Special Concern in Colorado by the CPW and protected at Federal level by the Bald and Golden Eagle Protection Act. There are 15 active nests on Fort Carson, which contribute significantly to the sustainability of the regional breeding population. There is an active nest just southwest of the potential wind turbine area (Wildhorse site) in the southeast corner of the Installation. As described below, the black-tailed prairie dog colonies located within or directly adjacent to the Gate 2 South, Ray Nixon, Gate 19, Wildhorse, and Tent City sites could be considered potential foraging locations.
- **Bald eagle.** Colorado-listed as threatened and protected at the Federal level by the Bald and Golden Eagle Protection Act. This species is an uncommon winter resident (late October through late February) at Fort Carson. Most records are from the northern region of the Installation, probably because of the presence of several prairie dog colonies in the Main Post area, in the Small Arms Impact Range, and along Fountain Creek east of the Installation. A winter roost probably exists on Fountain Creek east of Fort Carson, but the location is unknown. There have been several sitings in the southern portion of Fort Carson. As described below, the black-tailed prairie dog colonies located on the Gate 19, Gate 2 South, and Ray Nixon sites, as well as along the southern boundary of the Tent City site could also serve as foraging locations for eagles.
- **Black-tailed prairie dog**. A former candidate for Federal listing, is common on Fort Carson, occupying approximately 7,700 acres in 78 colonies. It is listed as a Species of Special Concern in Colorado by the CPW. Frequently referred to as a keystone species of the shortgrass prairie ecosystem, the prairie dog plays a significant role in life cycles of several Species of Special Concern on Fort Carson: the ferruginous hawk, bald and golden eagles, mountain plover, and the state-listed burrowing owl. Prairie dogs are managed on Fort Carson according to prescriptions detailed in the Installation prairie dog management plan. The plan balances conservation with human health and property loss and details circumstances for lethal control of the species on Fort Carson. There are black-tailed prairie dog colonies within the Gate 2 South, Ray Nixon, and Gate 19 sites and another just west of the Wildhorse site. Prairie dog colonies are also known to occur along the southern boundary of the Tent City site associated with the topographically flat bench of Rock Creek.
- **Burrowing owl.** Colorado-listed as threatened. This species is a small, burrow-dwelling owl that nests underground in unoccupied prairie dog burrows. The burrowing owl has never been common on Fort Carson, and the number of prairie dog colonies annually occupied by this species is low. Much more habitat exists than is used by this species. Any of the locations for black-tailed prairie dog colonies described above could contain burrowing owls as well.

The State of Colorado does not list threatened or endangered plant species. The following Colorado Species of Special Concern plants are either known to occur or have the potential to occur on Fort Carson: dwarf milkweed (*Asclepias uncialis*), Arkansas River feverfew (*Bolophyta tetraneuris*), bird-bill dayflower (*Commelina dianthifolia*), brandegee wild buckwheat (*Eriogonum brandegei*), Rocky Mountain bladderpod (*Lesquereula calcicola*), golden blazing star (*Mentzelia chrysantha*), Arkansas Valley evening primrose (*Oenothera harringtonii*), round-leaf four o'clock (*Oxybaphus rotundifolius*), degener penstemon (*Penstemon degeneri*), ute ladies' tresses (*Spiranthes diluvialis*), Pueblo goldenweed (*Oonopsis puebloensis*), Rocky Mountain phacelia (*Phacelia denticulata*), twinevine (*Scarcostemma crispum*), and Fendler's Townsend-daisy (*Townsendia fendleri*) (Fort Carson, 2009). Arkansas River feverfew, golden blazing star, Arkansas Valley evening primrose, round leaf four o' clock, and Pueblo goldenweed are known to occur at the Wildhorse site (Neid and Handwerk, 2007).

3.7.2 ENVIRONMENTAL CONSEQUENCES

This section provides a discussion of the possible environmental impacts to biological resources that could result from the Proposed Action Alternatives. Section 3.1.2, Approach for Analyzing Impacts, describes the overall approach for analyzing impacts and defines each impact rating. As stated in Table 3.1-1, a significant impact to biological resources would result if it results in an unpermitted "take" of threatened and endangered species.

3.7.2.1 No Action Alternative

Under the No Action Alternative there would be no new construction and biological resources would remain in their current state; therefore, no new direct or indirect impacts would occur.

3.7.2.2 Proposed Action Alternatives

3.7.2.2.1 Biological Resource Impacts Common to All Proposed Action Alternatives

Impacts to Terrestrial Wildlife and Habitat

Overall, the majority of impacts to terrestrial wildlife and habitat, including vegetation resources, would be related to vegetation and associated wildlife habitat losses that would be incurred during project construction. Any of the potential construction projects would require initial land clearing and grading, which would involve the removal of existing vegetation. Thus, vegetation losses would result and any wildlife species previously utilizing the disturbed habitats would be displaced. Due to the avoidance of more sensitive habitat types (e.g., riparian and wetland) and abundance of similar habitat types which may be impacted by the Proposed Action Alternatives on Fort Carson and within the region, minor adverse impacts would be anticipated. In addition, direct mortality of wildlife species could occur, most likely smaller less-mobile species, due to collisions with equipment during construction. This impact would be localized and would not affect overall regional wildlife populations or species viability; therefore, minor adverse impacts would be anticipated.

Wherever land disturbing activities occur, the potential exists for the introduction and spread of noxious weeds. Fort Carson's program to control noxious weeds as described in Section 3.7.1.1.1 and the stabilization of areas temporarily disturbed during construction with native seed mixes or approved plant species would minimize this potential threat. Therefore, minor adverse impacts would be anticipated.

Impacts to Aquatic Life and Habitat

During the initial design stages of the sites requiring electric distribution lines (Alternatives 1, 2, 3, 5, and 6), specific routes for the electrical tie-ins would be determined. Siting of the lines would likely follow existing ROW and would avoid to the greatest extent possible direct impacts to surface waters and aquatic habitat. If the distribution lines are buried, trenching methods would temporarily disturb aquatic habitat and may cause minor losses of aquatic life. To minimize potential impacts to water resources and aquatic habitat, a General Permit would require the preparation of a SWPPP. This plan includes BMPs for erosion control and pollution prevention requirements. The BMPs would reduce temporary impacts by controlling sedimentation and turbidity and restoring stream crossings to their original grade to stabilize streambanks post construction.

The majority of stream features are intermittent in nature and, when flowing, likely contain no or limited larger aquatic life (e.g., fish). Should construction activities occur near a surface water feature, the primary effect would be sedimentation resulting from land disturbing activities, which can have negative effects to aquatic life primarily because the sediments can fill in open spaces within the stream bed (e.g., riffles) that provide habitat for aquatic macroinvertebrates (e.g., insects). Therefore, macroinvertabrate populations can decline and food resources for larger species (e.g., fish) can become more limited. In addition, accidental releases of toxic materials could occur during construction, which could degrade aquatic habitat if it were to reach surface waters. The potential for these impacts to occur would be minimized substantially through the use of standard construction BMPs to control erosion (e.g., the use silt fencing) and releases of toxic materials (e.g., providing secondary containment around equipment refueling areas). No impacts to aquatic species would be expected during operations of any of the potential features under all of the alternatives.

3.7.2.2.2 Alternative 1

Impacts to Terrestrial Wildlife and Habitat

The WTE plant would be located within the Gate 19 area, an approximately 163-acre site, of which the WTE plant would occupy 40 acres. The entire 163-acre area consists of grassland (Fort Carson, 2012e), thus no matter where the WTE plant would ultimately be sited in this area, it would result in a loss of 40 acres of grassland and associated wildlife habitat, causing minor, long-term impacts. Potential impacts would be as described in Section 3.7.2.2.1.

Impacts to Aquatic Life and Habitat

There are no aquatic habitats present at the Gate 19 site (Fort Carson, 2012e; USDA, 2011; USGS, 2011). Depending on final siting, the WTE plant may be constructed in the general vicinity (within ½-mile) of off-site intermittent streams and negligible impacts of pollutant input may occur as described in Section 3.7.2.2.1.

Impacts to Protected Species

There is a black-tailed prairie dog colony on the far west side of the Gate 19 site, which could also serve as habitat for burrowing owl. Although black-tailed prairie dogs are Species of Special Concern that are not afforded any regulatory protections, they are important prey species for raptors (e.g., golden eagles) and there is also the presence of burrowing owl, which is protected as a Colorado-Threatened species. Thus, as described further in Section 3.7.4, disturbance of this area would be avoided by siting the WTE plant away from the black-tailed prairie dog colony.

The WTE plant would also include one or more exhaust stacks up to 200 feet in height, which could induce migratory bird mortality via collisions. Minor impacts would be expected as collisions at these relatively large static structures would most likely be avoidable by birds; impacts would most likely occur during periods of inclement weather that reduces visibility.

3.7.2.2.3 Alternative 2

Impacts to Terrestrial Wildlife and Habitat

The biomass plant would be located within one of three potential areas (Fort Carson, 2012e):

- Gate 19 area (Alternative 2a) – 163 acres of grassland;
- Bravo North Sites 1 and 2 (Alternative 2b) – 61.3 acres of shrubland, 30.6 acres of grassland, 0.1 acres of riparian vegetation, and 2.2 acres with no vegetation; and
- Site expansion for upgrading the proposed CEP (Alternative 2c) – 16.5 acres of grassland.

The biomass plant would occupy an area of 20 to 40 acres. At the Gate 19 site, the entire area consists of grassland, thus no matter where the biomass plant would ultimately be sited in this area, it would result in a loss of 20 to 40 acres of grassland. At the Bravo North Sites 1 and 2, it is likely that more than one vegetation type would be lost; these would most likely consist of grassland and/or shrubland. Upgrading the proposed CEP to a biomass plant would result in a loss of grassland habitat. For each of these options minor, long-term impacts would be expected to vegetation and associated habitat losses; however, potential losses of shrubland at the Bravo North Sites 1 and 2 would likely result in a loss of more biologically diverse habitat than the grasslands. The general impacts described in Section 3.7.2.2.1 would apply under any of the alternative locations for the biomass plant.

Impacts to Aquatic Life and Habitat

There are no aquatic habitats present at any of the alternative sites for the biomass plant (Fort Carson, 2012e). Depending on final siting at any of the potential locations, the biomass plant may be constructed in the general vicinity (within ½-mile) of off-site streams and negligible impacts of pollutant input may occur as described in Section 3.7.2.2.1.

Impacts to Protected Species

Should the Gate 19 site be selected for the biomass plant, there is a black-tailed prairie dog colony on the far west side of the Gate 19 site, which could also serve as habitat for burrowing owl. Although black-tailed prairie dogs are Species of Special Concern that are not afforded any regulatory protections, they are important prey species for raptors (e.g., golden eagles) and there is also the presence of burrowing owl, which is protected as a Colorado-Threatened species. Thus, as described further in Section 3.7.4, disturbance of this area would be avoided by siting the biomass plant away from the black-tailed prairie dog colony.

The biomass plant would also include one or more exhaust stacks up to 200 feet in height, which could induce migratory bird mortality via collisions. Minor impacts would be expected as collisions at these relatively large static structures would most likely be avoidable by birds; impacts would most likely occur during periods of inclement weather that reduces visibility.

3.7.2.2.4 Alternative 3

Impacts to Terrestrial Wildlife and Habitat

The PV systems could be located within 13 potential sites (Fort Carson, 2012e):

- Gate 2 North – 2.6 acres of shrubland and 8 acres with no vegetation;
- Gate 2 South – 7.6 acres of grassland;
- Chiles – 12.7 acres with no vegetation;
- SWMU 1-170 – 86.3 acres with no vegetation, 0.6 acres of shrubland, and 0.1 acres of riparian vegetation;
- SWMU 5 (Site 1) – 8.9 acres of grassland and 5.4 acres with no vegetation;

- SWMU 5 (Site 2) – 41 acres of grassland, 0.3 acres of riparian vegetation, and 0.5 acres with no vegetation;
- Bravo North (Site 1) – 40.7 acres of shrubland, 30.6 acres of grassland, 0.1 acres of riparian vegetation, and 0.2 acres with no vegetation;
- Butts Road – 70.7 acres of grassland and 18.7 acres of shrubland;
- Magrath Avenue – 0.3 acres of shrubland, 0.7 acres of riparian vegetation, and 18.5 acres with no vegetation;
- Wildhorse – 327.9 acres of forest, 33 acres of grassland, and 0.25 acres of riparian vegetation;
- Titus/Signal Hill – 17.6 acres of shrubland and 14 acres with no vegetation;
- Ray Nixon – 80.5 acres of grassland, 55.5 acres of shrubland, and 10.8 acres with no vegetation; and
- Tent City – 77 acres of grassland and 20 acres with no vegetation.

Construction of PV sites would result in temporary minor adverse impacts to vegetation. In areas where grading is required to meet specifications, top soils would be removed, grading accomplished and top soils replaced with subsequent planting of native grasses or seed mixtures. In addition, during installation activities, it is expected that some vegetation cover would be lost due to vehicles carrying supplies, movement of workers, and general activity on site. The amount of temporarily disturbed area would depend on the size and configuration of the PV system designed, and would not likely require entire site-wide disturbance to vegetation. After the PV system and associated electrical tie-ins are installed, disturbed areas would be reseeded with an appropriate grass species. Forested land and shrubland at Gate 2 North, Bravo North (Site 1), Butts Road, Titus/Signal Hill, and Ray Nixon would be permanently converted to grassland habitat within the PV field. Furthermore, it is unlikely that PV systems would be placed in any riparian habitat. The general impacts described in Section 3.7.2.2.1 would apply under any of the alternative locations for PV systems that contain vegetation.

A number of Colorado Species of Special Concern plants have been identified as potentially occurring in the Wildhorse site, including: Arkansas River feverfew, golden blazing star, Arkansas Valley evening primrose, round leaf four o' clock, and Pueblo goldenweed (Neid and Handwerk, 2007). In particular, Training Area 48 is known to have some of the highest occurrences of Round-leaf four-o'clock; out of the approximate 1,052 acres of excellent habitat in Colorado, as classified by CNHP, Fort Carson (including PCMS) possesses approximately 73 percent (764 acres) of this habitat (Peyton, 2012). Although Species of Special Concern are not afforded any regulatory protections, Fort Carson would perform vegetation surveys prior to final project siting (see Section 3.7.4). Given the widespread habitat and occurrence of rare plant species, localized habitat and species loss would be anticipated. Vegetation surveys would be used to avoid prime habitat and locations with high density populations of rare plant species during siting of PV panels. Less than significant impacts would be anticipated.

During the lifetime of the PV system, changes in vegetation communities may occur within developed PV areas. Changes may include increased vegetative cover in some areas, decreased cover in other areas, and changes in plant species composition. Shading and soil moisture retention may increase under the solar panels although total precipitation may decrease. These effects would be greater under the edge of the panels nearest the ground. In between the panels, runoff may increase, and some plants may be crushed by occasional maintenance-vehicle traffic. All of these changes could cause shifts in plant community composition because ambient species more adapted to the changed conditions may gradually outcompete the existing dominant plants. It is unlikely, however, that large, unvegetated areas would develop, and it is anticipated that net vegetative cover would likely increase or remain the same. Negligible to minor adverse impacts would, therefore, be anticipated.

As operation of the proposed PV systems would be dependent on an open view of the sky, vegetation management would be an integral part of maintenance activities within the proposed PV sites. Various understory plants may grow taller than the height limit for vegetation under the solar arrays (typically two feet). When plants approach that height limit, mowing or trimming would be required. Grasses would likely be cut back to a few inches high, while shrub species would be cut back to heights of 6 – 12 inches (0.15 – 0.3 meters). Mowing would not be expected to occur more than twice per year for grasses and once per year for understory vegetation. As the proposed sites are primarily within grassland habitat; negligible adverse impacts would be anticipated within those areas. Within shrubland and woodland sites, various shrub and tree species would likely grow from root material left behind during the clearing process. These "volunteer" species would be periodically removed, constituting minor adverse impacts. The temporary disturbance caused by short-term maintenance actions (lasting a few hours to a day) would be unlikely to disrupt birds or wildlife in the area.

Impacts to Aquatic Life and Habitat

The following potential sites for PV systems contain intermittent streams: Gate 2 South, Chiles, SWMU 1-170, SWMU 5 (Site 1), SWMU 5 (Site 2), Butts Road, Magrath Avenue, and Wildhorse. None of the stream features would be directly disturbed by development of PV systems. Potential impacts would be as described in Section 3.7.2.2.1.

Impacts to Protected Species

There are black-tailed prairie dog colonies which could also serve as habitat for burrowing owl on the Gate 19, Gate 2 South, and Ray Nixon sites, as well as along the southern boundary of the Tent City site. Although black-tailed prairie dogs are Species of Special Concern that are not afforded any regulatory protections, they are important prey species for raptors (e.g., golden eagles) and there is also the potential presence of burrowing owl, which is protected as a Colorado-Threatened species. Thus, as described in Section 3.7.4, should any of these sites be selected for PV systems, the PV systems would be sited away from the black-tailed prairie dog colonies to avoid impacts.

In addition, the potential exists for construction of aboveground powerlines for the electrical tie-in of the Wildhorse site due to its distance from the nearest interconnection point (see Section 3.12). As a result, the potential exists for adverse impacts to raptors. If an overhead powerline is required, CPW would likely require that a raptor-proof system be installed to avoid adverse impacts and, therefore, negligible to minor adverse impacts would be anticipated.

3.7.2.2.5 Alternative 4

Impacts to Terrestrial Wildlife and Habitat

Expansion of the existing reclaimed water system would have a negligible impact on terrestrial wildlife and habitat. Expansion of the golf course pond would not alter any natural vegetation potentially useful for wildlife. Construction activities to increase the size of the pond may cause any wildlife utilizing the pond (e.g., waterfowl) to temporarily avoid it. The new pipelines would be developed along existing roadways; thus, no vegetated habitats would be disturbed and no impacts would result.

Impacts to Aquatic Life and Habitat

No impacts to aquatic species would be expected as a result of altering the golf course pond as this is an isolated pond without any connection to natural habitats that could contain native aquatic fauna (e.g., fish). Development of the reclaimed water distribution pipelines would occur in close proximity to two intermittent streams; thus, potential impacts would be as described in Section 3.7.2.2.1. If crossing of these features is unavoidable, temporary and minor adverse impacts would occur from trenching activities for installation of the pipeline. Following construction, any contours within these intermittent features would be restored to their original grades and stabilized as necessary.

Impacts to Protected Species

There are no protected species known to occur in any of the proposed disturbance areas; thus, no impacts to protected species would be expected.

3.7.2.2.6 Alternative 5

Impacts to Terrestrial Wildlife and Habitat

Alternative 5 includes the construction and operation of up to eight wind turbines, each of which would consist of an approximately one-acre disturbance area; the total height of each turbine, including the blades, would be up to 150 meters (492 feet). Overall, the entire potential site (Wildhorse site) consists of approximately 360 acres, of which approximately 91 percent is forested land (328 acres) and 9 percent is grassland (33 acres). Impacts from site development would be the same as those described in Section 3.7.2.2.1.

A number of Colorado Species of Special Concern plants have been identified as potentially occurring in the project area, including: Arkansas River feverfew, golden blazing star, Arkansas Valley evening primrose, round leaf four o’ clock, and Pueblo goldenweed (Neid and Handwerk, 2007). In particular, Training Area 48 is known to have some of the highest occurrences of Round-leaf four-o’clock; out of the approximate 1,052 acres of excellent habitat in Colorado, as classified by CNHP, Fort Carson (including PCMS) possesses approximately 73 percent (764 acres) of this habitat (Peyton, 2012). Although Species of Special Concern are not afforded any regulatory protections, Fort Carson would perform vegetation surveys prior to final project siting (see Section 3.7.4). Given the widespread habitat and occurrence of rare plant species, localized habitat and species loss would be anticipated. Vegetation surveys would be used to avoid prime habitat and locations with high density populations of rare plant species during siting of PV panels. Less than significant impacts would be anticipated.

The operation of wind turbines can have adverse impacts on birds and bats primarily by mortality of individuals through collision and/or barotrauma of bats (i.e., internal organ damage caused by atmospheric pressure changes near the tips of moving blades). Bird collisions with turbines appear to generally occur at similar rates as those associated with static structures (e.g., buildings and electrical transmission towers); however, bats appear to be attracted to wind turbines. Precise causes for this are currently unknown though current hypotheses include: sounds produced by turbines, concentrations of insect prey near turbines, and bats attempting to find roost locations. Bat fatalities typically peak in late summer and early fall, coinciding with the migration of many species (NWCC, 2010).

As described in Section 3.7.1.2, bat species known to occur on Fort Carson include: Townsend’s big-eared bat, big free-tailed bat, eastern pipistrelle, fringed myotis, pallid bat, big brown bat, hoary bat, and Yuma myotis. None of these species are protected by Federal or Colorado regulations.

The Colorado Bat Working Group (CBWG) has developed a system for classifying the vulnerability of bat species to a number of potential threats, including wind energy development. CBWG ranked the scope, severity, and immediacy of potential threats as high, moderate, low, or insignificant for 18 bat species found in Colorado. These rankings were summarized into a value ranging from “A” (substantial, imminent threat) to “H” (unthreatened) for each threat-species combination. For the wind energy development threat, each of the aforementioned species known to occur at Fort Carson are classified as “G” (slightly threatened) except for hoary bat, which is considered “A”, a substantial, imminent threat (CBWG, 2010). Through informal conversations with CBWG, Fort Carson personnel have learned that little is known about the impacts of wind turbine development on Townsend’s big-eared bat; therefore, although CBWG lists them as slightly threatened by wind development, the true threat is not clear due to a lack of research.

Overall, the hoary bat is considered “globally secure” and “state secure” in Colorado in terms of its’ NatureServe conservation status. It is the most widespread of North American bats with a range extending from Canada to Chile as well as being found in Hawaii. The loss of forested roosting habitat due to timber harvesting is considered its greatest threat (Ellison et al., 2004). It is likely that the hoary bat's "substantial, imminent threat" status with respect to wind energy development is associated with it being one of the species most frequently found deceased at wind energy generation facilities overall as are other migratory tree- and foliage-roosting bats (BCI, 2012). Overall, a moderate adverse impact on hoary bats would be expected to occur in the form of direct mortality. No significant impacts in terms of the continued existence of the species would be expected as the species is widespread and generally common. Minor impacts would be expected for the other local bat species, also in terms of direct mortality, based on their relatively low ranking of "slightly threatened" by CBWG in terms of wind energy development threats.

Impacts to Aquatic Life and Habitat

Portions of five different intermittent streams are located within the overall site, which would not be directly disturbed by the project. Potential impacts would be as described in Section 3.7.2.2.1.

Impacts to Protected Species

The potential exists for construction of aboveground powerlines for the electrical tie-in of the Wildhorse site due to its distance from existing interconnection points. Existing powerlines in Training Area 48 are used as perches by raptors, and development of wind turbines in the area could present a higher risk to golden eagles with increased perch availability in the general project area from construction of additional aboveground powerlines. If an overhead powerline is required, CPW would likely require that a raptor-proof system be installed to avoid adverse impacts.

Operation of the wind turbines could cause bird mortality, including migratory birds and raptors protected under the MBTA and the Bald and Golden Eagle Protection Act. Sensitivity analysis suggest that key parameters in determining collision risk are bird speed, rotor diameter, and rotation speed, although variation in collision risk was still small within the likely range of these variables (Chamberlain et al., 2006). Studies have also indicated avoidance behaviors at wind farm sites. Avoidance behavior, however, is likely to vary according to conditions; with reduced avoidance rates during times of poor visibility, in poor weather, and at night. Additionally, in conditions of poor visibility, birds tend to be drawn towards, and circle in the vicinity of continuous lights, which may affect avoidance rates avoidance rates (Chamberlain et al., 2006).

Migratory songbirds tend to be the most abundant birds in North America; thus, they are most often found deceased at wind energy facilities. Most migratory species fly well above the height of wind turbines; therefore, the greatest threats to these species would likely occur during takeoff and landing and during migration in inclement weather, which could force individuals to fly at lower altitudes. Songbird fatalities typically peak in spring and fall during migration. Overall, current fatality levels are unlikely to affect population trends for most North American songbirds. Although only limited information currently exists, most bird collision studies at land-based and non-coastal wind energy facilities have reported low rates of waterbird and waterfowl collisions. Relatively low raptor fatality rates exist at most wind energy facilities with most reporting less than four fatalities per MW per year; however, as would be expected, raptor fatalities tend to increase as their abundance in an area increases (NWCC, 2010). Individual mortality of these species would not be anticipated to affect overall population levels as the turbines would be developed on a relatively small scale (up to eight turbines); therefore, less than significant, minor adverse impacts would be anticipated.

In terms of impacts to birds, bald and golden eagles are the greatest concerns as there are a number of sightings and known nesting locations in the southern portion of Fort Carson. There is one known golden eagle nesting location approximately 0.25 miles to the west of the project site and a known black-tailed prairie dog burrow area, a primary raptor prey item, also to the west of the site. There are no known nests or foraging areas within the project site. As golden eagles usually forage within 4.4 miles of their nests, the potential exists for golden eagle foraging activity within the proposed forested locations of the wind turbines. The primary locations for foraging, however, would likely occur along the edges of woodland locations where small mammal prey items are often found and power lines in the area are often used as perches. Golden eagles may also pass through the area to access offsite foraging locations. Overall, a potential for adverse impacts in terms of direct mortality of raptors would exist. The forested nature of the project area, however, makes it generally less suitable for foraging activity compared to surrounding grassland and shrubland areas where more abundant golden eagle prey species are found.

As discussed in Section 3.7.4, Fort Carson would consult USFWS on operational and deterrent measures to avoid or minimize “take” of migratory birds and raptors which could include the preparation of an Avian and Bat Protection Plan to reduce the potential for adverse impacts from wind turbine development at the Wildhorse site. Should it ultimately be determined that unavoidable significant adverse impacts would occur, alternative mitigation strategies may be considered. Less than significant impacts would be anticipated.

3.7.2.2.7 Alternative 6

Impacts to Terrestrial Wildlife and Habitat

The PV and ground-source heating and cooling systems could be located within 19 potential sites (Fort Carson, 2012e):

- Gate 2 North – 2.6 acres of shrubland and 8 acres with no vegetation;
- Gate 2 South – 7.6 acres of grassland;
- Chiles – 12.7 acres with no vegetation;
- SWMU 1-170 – 86.3 acres with no vegetation, 0.6 acres of shrubland, and 0.1 acres of riparian vegetation;
- SWMU 5 (Site 1) – 8.9 acres of grassland and 5.4 acres with no vegetation;
- SWMU 5 (Site 2) – 41 acres of grassland, 0.3 acres of riparian vegetation, and 0.5 acres with no vegetation;
- Bravo North (Site 1) – 40.7 acres of shrubland, 30.6 acres of grassland, 0.1 acres of riparian vegetation, and 0.2 acres with no vegetation;
- Butts Road – 70.7 acres of grassland and 18.7 acres of shrubland;
- Magrath Avenue – 0.3 acres of shrubland, 0.7 acres of riparian vegetation, and 18.5 acres with no vegetation;
- Wildhorse – 327.9 acres of forest, 33 acres of grassland, and 0.25 acres of riparian vegetation;
- Titus/Signal Hill – 17.6 acres of shrubland and 14 acres with no vegetation;
- Ray Nixon – 80.5 acres of grassland, 55.5 acres of shrubland, and 10.8 acres with no vegetation;
- Tent City – 77 acres of grassland and 20 acres with no vegetation;
- Bravo North (Site 2) – 20.6 acres of shrubland and 2 acres with no vegetation;
- CEP Biomass - 16.5 acres of grassland
- Gate 19 area – 163 acres of grassland;
- Highway 115 – 1.0 acre of forest;
- Fremont – 0.5 acres of grassland and 0.5 acres with no vegetation; and
- COARNG – 98.9 acres of grassland, 29.1 acres of riparian, 2.6 acres of shrubland and 0.7 acres with no vegetation.

Overall, development of ground-source heating and cooling projects would likely have a minimal effect as they would be associated with existing and future buildings; thus, the ground-source heating and cooling portion itself would likely have a minimal footprint adjacent to an existing building or one under construction. PV systems would disturb terrestrial vegetation and habitats, though rooftop systems would not disturb biological resources. For the non-rooftop options, minor, long-term impacts would be expected from vegetation and associated habitat losses. Forested land at the Wildhorse site, and to a much lesser extent Highway 115, would likely represent the most biologically diverse habitat; thus, losses of this habitat would likely have the greatest adverse effect. Losses of shrubland at Gate 2 North, Bravo North (Sites 1 and 2), Butts Road, Titus/Signal Hill, and Ray Nixon would represent the second most diverse habitat losses. It is unlikely that ground-source heating and cooling or PV systems would be deployed in any riparian vegetation. Development of areas with no vegetation would have no impacts on species or habitat. Potential impacts would be as described in Section 3.7.2.2.1 under any of the alternative locations for ground-source heating and cooling and PV systems that contain vegetation.

The Chiles site would have no impact as it does not contain any vegetation and the SWMU 1-170 site would have no impact as disturbing vegetation would be easily avoidable (only 0.7 acres of the overall 87-acre site contains vegetation). For the remaining parcels, Fort Carson would utilize the environmental screening criteria that have been developed and considered within this EA (see Appendix B) to assist in deciding the placement of the PV systems and ground-source heating and cooling units.

A number of Colorado Species of Special Concern plants have been identified as potentially occurring in the Wildhorse site, including: Arkansas River feverfew, golden blazing star, Arkansas Valley evening primrose, round leaf four o' clock, and Pueblo goldenweed (Neid and Handwerk, 2007). Although Species of Special Concern are not afforded any regulatory protections, Fort Carson would perform vegetation surveys prior to final project siting (see Section 3.7.4). Given the widespread habitat and occurrence of rare plant species, localized habitat and species loss would be anticipated. Vegetation surveys would be used to avoid prime habitat and locations with high density populations of rare plant species during siting of PV panels. Less than significant impacts would be anticipated.

Impacts to Aquatic Life and Habitat

The following potential sites for ground-source heating and cooling and PV systems contain intermittent streams: Gate 2 South, Chiles, SWMU 1-170, SWMU 5 (Site 1), SWMU 5 (Site 2), Butts Road, Magrath Avenue, and Wildhorse. None of the stream features would be directly disturbed by development of ground-source heating and cooling or PV systems. Potential impacts would be as described in Section 3.7.2.2.1. Rooftop PV systems would have no impact on aquatic resources.

Impacts to Protected Species

There are black-tailed prairie dog colonies which could also serve as habitat for burrowing owl on the Gate 19, Gate 2 South, and Ray Nixon sites, as well as along the southern boundary of the Tent City site. Although black-tailed prairie dogs are Species of Special Concern that are not any regulatory protections, they are important prey species for raptors (e.g., golden eagles) and there is also the potential presence of burrowing owl, which is protected as a Colorado-Threatened species. Thus, as described in Section 3.7.4, should any of these sites be selected for ground-source heating and cooling or PV systems, disturbance of the black-tailed prairie dog colonies would be avoided by siting the systems away from them.

In addition, the potential exists for construction of aboveground powerlines for the electrical tie-in of the downrange sites (Wildhorse, Fremont, and Highway 115) due to their distance from existing interconnection points (see Section 3.12). As a result, the potential exists for adverse impacts to raptors. If an overhead powerline is required, CPW would likely require that a raptor-proof system be installed to avoid adverse impacts and adverse impacts would be minor to negligible.

3.7.2.2.8 Alternative 7

Implementation of Alternative 7 would have negligible impacts on biological resources. These projects would primarily occur within previously disturbed areas (building interiors, developed portions of building exteriors and modifications to existing utility infrastructure).

3.7.3 CUMULATIVE EFFECTS

Overall, the Proposed Action would be expected to contribute minor cumulative impacts in terms of terrestrial vegetation and habitat losses and aquatic habitat degradation primarily through likely negligible degrees of sedimentation. Each of the reasonably foreseeable projects identified for inclusion in this analysis would likely cause some degree of terrestrial vegetation and habitat losses and minor amounts of sedimentation generated during their construction would likely cause a negligible degree of aquatic habitat degradation.

The primary future project that may cause impacts to migratory birds and raptors that could interact cumulatively with the wind turbines proposed under Alternative 5 would be the CAB stationing. Helicopter operations in the area of the Wildhorse site combined with wind turbine development at the Wildhorse site could result in migratory bird and raptor collisions causing mortality, as could collisions with the wind turbines. These combined activities would likely cause either direct take or displace the eagles to other areas where disturbance is lower. These cumulative effects would be less than significant as it is likely that helicopter movements would represent large, loud obstructions, which birds would largely avoid and the wind turbine development would be on a relatively small scale (up to eight turbines). Furthermore, due to the slower speeds at which helicopters move, it is likely that only a small number of bat mortality events would occur, most likely occurring during migration. During other times such as typical foraging behavior, bats generally do not fly much higher than tree canopies and would be unlikely affected by helicopter operations. Overall, a variety of activities at Fort Carson may result in raptor disturbances and reduction in suitable habitat availability, such as military training, recreational activities, land development reducing prey habitat. These disturbances and reduction of suitable habitat would result in minor to moderate cumulative impacts on raptors, and golden eagles in particular. None of the projects identified would be expected to have any impacts on bats that could interact cumulatively with the wind turbines proposed under Alternative 5.

3.7.4 PROPOSED IMPACT REDUCTION MEASURES

3.7.4.1 Mitigation

Under any of the Proposed Action Alternatives, Fort Carson would conduct initial land clearing associated with construction outside of the migratory bird nesting season, which is typically 1 April through 15 August for most species in Colorado, to avoid the "take" of any migratory birds or their nests or eggs to avoid any violations of the MBTA. Should Fort Carson be unable to work within this timing restriction, they would conduct bird nest surveys of the potentially-impacted area(s) in order to determine if the take of any migratory birds or their nests or eggs could occur. Should any nests be found, Fort Carson would take appropriate measures to develop the site while avoiding any violations of the MBTA.

The following alternative-specific measures would also be implemented to avoid or reduce impacts to biological resources:

Alternative 1: To avoid potential impacts to a black-tailed prairie dog colony and burrowing owls in the far west side of the Gate 19 site, Fort Carson would locate the WTE away from this area. If potentially suitable habitat ultimately would be affected, burrowing owl clearance surveys would be performed before ground leveling activities to avoid adverse direct impacts.

Alternative 2: Should the Gate 19 site be selected for the biomass plant, to avoid potential impacts to a black-tailed prairie dog colony and burrowing owls in the far west side of the site, Fort Carson would locate the biomass plant away from this area. If potentially suitable habitat ultimately would be affected, burrowing owl clearance surveys would be performed before ground leveling activities to avoid adverse direct impacts.

Alternative 3: Should the Gate 2 South, Ray Nixon, or Tent City sites be selected for PV systems, to avoid potential impacts to black-tailed prairie dog colonies and burrowing owls, Fort Carson would locate the PV systems away from the colonies. If potentially suitable habitat ultimately would be affected, burrowing owl clearance surveys would be performed before ground leveling activities to avoid adverse direct impacts.

Alternative 3: Should the Wildhorse site be selected for PV systems, prior to final project siting, Fort Carson would conduct a vegetation survey in potential disturbance areas in order to identify potential locations of Colorado Species of Concern plants known to occur in the area. Vegetation surveys would be used to avoid prime habitat and locations with high density populations of rare plant species during siting. If an overhead powerline is required, Fort Carson staff would consult with CPW and consider mitigations such as installing a raptor-proof system for reducing raptor mortality to avoid significant impacts to raptors protected by the Bald and Golden Eagle Protection Act.

Alternative 4: Should crossing of aquatic habitat be unavoidable during pipeline installation, contours within these features would be restored to their original grades and stabilized as necessary.

Alternative 5: If an overhead powerline is required, Fort Carson staff would consult with CPW and consider mitigations such as installing a raptor-proof system for reducing raptor mortality to avoid significant impacts to raptors protected by the Bald and Golden Eagle Protection Act.

Alternative 5: To minimize the impacts of bird and bat mortality from collisions with wind turbines, Fort Carson would consult with USFWS and implement, to the extent practicable, protection measures outlined in the USFWS' "Land-Based Wind Energy Guidelines." This consultation may result in the need to prepare an Avian and Bat Protection Plan in order to reduce the potential for adverse impacts from wind turbine development at the Wildhorse site. A project-specific Avian and Bat Protection Plan documents the steps a developer takes to avoid and minimize effects to birds and bats, and (if applicable) documents compensation measures taken and incorporates adaptive management. Typically, a project-specific plan documents the analyses, studies, and reasoning that support siting decisions and turbine design, and outlines post-construction monitoring efforts for mortality and habitat effects. This could include conducting preconstruction baseline surveys of raptor and migratory bird occurrences and travel patterns as well as continued monitoring of the area during operations. Through coordination with USFWS and implementation of mitigation measures, it is expected that less than significant impacts on migratory birds and raptors protected by the MBTA and Bald and Golden Eagle Protection Act would occur.

Alternative 5: To minimize the impacts of bat mortality from collisions with wind turbines, Fort Carson could reduce turbine activity during vulnerable times of year to the extent practicable. Research suggests that more bat fatalities occur during low-wind periods during the summer and fall months. Non-spinning blades do not kill bats; thus, shutting down wind turbines during low-wind periods can reduce overall fatalities. This can be accomplished by raising the cut-in speed (i.e., the lowest wind speed at which turbines generate power to a utility system) above the manufactured cut-in speed (usually 3.5 to 4.0 meters per second). Studies suggest that bat fatalities can be reduced by at least 44 percent when the cut-in speed is raised to 5.0 meters per second with a minimal power loss of one percent or less (Arnett et al., 2011). Thus, Fort Carson could choose to operate their wind turbines at a 5.0 meters per second cut-in speed during the summer and fall months.

Alternative 5: Prior to final project siting, Fort Carson would conduct a vegetation survey in potential disturbance areas in order identify potential locations of Colorado Species of Concern plants known to occur in the area. Vegetation surveys would be used to avoid prime habitat and locations with high density populations of rare plant species during siting.

Alternative 6: Should the Gate 19, Gate 2 South, Ray Nixon, or Tent City sites be selected for ground-source heating and cooling or PV systems, to avoid potential impacts to black-tailed prairie dog colonies and burrowing owls, Fort Carson would locate the systems away from the colonies. If potentially suitable habitat ultimately would be affected, burrowing owl clearance surveys would be performed before ground leveling activities to avoid direct impacts. If an overhead powerline is required, Fort Carson staff would consult with CPW and consider mitigations such as installing a raptor-proof system for reducing raptor mortality to avoid significant impacts to raptors protected by the Bald and Golden Eagle Protection Act Wildhorse, Fremont, and Highway 115 sites).

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3.8 Cultural Resources

3.8.1 AFFECTED ENVIRONMENT

3.8.1.1 Fort Carson Cultural Resource Management Program/Process for Identification of Resources

Management of cultural resources hinges on the identification and eligibility of resources for inclusion in the National Register of Historic Places (NRHP). Any historic or prehistoric site that is eligible for the NRHP is referred to as a historic property. A separate class of cultural resources is the traditional cultural property (TCP), which may be eligible for inclusion in the National Register because of traditional, religious, and/or cultural importance to Tribes or other cultural groups. This designation also incorporates and considers Native American sacred sites.

The foundation of broad legislation for preservation of cultural resources is the National Historic Preservation Act (NHPA) of 1966 (36 CFR Part 800). The NHPA calls upon the Federal government to be a leader in preservation and outlines roles of the National Register, the SHPO, and the Advisory Council on Historic Preservation (ACHP) in overseeing management of cultural resources.

Of particular importance to military installations are Sections 106 and 110 of the NHPA. Evaluative studies constitute the mechanism by which inventoried resources are assessed against criteria of the NRHP and upon which all subsequent management actions are based. Section 106 requires Federal agencies to consider effects of undertakings on resources listed in, or eligible for inclusion in, the National Register through a process of consultation. The process for compliance with Section 106 consists of the following steps:

1. Identification of cultural resources located within the APE of a proposed undertaking is accomplished through review of existing documentation and field surveys.
2. Cultural resources evaluation is conducted using National Register criteria (36 CFR Part 63). Properties that meet the criteria are considered eligible for listing in the NRHP and are subject to further review under Section 106. Properties that do not meet the criteria are considered not eligible for inclusion in the NRHP and are generally not subject to further Section 106 review.
3. Determination of effect of the proposed undertaking is assessed on properties that meet the NRHP criteria. One of the following effect findings would be made: No Historic Properties Affected, No Adverse Effect, or Adverse Effect.
4. Resolution of adverse effects/mitigation occurs when adverse effects are found. Consultation continues between the Federal agency and consulting parties to attempt resolution. Successful consultation results in an agreement of the efforts to be taken to avoid or mitigate adverse effects.

Section 110 of the NHPA, part of a 1980 revision, requires Federal agencies to institute programs to identify and evaluate cultural resources eligible for inclusion in the National Register under their care. Section 110 inventories identify cultural resources using literature review and physical/pedestrian survey. Documentation on each inventoried resource is submitted to the Colorado SHPO (COSHPO). These inventories, however, may not provide sufficient information to assess the historic significance, i.e., National Register eligibility, of identified resources.

Fort Carson has maintained a Cultural Resource Management (CRM) Program since the late 1970s. CRM Program personnel have developed and implemented various management plans and agreement documents to guide overall cultural resources identification, treatment, and preservation strategies for compliance with the NHPA and all Federal, state, DoD, and Army laws, regulations, and policies regarding cultural resources management. To date, the two most significant guidance documents are a Memorandum of Agreement between Fort Carson, the COSHPO, and the ACHP, and the ICRMP. An update to the ICRMP is currently in progress.

Fort Carson is pursuing a Programmatic Agreement to streamline their cultural resource compliance process. Until the Programmatic Agreement is in place, the case-by-case Section 106 compliance review stipulated in the 1980 Memorandum of Agreement with the COSHPO and ACHP, and the basic management principles outlined in the ICRMP remain as the governing guidance.

3.8.1.2 Archaeological, Architectural, and Historic Resources

A records search by the CRM Program of Fort Carson revealed that cultural resource surveys have been completed for the following Net Zero Energy sites: Gate 2 North, Gate 2 South, Chiles, SWMU 1-170, SWMU 5 (Site 1), SWMU 5 (Site 2), Gate 19, CEP Biomass, Bravo North (Site 1), Bravo North (Site 2), Butts Road, Magrath Avenue, Titus/Signal Hill, Tent City, COARNG PV, Highway 115, and Fremont. No NRHP-eligible archaeological resources are present. Cultural resource surveys have not been completed for the Wildhorse, Ray Nixon, and Fremont sites.

3.8.1.3 Native American Sacred Sites and Properties of Traditional and Religious Cultural Importance

Fort Carson has conducted the research and consultation necessary to determine if sacred sites or Traditional Cultural Properties are present (Blythe, 2005). No sacred sites have been identified, and there is only one recorded TCP on Fort Carson. The TCP is in the Turkey Creek Rock Art District, which is not in or near any of the proposed Net Zero sites.

3.8.2 ENVIRONMENTAL CONSEQUENCES

Impacts to cultural resources would be considered significant if the Proposed Action would result in irretrievable or irreversible damage to a prehistoric or historic site (exclusive of data recovery or mitigation) that has not been evaluated, is listed, or is eligible/potentially eligible for listing on the NRHP.

3.8.2.1 No Action Alternative

Under the No Action Alternative there would be no new construction and cultural resources would remain unchanged; therefore, no new direct or indirect impacts would occur.

3.8.2.2 Proposed Action Alternatives

3.8.2.2.1 Cultural Resource Impacts Common to All Proposed Action Alternatives

Impacts to Archaeological Resources

Archaeological resources are susceptible to damage and loss of research potential from any ground disturbing activity. Grading, construction, installation of buried cables/pipes, and installation of transmission line poles/towers can impact archaeological resources. Changes in groundwater chemistry may also affect the preservation conditions and research potential of archaeological sites.

Table 3.8-1 provides details of potential impacts by alternative and Energy Net Zero sites. For the majority of the alternatives and Energy Net Zero sites, there would be no impacts to archaeological resources. For the Wildhorse, Ray Nixon, and Fremont sites, potential impacts cannot be identified until a cultural resource survey has been completed. Treatment of any archaeological resources encountered in these sites and their associated electric tie-ins would follow the principles and procedures of the ICRMP; therefore, it unlikely that there would be significant impacts to archaeological resources in these three sites.

Table 3.8-1. Potential Impacts to Cultural Resources by Alternative

Alternative	Site	Archaeological Resources	Architectural Resources	TCPs/Sacred Sites
No Action	N/A	None.	None.	None.
1	Gate 19	None. Survey completed. No eligible resources present.	None. Survey completed. No eligible resources present.	None. Survey completed. No TCPs or Sacred Sites present.
2	Gate 19; Bravo North; CEP Biomass	None. Survey completed. No eligible resources present.	None. Survey completed. No eligible resources present.	None. Survey completed. No TCPs or Sacred Sites present.
3	Gate 2 North; Gate 2 South; Chiles; SWMU 1-170; SWMU 5 (Site 1); SWMU 5 (Site 2); Bravo North (Site 1); Butts Road; Magrath Avenue; Titus/Signal Hill; Tent City	None. Survey completed. No eligible resources present.	None. Survey completed. No eligible resources present.	None. Survey completed. No TCPs or Sacred Sites present.
	Wildhorse; Ray Nixon	Unknown. Survey not completed.	Unknown. Survey not completed.	None. Survey completed. No TCPs or Sacred Sites present.
4	Pond Expansion and Piping	None. Survey completed. No eligible resources present.	None. Survey completed. No eligible resources present.	None. Survey completed. No TCPs or Sacred Sites present.
5	Wildhorse	Unknown. Survey not completed.	Unknown. Survey not completed.	None. Survey completed. No TCPs or Sacred Sites present.
6	Gate 2 North & South; Chiles; SWMU 1-170; SWMU 5 (Sites 1 & 2; Bravo North (Sites 1 & 2); Butts Road; Magrath Avenue; Titus/Signal Hill; Tent City; Gate 19; CEP Biomass; Highway 115; COARNG	None. Survey completed. No eligible resources present.	None. Survey completed. No eligible resources present.	None. Survey completed. No TCPs or Sacred Sites present.

Table 3.8-1. Potential Impacts to Cultural Resources by Alternative

Alternative	Site	Archaeological Resources	Architectural Resources	TCPs/Sacred Sites
	Wildhorse; Ray Nixon; Fremont	Unknown. Survey not completed.	Unknown. Survey not completed.	None. Survey completed. No TCPs or Sacred Sites present.
7	Various[1]	None.	Unknown[2].	None. Survey completed. No TCPs or Sacred Sites present.

[1]Alternative 7 includes infrastructure efficiency upgrades at existing facilities throughout the Installation, including industrial, training, administrative, and residential facilities.

[2]Fort Carson CRM Program personnel would be coordinated with prior to construction activities to ensure prehistoric and historic resources are not adversely affected.

CEP = Central Energy Plant; COANG = Colorado Army National Guard; N/A = not applicable; SWMU = Solid Waste Management Unit; TCP = Traditional Cultural Property

Impacts to Prehistoric and Historic Resources

Prehistoric and historic resources can be impacted by any direct alterations that compromise the attributes for which the resource was recommended eligible for the NRHP. Changes to the materials or integrity of a building can be an impact. Prehistoric and historic resources can also be impacted through degradation of their viewshed.

Table 3.8-1 provides details of potential impacts by alternative and Energy Net Zero sites. For the majority of the alternatives and Energy Net Zero sites, there would be no impacts prehistoric and historic resources. For the Wildhorse, Ray Nixon, and Fremont sites, potential impacts cannot be identified until a cultural resource survey has been completed. Treatment of any prehistoric and historic resources encountered in these sites and their associated electric tie-ins would follow the principles and procedures of the ICRMP; therefore, it unlikely that there would be significant impacts to prehistoric or historic resources, if present, at these two sites.

Implementation of Alternative 7 would have minor to negligible impacts to prehistoric and historic resources. As the projects could involve modifications to existing buildings, the Fort Carson CRM Program personnel would be coordinated with prior to construction activities to ensure historic resources are not adversely affected.

Impacts to TCPs/Sacred Sites

TCPs and Sacred Sites can be impacted through construction-related, earth-moving activity. Such resources can also be affected by changes in access or conditions (including viewshed degradation) that prevent or detract from the traditional use of the location.

Table 3.8-1 provides details of potential impacts by alternative and Energy Net Zero sites. For all of the sites, TCP/Sacred Site research has been completed and no TCPs/Sacred Sites are in the project vicinity. There would be no impacts to TCPs/Sacred Sites for any of the alternatives.

3.8.3 CUMULATIVE EFFECTS

There would be no cumulative effects under Alternatives 1, 2, and 4 because these lack resources that are unevaluated, eligible for, or listed in the NRHP. Despite the lack of survey information for all sites considered within Alternatives 3, 5, and 6, it is anticipated that the seven Proposed Action Alternatives for the Energy Net Zero program would not result in significant adverse cumulative impacts because the Fort Carson Cultural Resources Program would continue to consider impacts to cultural resources and comply with the NHPA Section 106 process on a case-by-case basis. If potentially eligible cultural resources were discovered in a given area prior to construction of new waste, water or energy facilities, the Army would most likely avoid the site during the siting and facility design process.

3.8.4 PROPOSED IMPACT REDUCTION MEASURES

3.8.4.1 Mitigation

The potential exists for adverse significant impacts from implementation of Alternatives 3, 5 or 6 as potential Net Zero sites within these alternatives have not been surveyed for cultural resources. If an alternative is selected that would use the Wildhorse, Ray Nixon, or Fremont sites, cultural resource survey would be completed following the guidance of the ICRMP. If there would be impacts to cultural resources, the COSHPO would be consulted and the mitigation measures presented in the ICRMP would be implemented to avoid or reduce the impacts. For Alternative 7, the Fort Carson CRM Program personnel would be coordinated with prior to construction activities to ensure historic resources are not adversely affected.

No potential for impacts are anticipated for all other Net Zero sites as surveys have been conducted and sites have been determined to contain no eligible resources; therefore, no measures for reduction of impacts would be warranted. Cultural resources at Fort Carson would continue to be managed under the ICRMP. As stated in Section 1.5.2, as specific projects are proposed for construction, Fort Carson would consult with Tribes and COSHPO as part of the Section 106 process.

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3.9 Socioeconomics

3.9.1 AFFECTED ENVIRONMENT

3.9.1.1 Population and Housing

The defined ROI for Fort Carson includes El Paso, Fremont, and Pueblo counties. The estimated population of the ROI totaled 828,150 in 2010, an increase of 14.9 percent since 2000. Two large communities are located in the ROI: the City of Colorado Springs, located north of Fort Carson, with a population of just over 416,000 in 2010; and the City of Pueblo, located southeast of Fort Carson, with a population in 2010 of approximately 107,000 residents (U.S. Census Bureau, 2010).

Fort Carson has on-Post housing units for both unaccompanied and accompanied personnel. There are currently over 3,000 family housing units of various types contained in numerous clusters or "villages." Unaccompanied personnel are accommodated in barracks that collectively provide 5,672 spaces, of which 372 are Wounded Warrior spaces. According to the 2008 Housing Market Analysis, it is anticipated that another 952 units would be needed by 2013. Because of the severe shortfall in barracks spaces, a number of projects are planned or underway to provide more billeting for unaccompanied Soldiers. By 2013, an additional 4,346 barrack spaces should be available (Fort Carson, 2009).

As of December 2010, an estimated 341,600 housing units were located off-Post in the ROI. The proportion of owner-occupied housing units was 61 percent. Overall, the quality of housing in the ROI is considered good. Vacancy rates and rentals in all areas within the ROI are highly cyclical. The rental vacancy rate was estimated to be 2.8 percent, down from 4.8 percent in 2000 (U.S. Census Bureau, 2010).

3.9.1.2 Environmental Justice and Protection of Children

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, requires each Federal agency to identify and address any disproportionately high and adverse environmental or economic effects that its programs and policies might have on minority or low income populations.

"Environmental Justice: Guidance Under the National Environmental Policy Act" defines minorities as members of the following population groups: American Indian or Alaskan Native, Asian or Pacific Islander, Black or African American, or Hispanic. According to the guidance, a minority population should be identified where the minority population of the affected area either exceeds 50 percent or is meaningfully greater than the minority population percentage in the general population.

According to U.S. Census Bureau, the percentage of minority populations within the ROI is approximately 20 percent in El Paso County, 20 percent in Pueblo County, and 10 percent in Fremont County (U.S. Census Bureau, 2010). The population of the census tracts including and immediately adjacent to Fort Carson has a higher percentage of minority population than El Paso County and the ROI; however, this proportion is less than the 50 percent threshold. Fort Carson's residential population, as with other military populations, contributes to that higher minority percentage in the immediate area of the Installation. Of the total U.S. Military, 38 percent of active duty members identify themselves as minorities (Fort Carson, 2009).

Low-income populations are identified using the Census Bureau's statistical poverty threshold, which varies by household size and number of children. For example, the poverty threshold for a Family of four with two children was $17,463 in 2000 and rose to $22,811 by 2011. Nationwide, the proportion of people in poverty was 11.3 percent in 2000 and 14.4 percent in 2010. The Census Bureau defines a "poverty area" as a census tract or block numbering area where 20 percent or more of the residents have incomes below the poverty threshold. The percentage of the population below the poverty line is approximately 18.1 percent, 12.4 percent, and 12.3 percent in Pueblo, Fremont, and El Paso counties, respectively. While each county does not meet the definition of a poverty area (census tracts or blocks), there are small geographical areas within each county where more than 20 percent of the population lives below the poverty level (U.S. Census Bureau, 2010; Fort Carson 2009).

EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, seeks to protect children from disproportionately incurring environmental health or safety risks that might arise from government policies, programs, activities, and standards. As of 2010, approximately 207,500 children reside in the ROI; approximately 3,800 children live on-Post (U.S. Census Bureau, 2010).

3.9.1.3 Economic Development and Employment

Approximately 6,500 civilian workers are currently employed at Fort Carson (appropriated, nonappropriated, contractor, and others). Assuming each is a head of household, this represents a population of over 12,100 persons (applying an average household size of 1.87). The approximately 24,900 active duty military personnel are accompanied by approximately 37,400 Family members, a total connected population of about 74,500 persons, or nearly 9 percent of the entire 2010 population of the ROI.

Approximately 352,000 people were employed in the ROI as of 2011, with 76 percent of this figure employed in El Paso County. The unemployment rate in all counties of the ROI gradually increased from an average low of three percent in 2000 to an average of six percent in 2005. In 2010, the unemployment rate in El Paso County had climbed to 8.8 percent, while Fremont County and the area surrounding PCMS, unemployment was 9.4 percent. These increases can be largely attributable to the economic recession in the U.S. (USAEC, 2011).

The primary sources of revenue for the three counties within the ROI are sales taxes, property taxes, transfers from the state government, and transfers from the Federal government. In 2007, operating expenditures at Fort Carson that had the greatest effect on the local economy (after salaries) were local purchases and contracts (approximately $204 million), utilities (approximately $17 million), and rent and lease payments (approximately $3 million). The large majority (greater than 99 percent) of DoD prime contracts awarded to firms in the ROI have been made to companies located in El Paso County, accounting for over 54 percent of all DoD awards statewide. The value of prime contract awards in El Paso County totaled more than $2.2 billion in 2006. Fort Carson alone accounts for 10 percent of the region's economy (Fort Carson, 2009).

3.9.2 ENVIRONMENTAL CONSEQUENCES

3.9.2.1 No Action Alternative

Under the No Action Alternative, there would be no new construction or operations of proposed facilities and socioeconomics would remain unchanged; therefore, no new direct or indirect impacts would occur. There would also be no increase in workers and in turn no increase in demand for temporary or permanent housing. Furthermore, no impacts to low income or minority populations would be anticipated. Minor adverse impacts would occur as a result of the forgone economic benefit to the region from increased spending and increase in employment.

3.9.2.2 Proposed Action Alternatives

3.9.2.2.1 Socioeconomic Impacts Common to All Proposed Action Alternatives

Population and Housing

A temporary increase in population as a result of construction workers relocating to the area could occur as a result of implementation of any alternative. Alternatives 1 and 2 could require 600 to 800 employees per year for the duration of construction, which would be the highest temporary increase in construction workers among the alternatives. It is anticipated that that the majority of construction workers would be hired from within the ROI and would not represent an overall increase in population. Moreover, the entirety of the anticipated construction workforce would not all be present at the construction site at the same time due to the nature of different components of the construction phase. If any relocation of construction workers would occur, it would result in short term and negligible impacts.

Under Alternatives 1 or 2, a permanent increase in population could occur as a result of new employees hired to operate the proposed WTE or biomass plants. It is anticipated that some employees would be hired that currently reside within the ROI; however, more skilled positions may require Fort Carson to hire employees from outside of the ROI. In a worst case scenario of all 30 employees relocating to the ROI under the implementation of either Alternative 1 or 2 and given the average household size of 1.87, a potential increase of 56 residents within the ROI could occur. This would result in a negligible increase in population, and adequate housing options are available within the ROI to accommodate such an increase.

No permanent employees would be hired as a result of the operations of solar panels, wind turbines, reclaimed water distribution system, GSHPs, or to perform maintenance of upgraded existing infrastructure (Alternatives 3 through 7). These would be unmanned facilities and would only require periodic maintenance from existing facilities staff.

Environmental Justice and Protection of Children

No impacts to low income or minority populations are anticipated from construction or operations of any of the Proposed Action Alternatives as all construction and operations would occur on-Post and not result in adverse impacts to populations off-Post. Some construction would occur near the borders of the Installation; however, populations immediately adjacent to Fort Carson are not categorized as disproportionately minority or low income and would not be adversely impacted.

There is a potential for minor short-term adverse impacts to children. Because construction sites can be appealing to children, construction activity could be an increased safety risk. This analysis evaluates the potential impacts to the children in general terms. Only the proposed construction for the Chiles, Tent City, and Gate 2 North and South sites associated with Alternatives 3 and 6 would be located within the Main Post area near Family housing areas. Barriers and no trespassing signs would be placed around construction sites to deter children from playing in these areas and construction vehicles, equipment, and materials would be stored in fenced areas and secured when not in use.

Under Alternative 6, Fort Carson would utilize the environmental screening criteria that have been developed and considered within this EA (see Appendix B) to assist in deciding the placement of the PV systems and GSHP units.

Economic Development and Employment

Construction of each alternative would result in a short-term minor beneficial impact to economic development and employment in the region from the temporary hiring of construction workers and the local purchase of goods and materials for construction. Negligible beneficial indirect impacts would occur from construction workers purchasing goods and services within the ROI. Jobs created by the Proposed Action would represent jobs in a new sector of renewable energy development and sustainability, potentially laying a foundation for growth of the sector in the ROI.

Negligible beneficial impacts would occur for operations of Alternatives 1 and 2 due to the temporary employment of 600 to 800 construction workers over the course of each year of construction, and the permanent employment of 30 employees under each alternative. Additional negligible economic benefits would occur as a result of the purchase of construction materials and equipment required to operate the WTE or biomass plant. Short-term negligible economic impacts would occur as a result of temporary increases in employment and the purchase of construction materials and equipment within the ROI under Alternatives 3, 4, 5, 6, and 7 during to construction. No permanent employees would be required to operate the PV panels, irrigation system, wind turbines, GSHPs, or perform maintenance of upgraded existing infrastructure.

3.9.3 CUMULATIVE EFFECTS

CAB Stationing at Fort Carson would result in the influx of 2,700 Soldiers and approximately 4,000 Family members, with a large majority of military personnel projected to live off-Post. The potential 30 permanent employees from the implementation of Alternatives 1 or 2 would likely live off-Post in the ROI. This increase would not likely result in a cumulative impact to off-Post housing as the local housing market is projected to be able to absorb this growth (USAEC, 2011); therefore, cumulative impacts to population and housing are not anticipated.

Minor beneficial cumulative impacts to economic development could occur from construction of infrastructure projects listed in Table 3.1-2, as well as from operations of facilities that would require operational staff (i.e., the commissary, physical fitness center, PX, and SFAC).

3.9.4 PROPOSED IMPACT REDUCTION MEASURES

3.9.4.1 Mitigation

No potential for adverse significant impacts are anticipated; therefore, no mitigation would be required. While no significant impacts are anticipated the following measure may still be implemented. For all Proposed Action Alternatives, barriers and no trespassing signs would be placed around construction sites to deter children from playing in these areas. Construction vehicles, equipment, and materials would be stored in fenced areas and secured when not in use.

3.10 Traffic and Transportation

3.10.1 AFFECTED ENVIRONMENT

This section addresses existing regional transportation involving the roadway network, average daily traffic (ADT); Installation transportation involving the roadway network and traffic; as well as other transportation modes to include rail, aviation, and public transit.

3.10.1.1 Existing Roadway System

Fort Carson is in central Colorado near the southern edge of Colorado Springs, approximately 75 miles from Denver, and in the western portion of El Paso County. Fort Carson is bounded by I-25 to the east, SH 115 to the west, and Academy Boulevard to the north. In addition to I-25, the primary north-south routes in Colorado Springs are along Academy Boulevard and Powers Boulevard (SH 21). The Colorado Springs roadway network offers few continuous east-west routes, with movement primarily accommodated by Fountain Boulevard, Platte Boulevard, Austin Bluffs Parkway, and Woodmen Road. The only access from Colorado Springs to the west is on U.S. Highway 24, while primary access to the east of Colorado Springs is provided along U.S. Highway 24 and SH 94 (Fort Carson, 2009) (Figure 3.10-1). The annual ADT (AADT) counts for these roadways are compiled in Table 3.10-1 (CDOT, 2010).

Table 3.10-1. Annual Average Daily Traffic Counts for Nearby Off-Post Roadways

Roadway	Number of Lanes	Posted Speed Limit	AADT
I-25 (South of SH 16)	4	75	38,000
I-25 (North of SH 16)	4	75	45,000
I-25 (North of Academy Boulevard)	4	65	74,000
I-25 (North of Bijou Street)	6	55	112,000
US 24 (West of I-25)	4	35	35,000
Academy Boulevard (West of I-25)	5	45	45,000
Academy Boulevard (East of I-25)	5	50	48,000
US 24 Bypass/Fountain Boulevard (East of I-25)	4	55	48,000
SH 115 (North of Gate 1)	2	60	18,000
SH 115 (South of Gate 1)	4	55	25,000
SH 16 (East of I-25)	2	45	9,400
SH 85/87 (South of Academy Boulevard)	4	50	20,000
SH 94 (East of Marksheffel Road)	2	60	8,400

Source: CDOT, 2010
AADT = annual average daily traffic count; I = Interstate; SH = State Highway; US = U.S. Highway

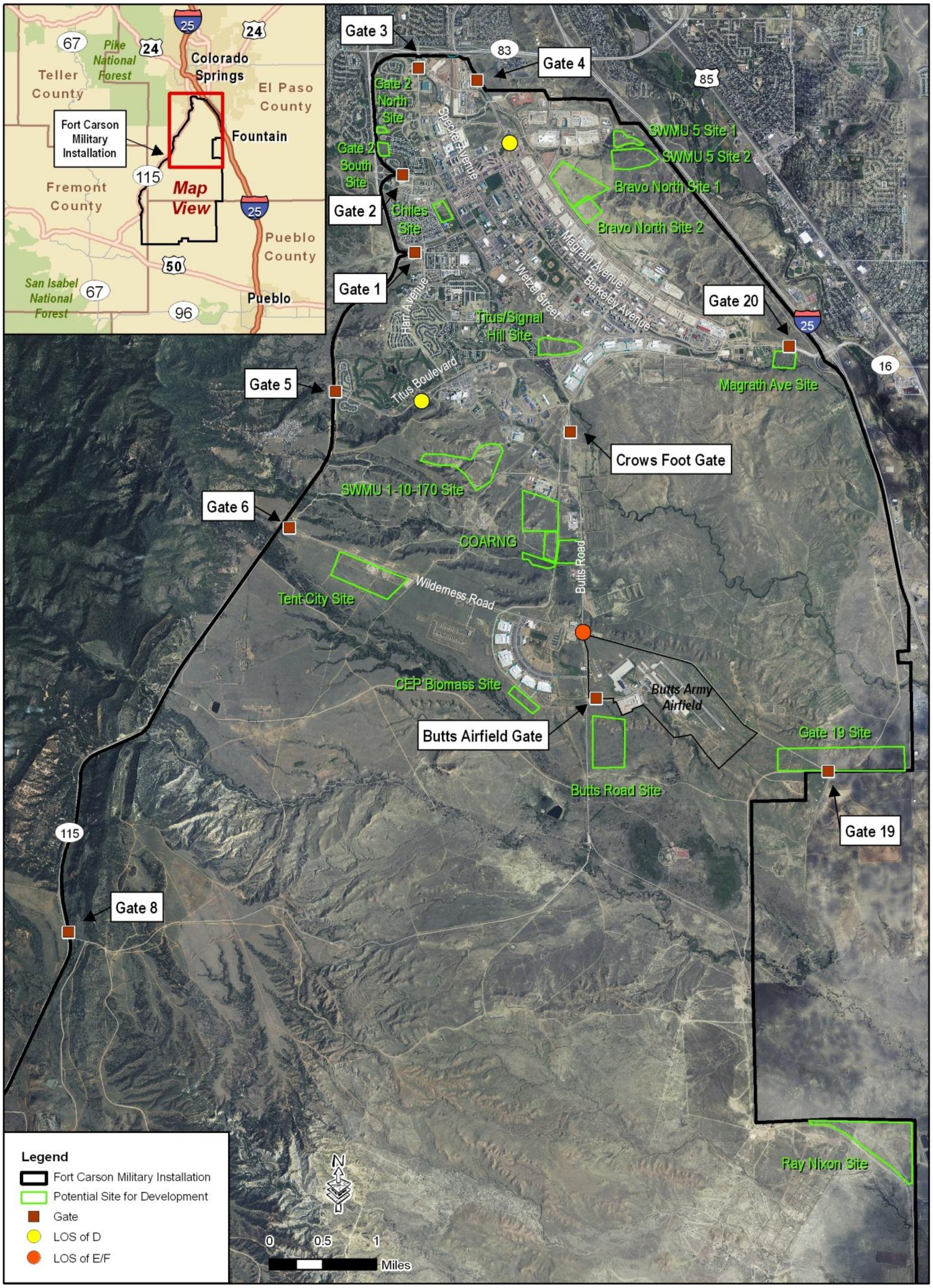


Figure 3.10-1. Existing Roadway System near the Main Post at Fort Carson

The Main Post area contains the majority of Fort Carson's approximately 266 miles of paved roadways. Unpaved roads are located throughout the Installation totaling approximately 433 miles. Four one-way roads – Specker Avenue, Wetzel Avenue, Magrath Avenue, and Barkley Avenue are the primary north-south roadways. Butts Road provides access from the Main Post area to ranges and operational facilities to the south and the downrange area. Butts Road intersects with Wilderness Road in the north-central part of the Installation near BAAF. In general, the paved roadway network is well maintained and is capable of accommodating most vehicle types. In 2005, Fort Carson funded a comprehensive transportation study to assess existing conditions and identify short- and long-term transportation needs associated with future demand. Subsequently, the 4th Infantry Headquarters Complex Supplemental Traffic Study prescribed further recommendations to address traffic impacts from the relocation of its Headquarters Complex. In 2012, the Installation's comprehensive transportation study was updated to account for potential population increases associated with the Grow the Army initiative, including the stationing of a CAB unit (USAEC, 2012).

3.10.1.2 Existing Traffic Conditions

Level of Service (LOS) is a qualitative measure of the operating conditions of an intersection or other transportation facility. There are six LOS' (A through F) defined; LOS A represents the best operating conditions with no congestion, and LOS F is the worst with heavy congestion. Roadways and intersections with LOS E or F would have traffic conditions at or above capacity. Traffic patterns would be congested, unstable, and normally unacceptable to individuals attempting to access and use roadways and intersections with LOS E or F. LOS issues are present on Installation roadways. Subject to the completion of proposed improvements outlined in the comprehensive transportation study, the intersection of Butts Road and Wilderness Road is the only intersection that has a projected overall LOS of E/F. The intersection of Titus Boulevard and Cochrane Circle and the intersection of Magrath Avenue and O'Connell Boulevard will have at least one approach with an LOS of E or less. Because this condition is limited to a single approach during a specific period of the day, the overall LOS for both intersections is projected to remain at LOS D or higher. LOS on I-25 ranges from D to F where it runs adjacent to the Installation perimeter, and A to C south of Fountain (El Paso County, 2011).

3.10.1.3 Existing Access Control Points

Fort Carson provides access from the external roadway network through eight Access Control Points (ACPs) (Table 3.10-2). A description and the existing peak hour traffic volumes at each of the ACPs are outlined in Table 3.10-2. An overview of the gates and their uses is outlined below. As the Proposed Action would involve the use of Gates 19 and 6, this discussion focuses on those two ACPs.

Table 3.10-2. Access Control Points at Fort Carson

Access Control Point	Location	Peak Hour Traffic Volume (vehicles per hour)
ACP 1	Western boundary, with access from SH 115	598
ACP 2	Western boundary, with access from SH 115	526
ACP 3	Primary commercial vehicle access gate at northern boundary, with access from Academy Boulevard	667
ACP 4	Northern boundary, with access from Academy Boulevard	1455
ACP 5	Western boundary providing access to the hospital and golf course, with access from SH 115	509
ACP 6	Western boundary, with access from SH 115	892

Table 3.10-2. Access Control Points at Fort Carson

Access Control Point	Location	Peak Hour Traffic Volume (vehicles per hour)
ACP 19	Eastern boundary just southeast of BAAF, currently closed, with access from Charter Oak Ranch Road	Gate currently closed
ACP 20	Eastern boundary just east of Main Post area, with access from SH 16 and I-25	1367

ACP = access control point; I = Interstate; SH = State Highway

Gate 19 is currently a limited access gate used primarily by emergency vehicles and Range Control administrative traffic. Fort Carson plans to open Gate 19 to general traffic in the near future to support the recent and projected traffic demands in the Wilderness Road/BAAF areas. Planning for that project is currently underway. The date of this opening would be subject to availability of funding to upgrade the ACP and improve the roadway linking the gate with Butts Road. Once funding is secured and these improvements made, Gate 19 would open regardless of the Net Zero activities. Gate 19 has been used in the past to support construction access for large projects in Fort Carson's downrange areas. Access such as this requires special arrangements to be made with Fort Carson's Physical Security Office. Once the gate is opened to general traffic, however, access control at Gate 19 would be the same as it is at the other ACPs on-Post.

Charter Oak Ranch Road is the off-Post road directly linking Gate 19 with I-25. Currently, the road primarily supports heavy truck traffic to and from the three commercial rock quarries located south and east of the gate. The road is scheduled to be reconstructed so it may better support that commercial traffic as well as the projected commuter traffic at Gate 19. Planning for this roadway reconstruction is currently underway. This roadway construction has qualified for funding under the Defense Department's Defense Access Road Program. Construction dates for the project are subject to the availability of that funding.

With two exceptions, all commercial traffic must enter Fort Carson through the Installation's commercial ACP at Gate 3. The exceptions include: vehicles allowed to access other gates by special arrangement with Fort Carson's Physical Security Office; and drivers/vehicles registered in the Rapid Gate Program. The Rapid Gate Program is a voluntary program where commercial carriers are vetted through the program's security checks. Once cleared through this system, the carrier may enter any ACP on Fort Carson, except Gate 1.

Gate 6 is currently open to general traffic and is available to commercial vehicles registered in the Rapid Gate Program or covered under special arrangement with Physical Security.

3.10.1.4 Rail, Air and Public Transportation

Fort Carson is served by a freight rail line between Gates 3 and 4, in the northern portion of the Main Post area. The access railroad is 3.4 miles in length and connects Fort Carson to the main line of the Union Pacific and the Burlington Northern Santa Fe railroads at Kelker Junction in Colorado Springs. Fort Carson is responsible for approximately 12.6 miles of rail track and has a total loading footage availability of approximately 5.2 miles of track. The railhead area has sufficient capacity to move 480 rail cars per day (Fort Carson, 2009).

Aviation facilities at Fort Carson are stationed at BAAF, approximately four miles south of the Main Post area and immediately south of the Small-Arms Impact Area along Butts Road. In addition to BAAF, there is a tactical airstrip at Camp Red Devil, at the south-west corner of Fort Carson (Fort Carson, 2009). The closest regional airport is Colorado Springs Municipal Airport (COS) approximately eight miles north of BAAF. COS provides passenger and cargo service to the surrounding areas with approximately 420 aircraft operations daily (AirNav, 2012).

3.10.2 ENVIRONMENTAL CONSEQUENCES

This section provides a discussion of the potential environmental impacts to transportation resources that would result from the alternatives. Impacts were primarily assessed by reviewing existing traffic conditions of public roadways and the types/frequency of military activities that may require use of these roadways. As stated in Section 3.1, an impact to traffic and transportation would be considered significant if it results in a reduction in state or Federal highway function by more than two levels of service.

3.10.2.1 No Action Alternative

Under the No Action Alternative, none of the alternatives would occur. No impacts to transportation resources would occur as there would be no change in traffic on the roadways and no change to other transportation modes, including rail, aviation, and public transit.

3.10.2.2 Proposed Action Alternatives

3.10.2.2.1 Traffic Effects Common to All Proposed Action Alternatives

All the alternatives would have some form of construction activities and associated traffic. Traffic congestion would increase at Fort Carson due to additional construction vehicles resulting in traffic delays near the proposed sites. These effects would be temporary in nature and would end with the construction phase at each site. The condition of the local on-Post and off-Post road infrastructure would be sufficient to support any increase in construction vehicle traffic. In addition, road closures or detours to accommodate utility system work would be expected, creating short-term traffic delays. Such effects would be minimized by directing all construction vehicles to access the Installation via the gates closest to each project site, minimizing construction vehicle movement during peak traffic hours, and placing construction staging areas where they would least interfere with traffic. All construction vehicles would be equipped with backing alarms, two-way radios, and Slow Moving Vehicle signs when appropriate.

3.10.2.2.2 Alternative 1

Short- and long-term minor adverse effects on traffic would be expected. The changes would be primarily due to construction vehicles and small changes in localized traffic patterns due to the delivery of feedstock to the proposed plant. This alternative would have no impact on rail, air, or public transportation in the area.

In general, traffic impacts due to construction and associated BMPs to minimize those impacts would be similar to those described in Section 3.10.2.2.1. Under this alternative, these effects would be more noticeable near the Gate 19 site, as discussed below, but impacts would be minor.

Access to the Gate 19 site would be via Santa Fe Avenue, I-25, and Charter Oak Ranch Road. If planned upgrades are not completed prior to implementation of Alternative 1, access gate improvements and road upgrades would be required to accommodate 24-ton garbage collection vehicles. Modifications would likely include road widening and resurfacing, and other upgrades may be required to support the additional truck traffic.

The location of the WTE plant site would determine which gate would provide the most direct access. If the plant is located near Gate 19, that gate could provide a number of advantages for plant-related traffic. Charter Oak Ranch Road is a low volume truck route that provides a direct link between Gate 19 and I-25. Gate 19 is projected to have a relatively low traffic count, so the gate would be able to accommodate the addition of a large number of authorized commercial vehicles more easily than the other Fort Carson ACP's. Having the WTE plant near Gate 19 would potentially minimize the impact of that plant's traffic on other Fort Carson traffic and roadways.

If currently planned upgrades are not completed prior to implementation of this alternative, Gate 19 would be reopened, as access from Gate 19 at Charter Oak Ranch Road would result in impacts far less noticeable than if Gate 20 at SH 16 were used. Gate 20 has substantially higher traffic than most ACPs, and if it were to be used, truck traffic would compete with other traffic during peak periods (Table 3.10-2). Recently opened Gate 6 on the western side of the Installation provides access from SH 115 and a direct connection between Wilderness Road and the proposed WTE plant site. Allowing access from both east and west access points may reduce the impacts to Gates 19 and 20 for trucks traveling from the north.

The proposed WTE plant would potentially require 60-120 trucks/day for operations, which would involve hauling feedstock to the plant from Fort Carson and the surrounding Colorado Springs area. Off-Post vehicles would primarily access the Installation from I-25. Existing traffic along I-25 ranges from 38,000 to 74,000 vehicles per day in areas near the Installation (CDOT, 2010). These additional vehicles represent a minute incremental increase in the total AADT on the surrounding roadways. This small increase in traffic would not affect the capacity of any nearby roadway or intersections. Notably, there are no failing intersections adjacent to the Gate 19 site (Figure 3.10-1). Therefore, impacts would be minor.

3.10.2.2.3 Alternative 2

Short- and long-term minor adverse effects on traffic would be expected. The changes would be primarily contributed to construction vehicles and small changes in localized traffic patterns due to the delivery of feedstock to the proposed plant. This alternative would have no impact on rail, air or public transportation in the area.

In general, traffic impacts due to construction and associated BMPs to minimize those impacts would be similar to those described in Section 3.10.2.2.1. Under this alternative, impacts to traffic would be more noticeable near the proposed biomass plant sites. These effects would be minor.

Alternative 2a. As with the WTE plant, access to the Gate 19 site would be via Santa Fe Avenue, I-25, and Charter Oak Ranch Road. Access gate and road upgrades would be required, and roads would be paved and designed to accommodate feedstock trucks. If currently planned upgrades are not completed prior to implementation of Alternative 2a, Gate 19 would be reopened, as access from Gate 19 at Charter Oak Ranch Road would result minimize traffic impacts compared to using Gate 20 at Charter Oak Ranch Road. Gate 20 has substantially higher traffic than most ACPs, and if it were to be used, truck traffic would compete with other traffic during peak periods (Table 3.10-2). Newly opened Gate 6 on the western side of the Installation provides access from SH 115 and a direct connection between Wilderness Road and the proposed WTE site. Allowing access from both east and west access points may reduce the impacts to Gates 19 and 20 from construction and waste hauling trucks traveling from the north to the Installation.

The proposed 13MW biomass plant would potentially require 15-25 trucks/day for operations, which would involve hauling wood chips to the plant from sources at distances of up to 120 miles away. Existing traffic along I-25 ranges from 38,000 to 74,000 vehicles per day in areas near the Installation (CDOT, 2010). The additional haul trucks and personally owned vehicles of plant staff represent a minute incremental increase in the total AADT on the surrounding roadways. This small increase in traffic would not affect the capacity of any nearby roadway or intersection. Notably, there would be no failing intersections adjacent to the Gate 19 site (Figure 3.10-1). Therefore, impacts to transportation resources would be minor.

Alternative 2b. Off-Post vehicles would access the Bravo North sites from I-25 via South Academy Boulevard or Magrath Avenue. This alternative would not involve the construction of an access gate and roads. The proposed 13MW biomass plant would potentially require 15-25 trucks/day for operations. Off-Post vehicles would primarily access the Installation from I-25. Existing traffic along I-25 ranges from 38,000 to 74,000 vehicles per day and existing traffic along Academy Boulevard ranges from 38,000 to 41,000 vehicles per day in areas near the Installation (El Paso County, 2009). The additional haul trucks and POVs of plant staff represent a minute incremental increase in the total AADT on the surrounding roadways. This small increase in traffic would not affect the capacity of any of nearby roadway or intersection. Several failing intersections, however, are adjacent to the Bravo North sites and efforts should be made to minimize deliveries during peak traffic hours (Figure 3.10-1). These adverse effects would be minor.

Alternative 2c. Access to the CEP Biomass site would be via SH 115 and Wilderness Road. This alternative would not involve the construction of an access gate and roads. Gate 6 would likely be used to access the CEP Biomass site, and Gate 19 if it were reopened under other planning activities. The proposed 2.5MW biomass plant would likely require less than 10 trucks/day for operations, which would involve hauling wood chips to the plant from sources at distances of up to 120 miles away. The additional haul trucks and POVs represent a minute incremental increase in the total AADT on the surrounding roadways. This small increase in traffic would not affect the capacity of any of nearby roadway or intersection. There are no failing intersections adjacent to the CEP Biomass site (Figure 3.10-1). These adverse effects would be minor.

3.10.2.2.4 Alternative 3

Short-term minor adverse effects on traffic would be expected. The changes would be primarily contributable to construction vehicles. In general, traffic impacts due to construction and associated BMPs to minimize those impacts would be similar to those described in Section 3.10.2.2.1. Under this alternative, minor effects would be more noticeable near the proposed PV sites during construction. There would be no traffic from the operation of the PV arrays, and there would be no long-term changes in the on- or off-Post traffic. This alternative would have no impact on rail, air or public transportation in the area.

3.10.2.2.5 Alternative 4

Short-term minor adverse effects on traffic would be expected. The changes would be primarily contributable to construction vehicles. In general, traffic effects due to construction and associated BMPs to minimize those impacts would be similar to those described in Section 3.10.2.2.1. Under this alternative, minor impacts to traffic would be more noticeable near the reclaimed water expansion project site during construction. There would be no traffic from the operation of the reclaimed water expansion components, and there would be no long-term changes in the on- or off-Post traffic. This alternative would have no impact on rail, air or public transportation in the area.

3.10.2.2.6 Alternative 5

Short-term minor adverse effects on traffic would be expected. The impacts would be primarily contributable to construction vehicles. In general, traffic effects due to construction and associated BMPs to minimize those impacts would be similar to those described in Section 3.10.2.2.1. Under this alternative, minor impacts would be more noticeable near the proposed wind turbine site during construction. There would be no traffic from the operation of the wind turbines, and there would be no long-term changes in the on- or off-Post traffic. This alternative would have no impact on rail, air or public transportation in the area.

3.10.2.2.7 Alternative 6

Short-term minor adverse effects on traffic would be expected. The changes would be primarily contributed to construction vehicles. In general, traffic effects due to construction and associated BMPs to minimize those impacts would be similar to those described in Section 3.10.2.2.1. Under this alternative, minor impacts would occur near the future ground-source heating and cooling projects or PV arrays during construction. There would be no traffic from the operation of the ground-source heating and cooling projects or PV arrays, and there would be no long-term changes in the on- or off-Post traffic. This alternative would have no impact on rail, air or public transportation in the area. In addition, Fort Carson would utilize the environmental screening criteria that have been developed and considered within this EA (see Appendix B) to assist in the placement of the PV systems and GSHP units.

3.10.2.2.8 Alternative 7

Implementation of Alternative 7 would have negligible adverse impacts on traffic and transportation. These projects would primarily occur within building interiors, developed portions of building exteriors and modifications to existing utility infrastructure, and would not affect traffic conditions. Behavioral and conservation measures regarding waste, water, and energy would have no impact on traffic and transportation.

3.10.3 CUMULATIVE EFFECTS

Regardless of the alternative selected, the Proposed Action would have short-term minor and/or long-term minor adverse effects on transportation resources. These effects would primarily be due to very small increased traffic volume on regional and Installation roadways. These effects would be in addition to naturally occurring population growth in the region, and specifically projects that relocate people and activities to the region like Grow the Army, BRAC, CAB stationing, and Army Transformation actions. No large-scale projects or proposals have been identified that when combined with the Proposed Action would have significant cumulative impacts. Therefore, cumulative impacts to transportation resources would be minor.

3.10.4 PROPOSED IMPACT REDUCTION MEASURES

3.10.4.1 Mitigation

No significant adverse impacts are anticipated, therefore, no mitigation measures would be required for traffic and transportation. While no significant impacts are anticipated the following measure may still be implemented. For all Proposed Action Alternatives, construction vehicles would be directed to access the Installation via the gates closest to each project site, minimizing construction vehicle movement during peak traffic hours. In addition, construction staging areas would be placed where they would least interfere with traffic. All construction vehicles would be equipped with backing alarms, two-way radios, and Slow Moving Vehicle signs, when appropriate.

For Alternative 2b, deliveries during peak traffic hours would be minimized to minimize operation impacts to failing intersections adjacent to the Bravo North Site 2.

3.11 Airspace

3.11.1 AFFECTED ENVIRONMENT

This section provides an overview of airspace in the study area (Section 3.11.1.1) and existing airspace components at Fort Carson (Section 3.11.1.2) that could be affected by the implementation of any or all of the NetZero initiatives as proposed in the Alternatives Carried Forward for Consideration (Section 2.4). This discussion is followed by a description of the current level of airspace use and management within the study area (Section 3.11.1.3).

3.11.1.1 Overview

> **Airspace Management** is defined as the direction, control, and handling of flight operations in the navigable airspace that overlies the geopolitical borders of the U.S. and its territories.

Airspace is a four-dimensional area (space and time) that overlies a nation and which comes under its jurisdiction. Airspace consists of both controlled and uncontrolled areas. Controlled airspace and the constructs created to help manage it are known as the National Airspace System (NAS). This system is defined as, "…a common network of U.S. airspace; air navigation facilities, equipment and services, airports or landing areas; aeronautical charts, information and services; rules, regulations and procedures; technical information; and manpower and material" (FAA, 2002). Navigable airspace is airspace above the minimum altitudes of flight prescribed by regulations under USC Title 49, Subtitle VII, Part A, and includes airspace needed to ensure safety in the launch, recovery and transit of the NAS (49 USC § 40102). Congress has charged the FAA with responsibility for developing plans and policies for the use of navigable airspace and assigning, by regulation or order, control over the use of the airspace necessary to ensure the safety of aircraft and its efficient use (49 USC § 40103(b); FAA Order 7400.2, 2004). The FAA also regulates military operations in the NAS through the implementation of FAA Order JO 7400.2G, Procedures for Handling Airspace Matters and FAA Handbook 7610.4J, Special Military Operations. The latter was jointly developed by DoD and FAA to establish policy, criteria and specific procedures for air traffic control (ATC) planning, coordination and services during defense activities and special military operations. The use of airspace and airfields by Army organizations is also strictly defined in AR 95-2 Airspace, Airfields/Heliports, Flight Activities, ATC, and Navigational Aids.

Different classifications of airspace are defined by different types of altitude measurements. These are commonly referred to throughout this section and include the following:

- **Above Ground Level (AGL).** This type of measurement is the distance above the earth and is used at lower elevations in Class-G airspace (defined later within this section), approach/departure (A/D) situations or any condition that typically resides in the area between surface and 1,200 feet AGL, or occasionally higher.
- **Mean Sea Level (MSL).** This measurement is defined as the altitude of the aircraft above MSL as defined by altimeter instrumentation.
- **Flight Level (FL).** FL is for airspace higher than 18,000 feet above MSL up to and including FL600. To obtain FL, the altimeter is set at the International Standard Atmosphere (ISA) and described by dropping the last two digits. FL600 is comparable to 60,000 feet MSL with the ISA setting.

Controlled airspace is defined as a limited section of airspace of defined dimensions within which ATC is provided to Instrument Flight Rules (IFR) and to Visual Flight Rules (VFR) traffic. IFR and VFR are the two modes of flying that can generally be described as follows:

> **Sectional Maps** represent airspace features and conditions relative to ground features as a mechanism to control the private, public and commercial use of that airspace as a means to reduce the likelihood of accidents (see Figure 3.3-3)

- IFR refers to a method of air travel that relies on instrumentation rather than visual reference, and which is always under the direction of ATC to provide proper separation of aircraft. As aircraft traverse the sky from launch at one airport to recovery at another, every movement is directed by the ATC of authority for each given area. Control is transferred from one ATC to another as aircraft cross jurisdictional lines defined on Sectional Maps prepared by the FAA (see Figure 3.11-1 for the sectional of this ROI [see Section 3.11.1.2 for more detail on the airspace ROI]).
- VFR refers to a method of air travel that relies primarily on visual reference (dead reckoning) for location and safe separation of aircraft while in Class-G or Class-E Airspace or as granted by ATC within their defined areas of control. VFR flying is inherently subject to weather conditions.

Controlled airspace has a set of classifications indicated on Sectional Maps to include classes A through G as listed below (see Figure 3.11-2):

- **Class-A airspace** refers to the region between 18,000 feet above MSL and FL600 over the contiguous U.S. All traffic in this airspace is IFR. The airspace is dominated by commercial traffic using jet routes between 18,000 feet MSL and FL450.
- **Class-B airspace** is typically associated with larger airports as a control mechanism for the large number of sorties and types of aircraft. It is typically configured in multiple layers resembling an upside down wedding cake. The first layer (inner circle) is typically from surface to 10,000 feet MSL. This circle could be in the range of 10 nautical miles (NM) to 20 NM in diameter. The next circle might be 30 NM and extend from 1,200 feet AGL to 10,000 feet MSL. The outer circle lies outside of the second and may extend from 2,500 feet AGL to 10,000 feet MSL. Each airport is unique and actual altitudes can be referenced from the Sectional. Aircraft must be equipped with specialized electronics that allow ATC to accurately track their altitude, heading and speed. They are also required to maintain radio communication while in the airspace and are given direction as to altitude, heading and speed at all times.
- **Class-C airspace** is associated with medium sized airports and is the most common class for airports with control towers, radar approach control and a certain number of IFR operations. While each is specifically tailored to the needs of the airport, a typical Class-C configuration consists of an inner circle of 5 NM extending from surface to 4,000 feet AGL and an outer circle of 10 NM extending from 1,200 feet AGL to 4,000 feet AGL. Aircraft must have an operable radar beacon transponder with automatic altitude reporting equipment and are required to maintain radio communication while in the airspace. They are given direction as to altitude, heading and speed at all times.

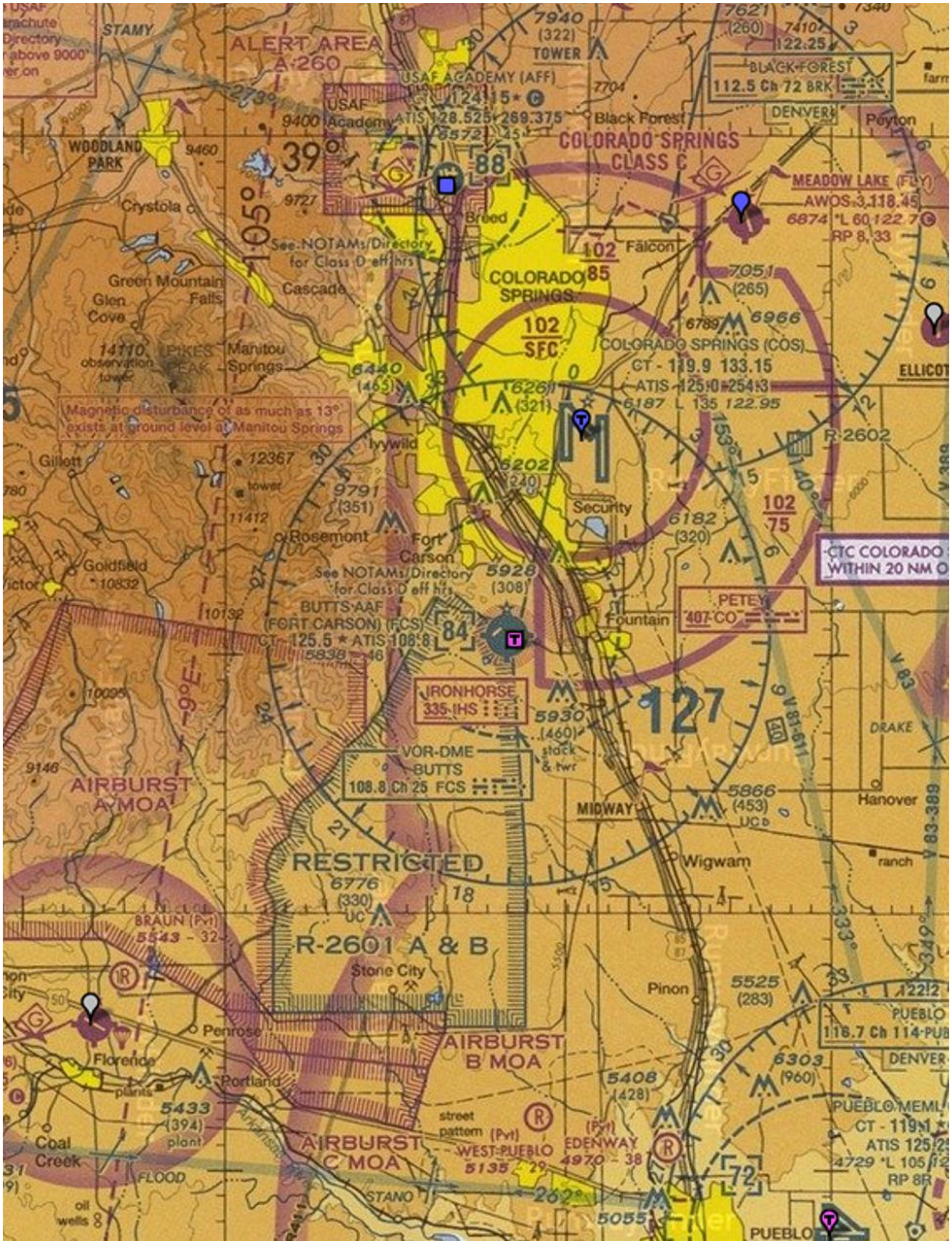
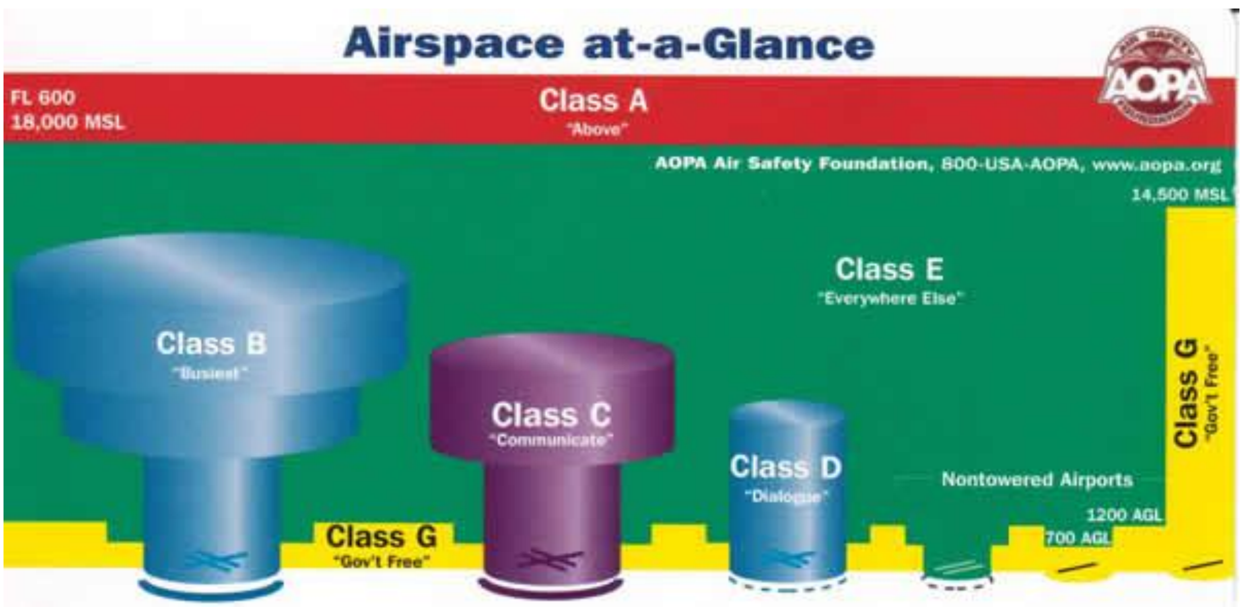


Figure 3.11-1. Federal Aviation Administration Sectional of the Region of Influence

- **Class-D airspace** is associated with smaller airports that have an operational control tower. They typically have a single circle of 5 to 10 NM that extends from surface to 2,500 feet AGL. Aircraft may not operate below 2,500 feet AGL within 4 NM of Class-D airspace at an indicated airspeed of more than 200 knots. Pilots must establish and maintain two-way radio communication with ATC for separation services. It is not uncommon for these airfields to have set hours of operation for ATC. Outside of these times, the area reverts to uncontrolled airfield status requiring pilots to fly VFR using "see and avoid" techniques and make radio addresses for all actions.
- **Class-E airspace** is any controlled airspace which is not Class A, B, C or D. It extends upward from either the surface or a designated altitude to the overlying or adjacent controlled airspace. Class-E airspace is also that used by transiting aircraft to and from the terminal or an en route environment normally beginning at 1,200 feet AGL to above 18,000 feet MSL. Class-E airspace ensures that IFR traffic remains in controlled airspace when approaching aircraft within otherwise classified airspace or when flying on Victor airways (see Section 3.3.1.2.4 regarding definition of Victor airways). Federal airways have a width of 4 statute miles on either side of the airway centerline and occur between 700 feet AGL and above 18,000 feet MSL.
- **Class-G airspace** is otherwise uncontrolled airspace that has not been designated as Class A, B, C, D or E. IFR aircraft do not operate in Class-G airspace with the possible exception of aligning an approach or departure on an IFR Flight Plan. This is done at their own risk, as ATC has no knowledge of VFR activity in these areas.



Source: AOPA Air Safety Foundation.

Figure 3.11-2. Airspace Classification Diagram

There are also Special Use Areas designed to ensure the separation of non-participating aircraft from potentially hazardous operations or conflict with military operations in general. These include Restricted Areas (RAs) and Military Operations Areas (MOAs). RAs are three-dimensional sections of airspace that are to be restricted from commercial or private traffic while activated, thereby allowing unfettered execution of military operations. MOAs are three-dimensional sections of airspace defined as having a high level of military use, in order to advise commercial and private traffic to either stay clear of this area or be vigilantly aware of that type of traffic when activated.

3.11.1.2 Airspace Components

The primary components of the airspace ROI include BAAF, Sectors A, B, C, & D of RA R-2601, and Sectors A, B, & C of Airburst MOA. Secondary components residing in the area exposing them to potential affect include COS, also home to Peterson Air Force Base (AFB) and the Pueblo Memorial Airport (PUB). The area also supports several Federal airways known as Victor routes that align with Very High Frequency Omni-Directional Range (VOR) beacons strategically located for safe and economical navigation of the NAS between controlled airspaces, including a VOR with distance measurement equipment (DME) located at BAAF.

3.11.1.2.1 Military Airfields

BAAF - FCS. This airfield is the hub of all military air operations in and around Fort Carson. It is a military use only airfield with two runways. Runway 13-31 is the primary runway of 75 feet wide by 4,572 feet in length. It is a Class B runway according to Unified Facilities Criteria (UFC) 3-260-01 *Airfield and Heliport Planning and Design,* as it regularly supports C-130 transport aircraft and Army Special Operations Command CASA C-212 aircraft launch and recovery operations. Airspace imaginary surfaces are consistent with an Army Class-B runway under IFR (see Figure 3.11-3). The second runway is 4-22 and it is for rotary wing use only. It is 75 feet wide by 2,700 feet in length. Airspace imaginary surfaces are consistent with an Army rotary wing landing facility under VFR. The airfield mean elevation is 5,838 feet MSL (FAA, 2012b). The airfield is currently home to the following units and aircraft:

UNIT	AIRCRAFT
• 1st Battalion 2d Aviation Regiment	(24) AH-64
• Company F, 7th Battalion, 158th Aviation Regiment	(8) HH-60M

Fort Carson is set to receive a full CAB Heavy in the coming years that would bring the following additional permanently stationed aircraft: (48) AH-64, (38) UH-60, (12) CH-47 and (15) HH-60 for a total projected number of permanent aircraft at the airfield of 145 (Taijeron, 2012). There are also many transient aircraft that frequent the Installation for either maintenance or training. As stated in Section 1.4.8, the CAB action is being analyzed in the *EA for the Implementation of Combat Aviation Brigade (CAB) Stationing at Fort Carson*.

The BAAF runway (13-31) has specific imaginary surfaces that traverse the area and support safe launch and recovery operations. Imaginary surfaces establish maximum height limitations for fixed or mobile obstacles surrounding the airfield. These are dictated by UFC 3-260-01. The runway is classified as a Class-B Army airfield, which requires a Primary Surface of 1,000 feet extending the length of and centered over the runway. The Transitional Slope rises at a rate of seven horizontal to one vertical off the sides of the Primary Surface to a height of 150 feet AGL. The Inner Horizontal Surface extends on a level plane out from the edge of the Transitional Slope a distance of 7,500 feet from runway centerline. The Conical Surface slopes upward from the edge of the Inner Horizontal Surface at a rate of 20 horizontal to one vertical to a height of 500 feet AGL. This levels off into what is referred to as the Outer Horizontal Surface, which extends on a level plane at 500 feet AGL for a distance of 30,000 feet from its starting point. The A/D slope begins at a point 200 feet from the end of the runway and extends out a distance of 25,000 feet. It rises at a rate of 50 horizontal to one vertical. The A/D is a trapezoid with a beginning width of 1,000 feet centered on the runway and an end width of 9,000 feet. The end elevation is at 500 feet AGL aligned with the Outer Horizontal Surface.

Rotary runway 8-22 also has specific criteria for imaginary surfaces. This runway requires a primary surface of 300 feet extending the length of and centered over the runway. The Transitional Slope rises at a rate of two horizontal to one vertical off the sides of the Primary Surface to a height of 150 feet AGL tying into the inner horizontal surface established for runway 13-31. The A/D begins at a point 75 feet from the ends of the runway and rises at a rate of three horizontal to one vertical also tying into the inner horizontal plane of runway 13-31.

The BAAF ATC supports a Class-D airspace with an 11 NM diameter circle extending from surface to 8,400 feet MSL. There is a 1.5-mile extension to the southeast aligned with the runway 31 approach. This airspace is segmented along the northern edge by a portion of the COS Class-C airspace, which rises from surface to 10,200 feet MSL. Outside of that circle is a 6 NM concentric ring that extends from 7,500 feet MSL to 10,200 feet MSL creating something of a conflict in undesignated space between BAAF and COS. There is an overlap of these airspaces from the floor of the outer ring of COS from 7,500 feet MSL to the ceiling of the BAAF at 8,400 feet MSL or a total of 900 vertical feet (see Figure 3.11-1). This seeming conflict is of little consequence however, as all air traffic (with the exception of the RA) is managed by COS ATC, including all launch and recovery operations at BAAF.

3.11.1.2.2 Restricted Airspace

The R-2601 consists of an undivided horizontal area with four vertical divisions that can be activated or deactivated as use of the range requires. Activations/deactivations are planned by Range Control and the airspace manager and then requested of the FAA, which subsequently informs pilots through Notices to Airmen. The four divisions of the R-2601 are as follows:

- A: Surface to 12,499 feet MSL
- B: 12,500 to 22,499 feet MSL
- C: 22,500 to 34,999 feet MSL
- D: 35,000 to 59,999 feet MSL

Activities within the range are multiple and vary from day to day as training requirements dictate. They include such activities as ground maneuver training for both vehicle and personnel, live fire ranges including everything from small arms fire to tanks and canons, helicopter flight operations such as close air support (CAS) and medical evacuation, unmanned aerial system intelligence, surveillance and reconnaissance training, parachute drop, cargo drop, fixed wing and rotary wing strafing runs and show-of-force passes. Air and ground operations are under the supervision of Range Control although most activities are scheduled and then allowed to function independently. Most rotary wing flights are conducted VFR. Routes are established throughout the range as known corridors of helicopter traffic. One such corridor resides near the Wildhorse site identified in Alternative 5 and is referred to as Route 1. Traffic on this corridor typically flies at 150-700 feet AGL and visually follows the perimeter road as a means to stay a safe distance from ground fire in the area.

Fixed wing flights are managed by Joint Terminal Attack Controllers (JTACs) associated with the 140th Wing from Buckley AFB. These training flights are primarily held to the southwest corner of the range within an area between the western boundary and grid coordinate 15 and between the southern boundary and grid coordinate 63. These training flights typically include F-16s from Buckley AFB, C-130s from Peterson AFB, and other aircraft such as C-17s and A-10s from the region. Air drops are conducted on a flight path that aligns with the drop zones (DZs) bringing aircraft across the southeastern corner of the range at a heading of roughly 290 (Anderson, 2012). Other fixed wing activities use the Airburst MOA for loiter, alignment attack run and exit from an attack run that maneuvers aircraft directly north then exits left (west) back into Airburst MOA-A before reaching grid coordinate 63.

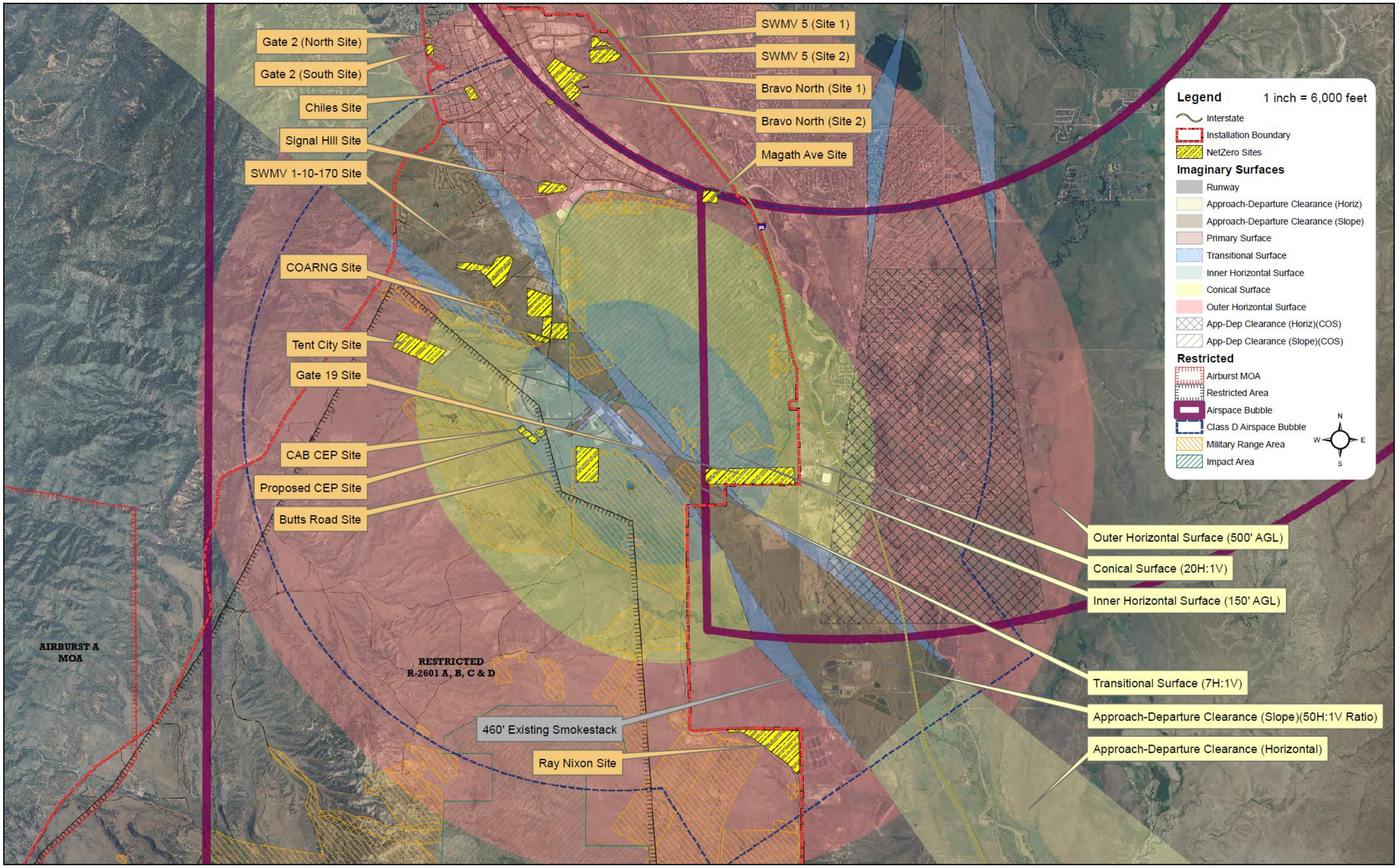


Figure 3.11-3. Butts Army Airfield Imaginary Surfaces

3.11.1.2.3 Military Operations Areas

The Airburst MOAs exist to help reduce the likelihood of interaction between military aircraft and public, private or commercial aircraft by identifying the area to VFR traffic that it is highly used by military aircraft and by redirecting IFR traffic safely through or away from that area. Airburst MOA-A is the largest of the three exceeding the size of the R-2601. It is contiguous with and lies west of the R-2601 and provides space for mountainous terrain flight training as well as loiter and maneuver area in preparation for runs through the RA. Airburst MOA-B & C are small contiguous segments located on the southern boundary of the R-2601 that act as a corridor providing access to the fixed wing area of the range located on the southwest corner. It provides enough airspace for aircraft to transition from Airburst MOA-A south through Airburst MOA-C, bank hard left (north) through Airburst MOA-B and into the RA.

3.11.1.2.4 Commercial Airports

The following contains information regarding commercial airports that are located within the ROI that have a potential impact associated with the proposed alternatives.

The City of Colorado Springs Municipal Airport (COS). This international airport is the most prominent commercial airport for this region of southern Colorado along the front-range. The next largest is the Denver International Airport, which is a major hub for several airlines. COS is also home to Peterson AFB, which uses its runways, taxiways and airspace on a daily basis. There are three runways at COS, including 17L-35R, 17R-35L and 13-31. Runway 17L and 35R have an Instrument Landing System (ILS)/DME approach system and runway 35L has an ILS approach system. The airport currently maintains a Class-C airspace with an inner circle of 10 NM radius that extends from surface (6,187 feet MSL) to 10,200 feet MSL. There are also two segmented concentric outer circles. The first covers roughly the southeast quarter extending out from the inner circle another 6 NM and rising from 7,500 feet MSL up to 10,200 feet MSL, aligning with the height of the inner circle. This segment overlaps a portion of the BAAF Class-D airspace as described previously in Section 3.11.1.2.1. The north segment roughly covers the northeastern quarter to a point tangent to the western edge of the inner circle also at 6 NM out from the inner circle. It extends from 8,500 feet MSL to 10,200 feet MSL. There is a 4 NM notch removed from the northeast edge allowing for independent airspace of the Meadow Lake Airport (FLY). Colorado Springs ATC manages all air traffic in the region including launch and recovery at BAAF and the Pueblo Memorial Airport (AirNav, 2012 and FAA, 2012c).

Pueblo Memorial Airport (PUB). The Pueblo Memorial Airport is a small community airport with some commuter traffic although the majority of all commercial flights in this region are through COS. PUB has three runways, including 17-35, 8L-26R and 8R-26L. An old diagonal runway is closed. This airfield supports a Class-D airspace of 14 NM diameter rising from surface (4,729 feet MSL) to 7,200 feet MSL. Runways 8L and 26R have an ILS approach system (FAA, 2012d).

3.11.1.3 Airspace Use and Management

Airspace of the ROI is under the control of several separate but integrated organizations including COS ATC, BAAF ATC, Range Control, JTACs and the Denver Air Route Traffic Control Center (ARTCC). The COS ATC manages the majority of air activity within the ROI including all launch and recovery operations for the three airports; COS, PUB and BAAF. Aircraft over the range within the R-2601 are managed by Range Control but are typically either flying independently via VFR or are under the control of JTACs as they enter and exit the range. Aircraft operations outside of those areas are either flying VFR or are under the control of the Denver ARTCC.

3.11.2 ENVIRONMENTAL CONSEQUENCES

This section provides a detailed discussion of the possible environmental impacts to airspace that could result as a consequence of implementing the alternatives described in Section 2.3, Alternatives. Specifics are provided that identifies each Proposed Action Alternative independent of the other alternatives even though more than one alternative may be implemented. The discussion addresses the limitations of each Proposed Action Alternative as defined by airspace criteria and restrictions therein. As stated in Section 3.1.2, impacts to airspace would be considered significant if they are in violation of FAA regulations that undermines the safety of military, civil, or commercial aviation or if they infringe on current military, private, and commercial flight activity and flight corridors.

3.11.2.1 No Action Alternative

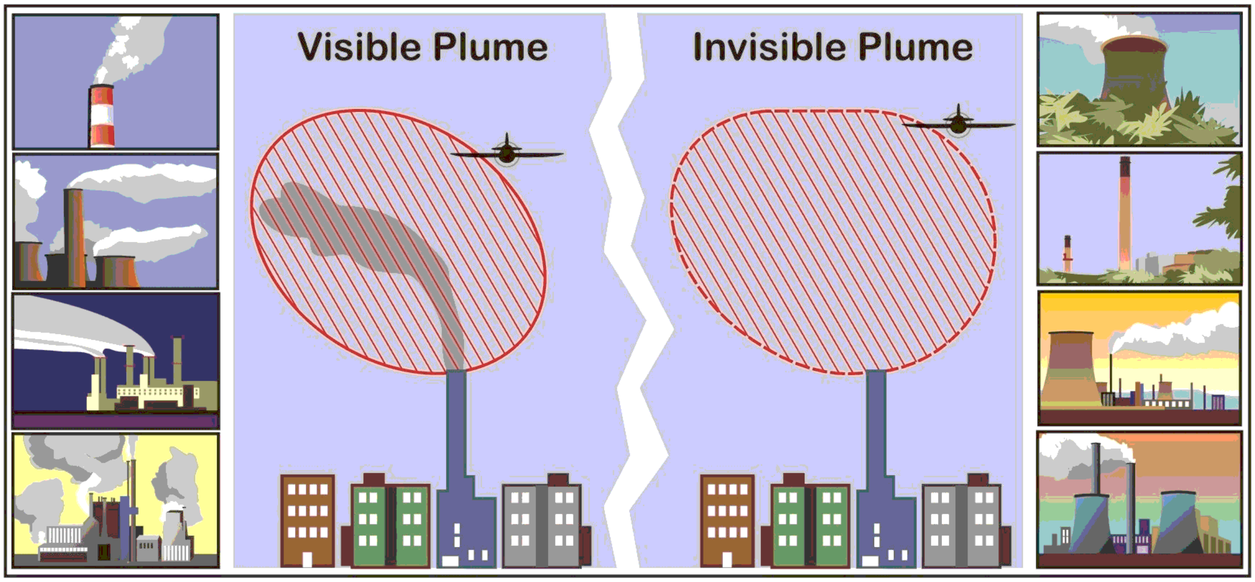
Under the No Action Alternative, there are no changes to the airspace, and therefore, no impacts to airspace use.

3.11.2.2 Proposed Action Alternatives

3.11.2.2.1 Aviation Approaches and Airspace Use Impacts Common to All Proposed Action Alternatives

All Proposed Action Alternative sites are located on Fort Carson and beneath airspace directly under the control of either COS ATC or Range Control if located within the R-2601. This means that the affected airspace is either within the BAAF Class-D circle or within the COS Class-C circles, indicating that there is considerable air traffic associated with approach and departure operations as well as air training operations if over the range. According to the Federal Aviation Regulation Part 77, any ground based object that extends above 500 feet AGL is to be considered an obstruction to air navigation. Any expulsion of heat, condensation or PM into the atmosphere that rises above 500 feet AGL is also considered a hindrance to airspace use, or that rises above 200 feet AGL if near BAAF or the R-2601 due to higher concentrations of low level flight activities in these areas and the possibility of diminishing visibility or the creation of thermals that could disrupt safe air navigation (Figure 3.11-4). Low level circular traffic (below 150 feet AGL) is common for a distance of nearly 1.5 miles surrounding the airfield. These and other imaginary surfaces associated with airfields, specifically BAAF, that have limitations below 200 feet AGL are identified in Section 3.11.1.2.1 and are depicted in Figure 3.11-3.

None of the Victor routes described in Section 3.11.1.2 would be affected by the Proposed Action Alternatives. In addition, the VOR with distance measurement equipment at BAAF is not associated with any Federal airways nor used by any commercial aircraft other than as a reference point and would not be affected by these alternatives. These airspace components, therefore, are not considered in the discussions below.



Source: FAA circular "Potential Flight Hazards".

Figure 3.11-4. Thermal Plumes and Low Level Flight

3.11.2.2.2 Alternative 1

Alternative 1 proposes the construction of a WTE plant at the Gate 19 site that would include one or more exhaust stacks up to 200 feet AGL. The stack(s) is for the expulsion of smoke as a by-product of the burning of feedstock. This site is in close proximity to BAAF and constrained by the imaginary surfaces associated with that airfield (see Figure 3.11-5). Approximately 24 acres of the southwest corner of the site intersects the Runway 31 approach corridor at approximately 3,200 feet from the end of the runway, which has an associated imaginary surface rising at 50 horizontal to 1 vertical (50H:1V) from a point 200 feet from the end of the runway. This places a structural height restriction for this area at less than 60 feet AGL with no air emissions of any kind due to the potential for aircraft visibility concerns in approaching and departing BAAF. Approximately 103 acres of the site lies below what is referred to as the inner horizontal surface, which is an imaginary plane at 150 feet AGL. Nothing may be constructed in this area that exceeds that height or emits any emissions that contain excessive heat, condensation or PM that may obstruct visibility. This area is within the circular traffic pattern of the airfield requiring clear visibility for launch, recovery and transit operations. Approximately 36 acres of the very far end of the site nearest the eastern boundary lies beyond the edge of the inner horizontal surface beneath what is referred to as the conical surface. While this surface rises from 150 feet AGL at a rate of 20H:1V (up to approximately 200 feet AGL at the eastern most edge), it remains similarly constrained.

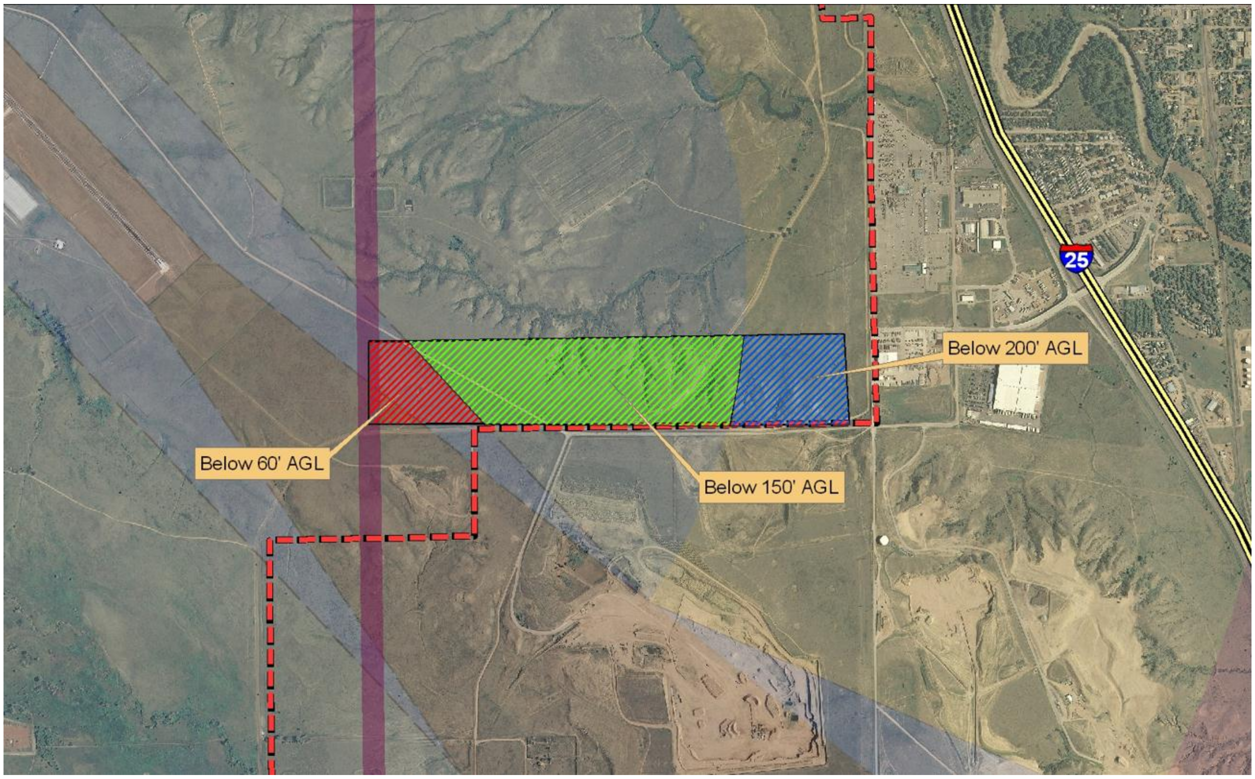


Figure 3.11-5. Gate 19 Site and Butts Army Airfield Imaginary Surfaces

If the Army were to proceed with this alternative the impacts to airspace could be significant due to the site's close proximity to the airfield. Additionally, the restrictions on development could potentially be too arduous for practical use of the site. Adherence to the UFC 3-260-01 criteria are mandatory, disallowing construction of any element of a building beyond the elevations specified for those areas such as the proposed smoke stack for the WTE plant. The expulsion of any element into the air from such a facility that could potentially diminish visibility within the flight corridors of the airfield would be considered hazardous. It is estimated that as many as 50 to 100 operations per day would be conducted at BAAF following completion of the CAB beddown. This high level of operations increases the potential threat of an accident due to unsafe conditions. If a low level condensate cloud formed over the airfield as a result of heat release and moisture in the atmosphere, flight training operations would cease until conditions improved. Additionally, if high levels of heat were released from a facility, there is potential for thermal columns to form, which could disrupt air traffic or even present unsafe conditions for aircraft operating at low altitudes.

If this site is selected it is recommended that the plant, and particularly the smoke stack(s), be constructed as far away from the airfield as possible on the eastern edge of the proposed site by the Installation boundary. This would provide the largest separation possible between airfield operations and the obstruction. The smoke stack(s) should not exceed 150 feet AGL and should be conditioned so as to eliminate the possibility of releasing excess heat, PM or condensation or the possibility of creating condensation through the normal process of heat being exposed to moisture naturally occurring in the atmosphere. Any element constructed in this area would have to be examined and approved by the FAA for compliance to the regulations and validation of continued safe flight operations.

3.11.2.2.3 Alternative 2

This alternative proposes construction of a biomass plant at three sites, including the Gate 19 site (Alternative 2a), Bravo North sites 1 & 2 (Alternative 2b), and the CAB CEP Biomass site (Alternative 2c). The specifics of each site are addressed separately below:

Alternative 2a. The Gate 19 site would have the same restrictions and implications to airspace use as those identified in Section 3.11.2.2.1 and Section 3.11.2.2.2 (Alternative 1). The physical and operational properties of the proposed biomass plant regarding impacts to airspace would be the same as those presented for the WTE plant.

Alternative 2b. The Bravo North 1 & 2 sites are located closer to the Main Post of the Installation, within the inner circle of COS and beneath the outer horizontal surface of BAAF. The outer horizontal surface is established at 500 feet AGL; however, the Main Post is also established as a no fly zone, thereby eliminating any possible conflict with airspace activities originating from BAAF.

Under this Alternative, there would be a minor potential for impact to airspace caused by emissions from the smoke stacks and non-Installation air traffic. The possibility exists of emissions rising from the stacks drifting into active operational airspace and subsequently diminishing visibility. There are no definitive studies or criteria for separation of air traffic from industrial functions; however, emissions from smoke stacks are known to be potentially hazardous for low level aircraft operations. If constructed in this location, the FAA may choose to include identification of the plant location and height on Sectional Charts. Construction would also need to be approved by the FAA for any facility over 199 feet AGL to include appropriate configuration and lighting.

Alternative 2c. This alternative proposes changes that would include a biomass plant as part of the proposed CEP to be constructed as a component of the CAB standup, parts of which are currently under construction. The CEP is proposed to be built adjacent to the dormitories and company operations facilities on the west side of Butts Road. The east side of Butts Road is BAAF, putting this site in close proximity to the airfield. This location is beneath the inner horizontal surface established at 150 feet AGL. Nothing may be constructed there that exceeds that height or emits any emissions that contain excessive heat, condensation or PM that may obstruct visibility. This area is within the circular traffic pattern of the airfield requiring clear visibility for launch, recovery and transit operations. It is assumed that the physical configuration and siting of the CEP has been established in compliance with airfield and airspace criteria as part of the CAB standup planning efforts. It is also assumed that the inclusion of a biomass plant in association with the CEP would not require additional smoke stacks or create any additional emissions in excess of what the CEP would produce through its normal operations. Therefore, the proposed plant modification would have no additional impact to airspace use as long as the criteria are met. This site, however, poses the same risks for flight operations as Alternative 1.

3.11.2.2.4 Alternative 3

Alternative 3 calls for the placement of PV systems at 13 sites throughout Fort Carson. A high reflectance off the surface of this type of facility could potentially distract pilots or cause temporary "whiteout" conditions that could be unsafe if operating in a highly congested area or on recovery approach to the airfield. This type of facility at these locations poses no conflicts with airspace use so long as systems installed have a low coefficient of reflectivity. There is no empirical data yet established as an acceptable limit of reflectance, however, PV systems are inherently non-reflective as a function of their ability to convert sunlight into energy, and therefore, are not considered to produce glare beyond acceptable limits (FAA, 2012e). There currently exists a solar field located near the airfield at the corner of Titus Boulevard and Butts Road with no ill effects having been reported. This solar field lies outside of the inner horizontal at approximately three miles from the airfield but near the Runway 13 approach corridor. Overall, adverse impacts to airspace use would be negligible to minor.

3.11.2.2.5 Alternative 4

This alternative deals with providing reclaimed water to an expanded reservoir located at the golf course for use in watering it and other athletic fields throughout the Installation. The majority of this proposal deals with elements being constructed on or under the ground surface, which in and of itself would have no effect on airspace use.

3.11.2.2.6 Alternative 5

This alternative proposes to construct up to eight turbines on the Wildhorse site along the ridgeline of the southeast corner of the R-2601 range. As the ridgeline sits at approximately 5,640 feet MSL and the proposed turbines could be up to 492 feet tall (150 meters), the tips of the turbine could exceed 6,100 feet MSL. This particular part of the range is used for a variety of activities, including ground maneuver training, tank and canon live fire, CAS, MEDEVAC and rotary wing transit along Route 1. All maneuver and live-fire exercises are conducted in this surface danger zone bounded by the perimeter road, which aligns with air corridor Route 1. These activities are restricted to the west side of the roadway. Rotary wing traffic in transit along Route 1 are required to keep east of the perimeter road as a visual reference (they must be able to see it out the window facing the range) to avoid de-confliction of air traffic and ground fire that can reach as high as 17,000 feet AGL. Although the air corridor has a required clear distance of 200 meters (656 feet), flights regularly utilize the area from the Perimeter Road to the range boundary.

Wind turbines are known to produce a wake turbulence effect that could cause an adverse significant impact to air traffic operating in their vicinity. Studies have identified wind velocity decreases to 2/3 of the free-stream velocity just in front of the turbine and to 1/3 of the free stream velocity behind the turbine (Holland, 2008). This turbulence has been found to extend beyond 16 blade diameters or 1.6 kilometers with the wind turbines proposed under this alternative. This represents a significant drop in airspeed that could cause an aircraft to tip or stall. The diagram in figure 3.11-6 portrays a scenario of five potential wind turbines on the Wildhorse site located based upon ground conditions favorable for construction and operation (highest buildable sites). Each is outlined with the blade diameter (100m) and a wake turbulence standoff area (1,600m radius). These areas are in direct conflict with Route 1 and areas generally used by helicopters for range training activities. This same area is also used for CAS training exercises. Wind turbines constructed on the Wildhorse site would decrease the available land required for training and present a hazard to aircraft operating in this area. This would be particularly more dangerous during instances of low visibility.

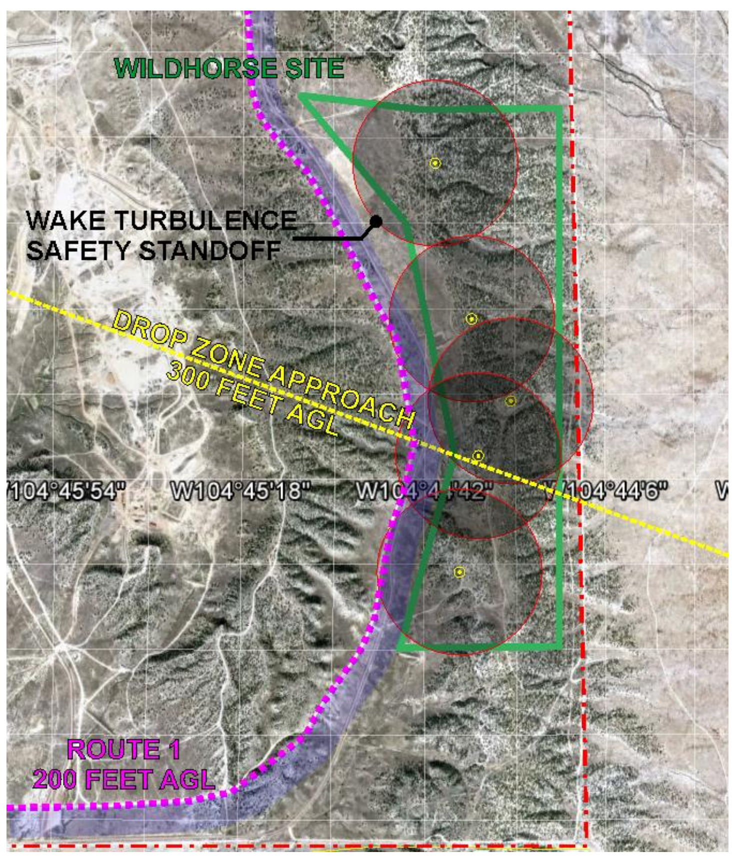


Figure 3.11-6. Potential Wind Turbine Wake Turbulence Effect

This area is also within the flight path for fixed wing air drop training being conducted in the southwest corner of the range identified in Section 3.11.1.2.2. These operations typically involve C-130 or C-17 aircraft approaching at 300 feet AGL along grid coordinate 57 on a heading of approximately 290. This corresponds to a straight run on the established DZs in that part of the range. Wind turbines located in this area would require a different path to be taken for these training flights. Considering that the wind turbines could be as much as 200 feet higher than the approach elevation, they would also present a hazard for any corridor established in this general area, particularly for night operations and blackout operations. A non-aligned approach would be possible to avoid the wind turbines but may cause minor adverse negative impacts to training or increase risks for flight operators.

As the potential for adverse significant impacts exists, any turbine constructed in this area would have to be examined and approved by the FAA for compliance to the regulations and validation of continued safe flight operations. Due to the size of the project, it would also require coordination with the DoD Clearinghouse which assesses proposed utility-scale renewable energy projects that potentially impact the DoD mission including the use of training ranges, airspace, and restricted areas. This coordination and any required mitigations would reduce adverse impacts to less than significant. Projects would not be sited in areas that would lead to critical conflicts with the military mission.

Impacts to Navigational Aids (Radar)

Although research is on-going, it is well established that wind turbines produce an electromagnetic field that has an effect on ground based and air-to-air or air-to-ground radar systems. They can cause shadows to form behind and above the towers preventing radar penetration essentially blacking out identification of single source radar systems (AWEA, 2008 and FAA, 2012a). The ground-based radar for this area is located at COS with microwave transmitters providing this same signal to the BAAF ATC. A new multiple point-of-presence system has been established that provides dual receivers (located at COS and Trinidad) providing coverage of the same area, which should eliminate any shadow effect caused by the turbines. This system is not yet operational at BAAF but would be included with the construction of the new ATC tower as part of the CAB standup. Air-to-air and air-to-ground systems would remain impaired as they operate in and around the turbines. The distance of such disturbance is not quantifiably defined at this point. This loss of radar contact between aircraft and from aircraft to ground elements could be potentially dangerous during training activities where aircraft approach at high speeds and low altitudes for strafing, Special Operations Forces, and airdrop runs as well as CAB activities. Although well-coordinated, there are typically multiple activities being conducted by multiple users (multiple Services) simultaneous to one another on the range. Continuous situational awareness is vitally important for safe flight operations (Wilson, 2012).

Wind turbines have also been known to cause radar “clutter” surrounding them, which delivers false-positive identifications of aircraft making it difficult to positively identify and track aircraft known or unknown (Brenner, 2008 and Poupart, 2008). This presents a problem for air traffic controllers to identify errant aircraft that may accidentally or intentionally stray into restricted airspace. It also makes it difficult for pilots to maintain positive or known radar contact with other aircraft as they operate in the area where turbines are established. Again, the distance of such disturbance is not yet quantifiably defined but would have an impact on training ability and flight safety. There are as yet no known mitigation techniques for this anomaly, although studies are on-going and improvements in radar or wind turbine technology may eventually resolve the issue.

Weather radar is also subject to these same anomalies as they also employ Doppler technology as a forecasting tool. Local weather radar operators, however, stated that there would be no negative impact for the proposed location of the wind turbines (Wilson, 2012).

3.11.2.2.7 Alternative 6

This alternative promotes ground-source heating and cooling and PV solar installations as programmatic additions to future projects. Ground-source heating and cooling involves subsurface installations only, and therefore, would have no impact to airspace use. Future solar applications are considered consistent with those discussed in Alternative 3, Section 3.11.2.2.4.

3.11.2.2.8 Alternative 7

Implementation of Alternative 7 would have negligible adverse impacts on airspace. These projects would primarily occur within building interiors, developed portions of building exteriors and modifications to existing utility infrastructure and would not affect airspace use. Behavioral and conservation measures regarding waste, water, and energy would have no impact on airspace.

3.11.3 CUMULATIVE EFFECTS

Alternative 1 and 2. Proposals for the improvements to the airfield in support of the incoming CAB include a runway extension of 2,192 feet towards the southeast. This would effectively lower the height-restricted ceiling created by the A/D slope by 44 feet associated with the western edge of the Gate 19 site, which would restrict development in that area to a height of less than 16 feet AGL. It would also extend the other imaginary surfaces associated with the airfield in that same direction by the same distance. This would have little effect on the rest of the proposed site, which would remain restricted to a height of 150 feet AGL. The increase in airspace usage associated with the CAB buildup could produce a significant impact by increasing the likelihood of aircraft collision caused by impaired visibility. FAA regulations limiting smokestack height would effectively address the risk. Cumulative adverse impacts to airspace would be anticipated to remain less than significant provided height restrictions are enforced.

Alternatives 3 and 6. As stated in Section 3.11.2.2.4, PV systems pose no conflicts with airspace use so long as systems installed have a low coefficient of reflectivity. As Fort Carson continues to implement Net Zero Initiatives, including the placement of PV arrays either on undeveloped land or on building rooftops, a net cumulative increase of structures with the potential for reflectance would occur within the Installation which would have the potential to adversely impact airspace operations. Adverse cumulative effects, however, would be minimized by using PV technologies with a low coefficient of reflectivity.

Alternative 4. Regarding this alternative’s proposal for increased water retention and subsequent watering of athletic fields throughout the Installation, a cumulative effect may occur if these improved grounds had the side effect of attracting fowl into the area, which could potentially create an increased risk of bird airstrike hazard for aircraft. Large fowl have an attraction to well-manicured healthy lawns as a source of food and bedding; however, the golf course and sports fields are presently far enough away from the airfield that no cumulative impacts to airspace would be likely.

Alternative 5. The loss of training land and the restricted airspace above it, due to the construction of wind turbines, although a relatively small amount of land, would negatively impact unit training especially as the op-tempo increases with the standup of the new CAB at Fort Carson.

3.11.4 PROPOSED IMPACT REDUCTION MEASURES

3.11.4.1 Mitigation

Alternatives 1 and 2 have the potential for significant adverse impacts to airspace. The imaginary surfaces associated with BAAF are a DoD requirement that must be adhered to. Proposed construction must meet all UFC and FAA criteria including FAA approval if above 199 feet AGL.

Specifically, for Alternatives 1 and 2a, it is recommended that the plant, and particularly the smoke stack(s), be constructed as far away from the airfield as possible on the eastern edge of the proposed Gate 19 site by the Installation boundary.

For Alternatives 3 and 6, PV systems installed would have a low coefficient of reflectivity to minimize conflicts with airspace.

For Alternative 5 the FAA would be consulted for compliance to the regulations and validation of continued safe flight operations in the siting and design of turbines. Coordination with the DoD Clearinghouse would also be required regarding avoiding adverse impacts to the DoD mission including the use of training ranges and airspace.

3.12 Utilities

This section describes the existing utilities at Fort Carson associated with potable water, wastewater, stormwater, solid waste, energy, heating and cooling, and communications. It also describes the environmental consequences for these utilities from construction and operation of new facilities and/or technologies.

3.12.1 AFFECTED ENVIRONMENT

Utilities at Fort Carson are operated in accordance with the base operations performance work statement and guided by the DPW. Potable water resources are controlled by the *Fort Carson Water Resources Management Plan* (Fort Carson, 2004a). Solid waste is managed in accordance with the *Integrated Solid Waste Management Plan* (Fort Carson, 2004b). Energy reduction efforts are guided by energy conservation programs detailed in the *Energy Management Plan* (Fort Carson, 2005) and Installation policy letters. The *Energy Management Plan* supports EOs 13423 and 13514, and the EPAct of 2005, which collectively require Federal installations to meet multiple goals in the areas of energy conservation, reducing GHG emissions, renewable energy implementation and water conservation.

3.12.1.1 Potable Water

Fort Carson purchases its drinking water from CSU, which maintains an extensive testing program that assures full compliance with the requirements of the Safe Drinking Water Act. In addition, Fort Carson Support Services (FCSS) performs routine supplementary testing for chlorine levels, coliform contamination, and chlorination byproducts on the drinking water distribution system with the goal of providing water that is safe to drink for all Fort Carson consumers. FCSS also performs annual lead and copper testing on water samples collected from schools, child development centers, and Family housing.

Fort Carson, including Family housing, used approximately 889 million gallons (3,365 million liters) of water in FY 2011 (Guthrie, 2012). Fort Carson's contracted water capacity with CSU over a rolling 365 day period is a 2,775,451 gpd (10,506 million liters per day [lpd]) average, and 5,161,890 gpd (19,540 million lpd) peak daily demand over five consecutive days. Average daily use is approximately 2,356,515 gpd (8,920 million lpd) with a current peak demand of 4,488,600 gallons (16,991 million lpd) over five consecutive days, which are both below contracted capacities (Fort Carson, 2009). Fort Carson's current water conservation efforts have kept water usage below contracted capacity limits even with Fort Carson's growth. Water reduction has been achieved through installation of low-flow fixtures in some facilities, waterless urinals in new and renovated facilities, single-bay washes inside motor pools, irrigation through use of treated wastewater, and other conservation efforts. Reduced troop levels as a result of deployments are also a factor. In 2002, Fort Carson implemented a water reduction goal of 75 percent by 2027. Fort Carson has achieved a 40.3 percent reduction in water use since that time going from 79.8 gallons per square foot (gl/ft^2) (302 l/ft^2) to 47.6 gl/ft^2 (180 l/ft^2) in FY 2011 (Clark, 2012). In 2002, Fort Carson also implemented a sustainable development goal that includes a current minimum LEED Silver and Platinum goal by 2027.

3.12.1.2 Wastewater

Fort Carson operates and maintains a WWTP in the vicinity of Gate 20 that treats sanitary sewage and Industrial Wastewater Treatment Plant (IWTP) effluent from Fort Carson. Both plants also treat sanitary sewage and miscellaneous wastewater from the U.S. Air Force's nearby Cheyenne Mountain Air Station. The population served includes residential, non-transient, and transient populations and is estimated to be greater than 40,000 but less than 50,000. The actual population served, however, can vary with factors such as troop deployments.

The present WWTP treatment process includes preliminary treatment, aerated flow equalization, secondary treatment with nitrification/denitrification, followed by tertiary filtration and ultraviolet (UV) disinfection. The hydraulic and organic design capacities are 4 million gpd (15,141,647 liters) and 8,500 pounds (3,856 kilograms), biochemical oxygen demand 5/day, respectively. The WWTP has a peak historical flow of 2.6 mgd (9,842 million liters) and average load of 1.1 mgd (4,163 million liters) (Fort Carson, 2009). Effluent discharges from the sewage treatment plant are regulated under EPA NPDES Permit Number CO-0021181, which is in effect as of December 1, 2011. CDPHE allows Fort Carson to discharge 4.0 million gpd into "I" Ditch (Clover Ditch), which is one of Fort Carson's three main ditches (Fort Carson, 2010a).

The IWTP is located directly north of the sanitary sewage plant and is designed and constructed to treat petroleum-contaminated water from the motor pools in the Main Post area. The IWTP collection sewer extends down Minick Avenue behind the motor pools and delivers industrial wastewater to the IWTP. Wastewater is conveyed using both lift stations and gravity flow. IWTP effluent is combined with the sanitary sewage water entering the sewage plant. Treated IWTP effluent is discharged directly into Clover Ditch.

3.12.1.3 Stormwater

The Fort Carson Stormwater Program's main objective is to protect surface waters from pollution. Stormwater runoff can carry physical, chemical, and biological pollutants to sewer systems or directly to a pond, creek, river, or wetland. Therefore, construction and post-construction stormwater controls are assessed on a watershed level during project planning phases.

Section 438 of the EISA of 2007 requires that, if the post-development footprint of new surfaces (sidewalks, buildings, parking, non-vegetated landscaping, etc.) exceeds 5,000 square feet, then post-development stormwater controls are required to return the developed area to predevelopment hydrology. Retention and/or detention for stormwater control, however, are not allowed on Fort Carson due to regulatory issues and permit requirements, respectively. Instead, Low Impact Development (LID) is required. In accordance with Fort Carson's SWMP (Fort Carson, 2010b), the difference in discharge between the predevelopment hydrology and the proposed impacted condition will be the minimal target amount required to be mitigated through permanent BMP design. BMP design should address storms with a five-year return period or less (plus 10 percent) and should account for the pre-development temperature, discharge rate, volume, and duration of flow. The BMP designs should be constructed to mitigate the change in flow and volume while passing the 25-year native flow characteristics downstream.

The EPA administers two stormwater permit types on Fort Carson that apply to the Proposed Action Alternatives; the Municipal Separate Storm Sewer System (MS4) and the Construction General Permit. Fort Carson's MS4 permit goals are to maximize the utilization of multiple BMP placements at each new development site by focusing on LID BMPs.

3.12.1.3.1 MS4

Under the NPDES stormwater program, operators of regulated MS4s, which includes all of Fort Carson, require authorization to discharge pollutants under a NPDES permit. The EPA issued an individual MS4 permit to Fort Carson on April 30, 2009. The EPA and Fort Carson collectively manage permit requirements in accordance with the individual permit (EPA, 2009) and Fort Carson's SWMP. Contractors must coordinate with DPW-Stormwater prior to construction of any BMPs to ensure compliance with the MS4 permit and SWMP.

3.12.1.3.2 Construction General Permit

Construction projects are authorized to discharge stormwater runoff from construction sites under a NPDES Construction General Permit. To obtain coverage under the general permit, contractors must coordinate with DPW-Stormwater and receive concurrence prior to submitting a Notice of Intent for each construction project that disturbs one acre or more of land. In addition, contractors must develop and implement a SWPPP for each project and comply with the additional BMPs set forth in the SWMP (DPW, 2010b). Contractors may eliminate NPDES permitting requirements by filing for a Low Erosivity Waiver (LEW) certification, if applicable (DPW, 2010b). Contractors may file for a LEW if a project is between one and five acres, has a short duration, and an early projected start date that would allow sufficient time to reestablish vegetation. A LEW, however, does not eliminate contractor responsibility for implementing management practices that prevent sediment and other contaminants from leaving the project area and discharging into local drainages and storm drains.

As a requirement of AR 200-1, it is the policy of the Installation to comply with applicable Federal, state, and local regulations regarding water resources management and permitting. As described in the SWMP all work performed at Fort Carson is subject to stoppage by Installation environmental officials for failure to comply with Federal, state, county, local, or Fort Carson stormwater requirements.

3.12.1.4 Solid Waste

The ISWMP (Fort Carson, 2004a) contains details of the Solid Waste Management Program at Fort Carson. Fort Carson intends to achieve a 50 percent annual reduction/diversion rate of solid waste through recycling, re-use, and reduction (based on a 1992 baseline generation rate), while ensuring that integrated non-hazardous solid waste management programs provide an economic benefit when compared with disposal using landfills and incineration alone. Refuse, construction-related solid waste, and recyclable materials are all managed by the DPW.

All solid waste from Fort Carson is hauled to offsite landfills, including the Midway Landfill in Fountain, Colorado, by a licensed contractor. Midway Landfill and the other landfills used by Fort Carson are permitted Subtitle D landfills. Fort Carson operates a recycling center near Gate 3 and two additional large drop-off facilities at the Post Exchange and at Building 155. Smaller recycling bins are located near all facilities. As growth continues on Fort Carson, the Installation indicates additional recycling containers will be placed at all new facilities. Recyclable materials collected at these sites include paper, plastic, glass, cardboard, wood pallets, aluminum, and scrap metal.

In FY 2011, Fort Carson diverted approximately 69.7 percent of its entire solid waste stream from landfills (Fort Carson, 2011b). Installation construction and operation activities collectively generated approximately 34,347 tons of solid waste, of which 18,361 tons were comprised of C&D debris and the other 15,986 tons from MSW. Fort Carson and its construction contractors diverted approximately 91.8 percent of C&D waste from landfills in FY 2011. According to Installation personnel, C&D waste quantities are not included in the Fort Carson solid waste reduction goal because the amounts can fluctuate significantly from year-to-year. This waste stream also consists of materials, such as concrete, that are heavy and almost always recycled. Therefore, from a mass-balance posture, incorporating C&D waste could give Installation personnel a false sense of accomplishment, which would not necessarily accelerate the Installation's status towards achieving Net Zero waste. Instead, the Installation segments and monitors MSW data and its subsequent progress towards achieving zero waste. Municipal solid waste is a relatively static data element and is traditionally consistent from-year. In FY 2011, Fort Carson disposed of approximately 8,880 tons of MSW in landfills, thus yielding an approximate 44.5 percent diversion rate based on Installation reporting processes.

3.12.1.5 Energy

Fort Carson has an energy goal of 100 percent renewable energy (gas and electric) by 2027, and currently obtains 2.3 percent of its energy needs from solar panels. The Installation is considering other sources of renewable energy for future use as part of its sustainable assessment. Fort Carson purchases electricity and natural gas from CSU.

Electrical services are provided through two aerial 34.5-kilovolt, three-phase supply lines, which terminate at three power substations in the Main Post area. The substations are located in the vicinities of the following intersections: the O'Connell Substation located near O'Connell Boulevard and Chiles Avenue; The Magrath Substation located near Nelson Boulevard and Minick Avenue; and the Titus Substation located near Titus Boulevard and Butts Road. The peak historical electrical demand at Fort Carson is 27.9 mega-volt amperes (MVA), while the total capacity of transmission lines available to the Installation is 57.4 MVA, and the total capacity of transformers is 37.9 MVA.

Fort Carson receives natural gas from CSU via two feeds at the north end of the Installation and an additional gas line along SH 115. The natural gas is metered and piped through a series of gas mains and distribution lines to Fort Carson's central heating plant, BAAF, and the Family housing areas. The peak historical daily consumption of natural gas at Fort Carson is 9,329 million cubic feet per day (Fort Carson, 2009). CSU's maximum delivery capacity to the Installation is 24,000 million cubic feet per day (Fort Carson, 2009).

3.12.1.6 Heating and Cooling

Fort Carson primarily delivers heating and cooling through electrical powered and natural gas-fired equipment such as air-handling units, furnaces and boilers. The Installation has one main heat plant, Building 1860, that distributes high-temperature hot water throughout most of the "Banana Belt" region of the Main Post area, which is east of and adjacent to Barkeley Avenue. Building 1860 is equipped with two main boilers and one back-up. Building 1864 is the Installation's main chiller plant and is equipped with two chillers that provide cooling air to the "Banana Belt" facilities. The chiller plant and heat plant do not simultaneously provide cooled and heated air. Instead, each plant is turned on and off at prescribed times in the year as most of the distribution lines are used by both plants. Building 1860 and 1864 are located in the vicinity of the Prussman and Magrath Avenue intersection. The remaining facilities on Fort Carson, if temperature controlled, use other sources of electrical and/or natural gas-fired equipment to control temperatures. Additionally, there are approximately five GSHPs in use throughout the Installation.

3.12.1.7 Communications

The primary communication infrastructure at Fort Carson consists of cable lines that run throughout the Main Post area, seven ranges, and the WRC and BAAF area. The Main Post area infrastructure is sufficient to meet the current needs for personnel and operations. Cable extensions have recently been and continue to be extended for various new construction projects underway within the Main Post area. Basic administrative analog telephone and low-speed data are available along Wilderness Road, while the downrange area infrastructure consists of copper and leased fiber lines.

3.12.2 ENVIRONMENTAL CONSEQUENCES

As presented in Section 3.1, an impact to utilities would be considered significant if it would cause an impairment of utility service to local communities, homes, or businesses within the ROI.

3.12.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Action Alternatives would not be constructed. No construction activities would be required and the sites identified would not be affected. Utility demands and operations would remain consistent with current conditions. Less than significant adverse impacts to utilities would be anticipated as utility upgrades and improvements in efficiency and conservation associated with the Proposed Action Alternatives would not be implemented.

3.12.2.2 Proposed Action Alternatives

3.12.2.2.1 Utilities Impacts Common to All Proposed Action Alternatives

Use of Potable Water

Potable water uses for construction activities would be similar for all Proposed Action Alternatives and would primarily include small quantities for drinking water purposes. It is anticipated and highly likely, however, that drinking water and/or refreshments for hydration would be provided by construction contractors from sources outside of the Installation. Potable water could be used in larger quantities for construction-related activities such as dust suppression or soil compaction, concrete work, and washing machinery and tools but is unlikely. Non-potable water is typically used for these purposes and would, therefore, be anticipated to have no adverse impacts on the potable water system.

Operational potable water uses and demands vary between each Proposed Action Alternative and are discussed in more detail relative to each alternative in this section.

Collectively, none of the Proposed Action Alternatives would be anticipated to cause impairment to potable water systems to local communities, homes, or businesses within the ROI.

Impacts to Wastewater

Generation and discharge of wastewater would not be anticipated during construction-related activities associated with the Proposed Action Alternatives. Therefore, no adverse impacts would be expected.

Small amounts of wastewater would be generated and discharged to the sanitary sewer periodically due to boiler operation and maintenance activities of the WTE and biomass plants. These impacts would be considered long-term minor adverse impacts. Operational and maintenance related activities associated with the extension of reclaimed water lines would be anticipated to have long-term beneficial impacts on wastewater as described in Section 3.12.2.2.5. Operations related to employment of PV, wind and GSHP technologies would generate minor amounts of wastewater, if any, and would have negligible adverse impacts.

Based on the minor amounts of wastewater generated relative to the construction and maintenance activities under each of the Proposed Action Alternatives, impairment to local communities, homes, and businesses wastewater systems within the ROI would not be anticipated.

Impacts to Stormwater

Construction activities could impact between a few acres to over 360 acres between the ranges depending on the alternative being considered. Stormwater runoff from land disturbances could increase sedimentation in waterways beyond project site boundaries if not properly controlled. Compliance with the NPDES General Permit for Storm Water Discharges for Construction Activity in Colorado, however, is an existing and required measure that reduces impacts associated with stormwater runoff during construction. Compliance with permit requirements would result in short-term minor adverse impacts to stormwater.

Stormwater impacts related to operations of the Proposed Action Alternatives would be anticipated to be long-term minor adverse for the WTE plant and biomass plant as discussed in Sections 3.12.2.2.2 and 3.12.2.2.3, respectively. Stormwater impacts related to operating PV, wind turbine and GSHP technologies would be anticipated to be negligible. Additionally, operating an expanded reclaimed water system would be expected to have negligible impacts on stormwater.

Erosion and run-off from operations would be managed in accordance with Fort Carson's SWMP for post-construction BMPs. BMPs would include, at a minimum, the following: containing excavated material, use of silt fences, protecting exposed soil, stabilizing restored material, and re-vegetating disturbed areas. The potential for offsite flow of sediment associated with stormwater would be regulated by the project SWPPP. Areas disturbed during construction would be re-vegetated using local non-wildlife attracting native species.

None of the Proposed Action Alternatives would be anticipated to cause impairment to stormwater systems within local communities, homes, or businesses within the ROI.

Impacts to Solid Waste

Each alternative would slightly increase Installation solid waste generation during construction activities. Solid wastes would be segregated to allow for increased recycling opportunities. Overall, adverse impacts would be short-term and minor.

Solid waste generation during the operational phases of employing PV, wind and GSHP technologies would be negligible. Operations of the WTE plant and biomass plant would provide long-term beneficial and minor adverse impacts, respectively. Analysis of these technologies is provided in Sections 3.12.2.2.2 and 3.12.2.2.3.

Since construction and operational impacts under the Proposed Action Alternatives are anticipated to be short-term minor adverse and/or beneficial, impairment to solid waste systems within local communities, homes, or businesses within the ROI would not be likely.

Impacts to Energy

Additional electrical tie-ins would be required for most of the alternatives, and would be necessary to distribute electricity into the utility grid for customer use. Construction activities are anticipated to have a negligible adverse impact on Installation energy use as efforts primarily involve setup for return flows of electricity and involve minimal, if any, electrical demand.

There are 19 separate potential sites that would require electrical tie-ins. Thirteen of the sites are under Alternative 3 and use PV technology. The remaining six sites include those associated with Alternatives 1, 2 and 6. Each site is presumed to connect to the nearest interconnection point. For all sites interconnection is not anticipated to require more than the construction of 0.5-mile of transmission line. For all sites with the potential exception of the Gate 19 site, all renewable energy sites would be connected to Fort Carson's electrical system. Interconnections, however, must be made in accordance with Colorado Springs Utilities interconnection requirements. Renewable energy projects over 10MW would likely require the completion of additional interconnection studies. Studies, if required, would be completed prior to project implementation to more fully understand interconnection requirements.

With the exception of a few distribution lines in the housing area, most electrical distribution lines within the Installation are buried. It is assumed that most distribution lines as part of the Proposed Action Alternatives connecting to these interconnection points would be buried and either connected to the existing grid or run parallel (adjacent) to existing utility ROW.

Consistent with the purpose and intent of this EA, most of the Proposed Action Alternatives would yield a long-term beneficial impact on energy use. Expansion of the existing reclaimed water system is the only alternative that would not provide a long-term beneficial impact. Instead, it would have a long-term negligible adverse impact on energy use as discussed in Section 12.2.2.5.

Impacts to Heating and Cooling

Regardless of alternative employed, there would be no adverse impacts to heating and cooling during construction.

Employment of GSHP technologies would be the only alternative anticipated to have a long-term beneficial impact on heating and cooling operations. GSHP technology could reduce overall energy demand while providing heating and cooling. Each of the other alternatives yield electricity as an output, except for the expansion of the existing reclaimed water system alternative. Waste heat from the WTE or biomass (Alternatives 1 and 2) could also be used to support the Installation's heating and cooling demands.

Construction related impacts are not anticipated under the Proposed Action Alternatives. Additionally, operations of GSHP technologies would have a long-term beneficial impact. Therefore, impairment to heating and cooling systems within local communities, homes, or businesses within the ROI are not anticipated.

Impacts to Communications

No adverse impacts to communication systems would be anticipated during construction or operation of the Proposed Action Alternatives. Therefore, there would be no impairment to communication systems within communities, homes, and businesses within the ROI.

3.12.2.2.2 Alternative 1

Use of Potable Water

Minor to moderate adverse impacts to potable water use would be anticipated for operation of the WTE plant. The WTE plant would be equipped with boilers that would convert heat to steam, subsequently driving a steam turbine to produce electricity. Operation of the WTE plant would require approximately 70,000 gpd (80 acre-feet per year) totaling 25.55 million gallons per year if operated for 365 days. This equates to approximately 3 percent of Fort Carson's 889 million gallon water use figures in FY 2011. Although this alternative would not further Fort Carson in meeting Net Zero water goals due to additional water requirements of plant operations, this alternative would assist the Installation in achieving Net Zero energy goals. Expansion of the reclaimed water system under Alternative 4 and the general water conservation measures as a part of Alternative 7 would help offset additional potable water requirements under this alternative, if implemented, and overall impacts would be less than significant.

Impacts to Wastewater

Minor amounts of wastewater generation would be anticipated to discharge to the sanitary sewer system during daily operations and boiler maintenance events. Most of the water used in the WTE plant would be converted to steam and not be introduced into the WWTP. Therefore, this slight increase would not cause a significant change in daily flow, thus jeopardizing the WWTP's permit conditions. Long-term minor adverse impacts to wastewater would be anticipated.

Impacts to Stormwater

Operation of the WTE plant would have negligible impacts to stormwater. As stated in Section 3.12.2.2.1, erosion and run-off from operations would be managed an accordance with Fort Carson's SWMP for post-construction BMPs. Unlike the biomass plant alternative, all waste feedstock would be handled indoors.

Impacts to Solid Waste

The WTE plant would reduce Fort Carson's landfill disposal volumes by approximately 80-90 percent, by weight. Fort Carson diverted approximately 44.5 percent of MSW from landfills in FY 2011, leaving about 8,880 tons to be landfilled. If the WTE plant was constructed and operated, a long-term beneficial impact would result from an additional 7,104 – 7,992 tons of diverted landfill waste. This could result in reducing Installation annual MSW landfill disposal quantities to as little as 888 – 1,776 tons.

Impacts to Energy

Operation of the WTE plant would enable Fort Carson to beneficially increase its overall energy independence by reducing its CSU energy demand, assuming an uncompromised flow of waste from outside Fort Carson for fuel and no adverse interconnection impacts within the ROI. The maximum size plant under consideration would be 40MW. Fort Carson would reduce its energy demand commensurate with the output levels associated with a 40MW facility, and would therefore, realize long-term cost savings.

Impacts to Heating and Cooling

Beneficial impacts would be anticipated for heating and cooling during use of the WTE plant. Steam from the WTE plant could be used for various heating applications if determined desirable.

Impacts to Communications

There would be no impacts to communications under this alternative.

3.12.2.2.3 Alternative 2

Use of Potable Water

Minor adverse impacts to potable water use would be anticipated for operation of the biomass plant. The biomass plant would be equipped with boilers that would convert heat to steam, subsequently driving a steam turbine to produce electricity. Operation of the biomass plant would require approximately 188,040 gpd (210 acre-feet per year) of water with most of it exiting as steam and the majority of the remainder being recycled within the system.

Although this alternative would not further Fort Carson in meeting Net Zero water goals due to additional water requirements of plant operations, this alternative would assist the Installation in achieving Net Zero energy goals. Expansion of the reclaimed water system under Alternative 4 and the general water conservation measures as a part of Alternative 7 would help offset additional potable water requirements under this alternative, if implemented, and overall impacts would be less than significant. Additionally, BMPs could be implemented to reduce levels of water consumption such as use of municipal recycled water for power plant cooling; adaptation of innovative water use and water recovery, water reuse and water recycling measures; and implementation of advanced cooling technologies.

Impacts to Wastewater

Minor amounts of wastewater generation would be anticipated to discharge to the sanitary sewer system during daily operations and boiler maintenance events. Most of the water used in the biomass plant would be converted to steam and not be introduced into the WWTP. Therefore, this slight increase would not cause a significant change in daily flow, thus not jeopardizing WWTP's permit conditions. Long-term minor adverse impacts to wastewater would be anticipated.

Impacts to Stormwater

Operation of the biomass plant involves outdoor storage of approximately 30 days' of feedstock material, which includes the frequent use of heavy equipment, (e.g., wheel loaders and trucks). This activity can loosen soil, which during a rain event would enter the stormwater flow. Collectively, loose organic materials and soil coupled with frequent use of heavy equipment have the potential to create long-term minor adverse impacts on stormwater quality.

Impacts to Solid Waste

Fort Carson currently recycles most woody biomass on the Installation. Therefore, operation of a biomass plant would have a negligible adverse impact on current solid waste management practices since it would require the management and combustion of additional waste from off-Post and outside the ROI.

Impacts to Energy

Operation of the biomass plant would enable Fort Carson to beneficially increase its overall energy independence by reducing its CSU energy demand, assuming an uncompromised flow of biomass from the community for fuel and no adverse interconnection impacts within the ROI. Fort Carson could also realize a long-term return on investment based on the technology employed. The maximum size plant under consideration would be 13MW for this technology. Fort Carson would reduce its energy demand commensurate with the output levels associated with a 13MW facility, and would therefore, realize long-term cost savings. A biomass plant over 10MW would likely require the completion of additional interconnection studies. Studies, if required, would be completed prior to project implementation to more fully understand interconnection requirements.

Impacts to Heating and Cooling

Beneficial impacts would be anticipated for heating and cooling during use of the biomass plant. Steam from the biomass plant could be used for various heating applications, if desired.

Impacts to Communications

There would be no impacts to communications under this alternative.

3.12.2.2.4 Alternative 3

Use of Potable Water

Operational use of PV technology would require minor to moderate amounts of potable water for cleaning PV panels. Median water consumption associated with cleaning PV panels is approximately 26 gallons per MWH (NREL, 2011). Water trucks would be used to wash panels in accordance with manufacturer specifications and frequencies. Only water is anticipated to be used for cleaning. Should cleaning require amended water in the future, environmentally benign materials would be used. This alternative is anticipated to have negligible adverse impacts on potable water.

Impacts to Wastewater

Operational use of PV technology would not generate wastewater. Therefore, use of this technology would have no adverse impacts on wastewater.

Impacts to Stormwater

Regardless of PV site(s) selected, each one would be required to adhere to Fort Carson's SWMP for post-construction BMPs. Upon meeting these requirements, negligible adverse impacts would be anticipated for stormwater.

Impacts to Solid Waste

Operational use of PV technology would create small amounts of solid waste during maintenance activities. Use of this technology would be anticipated to have negligible adverse impacts on solid waste management.

Impacts to Energy

Operation of the PV technology would enable Fort Carson to beneficially increase its overall energy independence by reducing its CSU energy demand. Fort Carson could also realize a long-term return on investment based on the technology employed. Fort Carson would reduce its energy demand commensurate with the output levels associated with PV output from each site selected, and would therefore realize long-term cost savings.

Impacts to Heating and Cooling

There would be no impacts to heating and cooling under this alternative.

Impacts to Communications

There would be no impacts to communications under this alternative.

3.12.2.2.5 Alternative 4

Use of Potable Water

Expanding the existing reclaimed water system would be a beneficial impact and would reduce the overall potable water demand on the Installation. Fort Carson irrigates the Sports Complex with an estimated 100 million gallons of potable water per year. Preliminary data suggests an approximate 200 million gallons per year of reclaimed water is being discharged from the WWTP, which could be captured and re-used. Switching to reclaimed water would potentially eliminate the potable water demand and some of the associated irrigation costs for the Sports Complex. An approximate 100 million gpy reduction in potable water demand could result in an estimated annual Installation-wide reduction of 11 percent and approximately $306,000 which is adjusted amount based on an augmentation fee imposed by CSU for reclaimed water use. Additionally under this alternative, the Installation would reuse and tie-in the existing potable water irrigation lines into new proposed lines coming from the Golf Course. Re-use of existing lines would reduce impacts to soils, stormwater, solid waste and potential impacts to subsurface communication lines.

Impacts to Wastewater

This alternative would have a long -term beneficial impact on wastewater treatment activities. As noted in the paragraph above, this alternative could reduce Installation wastewater treatment efforts and discharge by as much as one half. Re-use of approximately 100 million gallons of wastewater could ultimately reduce WWTP labor demands, additional construction efforts associated with ever-increasing capacity requirements and permit requirements associated with discharges into Clover Ditch.

Impacts to Stormwater

This alternative would be required to adhere to Fort Carson's SWMP for post-construction BMPs. Upon meeting these requirements, negligible adverse impacts are anticipated for stormwater. Fort Carson would re-use existing potable water irrigation lines that supply water to the Sports Complex, which would reduce some soils and surface disturbances. Additional new lines would be required to be emplaced and connected from the Golf Course to the Sports Complex. These new lines would require excavation and subsequent contractor coverage under an NPDES permit, SWPPP and conformance with Fort Carson's SWMP.

Impacts to Solid Waste

Operational use of the expanded reclaimed water lines would create nominal amounts of solid waste, if any. Employment of this alternative would be anticipated to have negligible adverse impacts on solid waste.

Impacts to Energy

The expansion of the existing reclaimed water system is anticipated to have a negligible adverse impact relative to energy use. As part of this alternative, a pump house station with new pumps, controls, and monitoring equipment would be installed.

Impacts to Heating and Cooling

There would be no impacts to heating and cooling under this alternative.

Impacts to Communications

There would be no impacts to communications under this alternative.

3.12.2.2.6 Alternative 5

Use of Potable Water

Operational use of wind turbines does not require potable water. As such, use of this technology would have no adverse impact on potable water usage.

Impacts to Wastewater

Operational use of wind turbines would not generate wastewater. Therefore, there would be no adverse impact on wastewater.

Impacts to Stormwater

This alternative would be required to adhere to Fort Carson's SWMP for post-construction BMPs. Upon meeting these requirements, negligible adverse impacts are anticipated for stormwater.

Impacts to Solid Waste

Operational use of wind turbines would create negligible amounts of solid waste, if any. Use of these technologies would be anticipated to have negligible adverse impacts on solid waste.

Impacts to Energy

Operation of wind turbine technology would enable Fort Carson to beneficially increase its overall energy independence by reducing its CSU energy demand. Fort Carson could also realize a long-term return on investment based on the technology employed. Fort Carson would reduce its energy demand commensurate with the output levels associated with the magnitude of wind turbine technology selected, and would therefore realize long-term cost savings.

Impacts to Heating and Cooling

There would be no impacts to heating and cooling under this alternative.

Impacts to Communications

There would be no impacts to communication under this alternative.

3.12.2.2.7 Alternative 6

Environmental impacts associated with PV technologies discussed in Section 3.12.2.2.4 would be the same for Alternative 6. The use of GSHP technologies is discussed below.

Use of Potable Water

The use of GSHPs does not require significant quantities of potable water. As such, use of this technology would have a negligible adverse impact on potable water.

Impacts to Wastewater

The operational use of GSHPs would not generate large amounts of wastewater and would have negligible adverse impacts on wastewater.

Impacts to Stormwater

Development activities under this alternative would be required to adhere to Fort Carson's SWMP for post-construction BMPs. Upon meeting these requirements, negligible adverse impacts are anticipated for stormwater.

Impacts to Solid Waste

Operational use of GSHPs would create minor amounts of solid waste, if any. Use of GSHPs would have negligible adverse impacts on solid waste.

Impacts to Energy

Operation of GSHP technology would enable Fort Carson to beneficially increase its overall energy independence by reducing its CSU energy demand. Fort Carson could also realize a long-term return on investment based on the technology employed. Fort Carson would reduce its heating and cooling energy demand commensurate with the sizes and quantities of GSHP technologies selected, and would therefore realize long-term cost savings.

Impacts to Heating and Cooling

Beneficial impacts would be anticipated for heating and cooling during use of the GSHPs. GSHPs are specifically designed to heat and cool facilities using a fluid-heat-exchange process. GSHPs also reduce electrical demands associated with heating and cooling.

Impacts to Communications

There would be no impacts to communication under this alternative.

3.12.2.2.8 Alternative 7

Use of Potable Water

Operating programmatic-level potable water conserving techniques and technologies would have long-term beneficial impacts. Under this alternative, Fort Carson would continue to communicate water reduction methods to Installation personnel, enforce standards and provide incentives for tenants to comply with policies. Fort Carson would also continue to identify and implement other potable water reduction methods, thus reducing overall demand.

Impacts to Wastewater

Implementation and operation of wastewater reclamation technologies would have long term beneficial impacts on wastewater. Under this alternative, Fort Carson would continue to identify and potentially implement wastewater reduction through reclamation of grey water from showers, sinks and dining facilities for re-use in toilets or landscaping activities. Additionally, the Installation would continue to acquire and install systems that use less potable water, thus commensurately generating less wastewater; for example, composting toilets.

Impacts to Stormwater

This alternative seeks to reduce overall potable water and wastewater generation through implementation of water conservation measures; for example, xeriscaping and low water demand landscaping. This alternative is also not anticipated to increase impervious surfaces. For these reasons, impacts to stormwater would be long-term beneficial.

Impacts to Solid Waste

Implementation and operation of Fort Carson's solid waste reduction policies and techniques would have long-term beneficial impacts. Tenants would continue to be trained on solid waste reduction and recycling opportunities. Policies would also continue to be expanded and implemented through contracting language and opportunities that provide competitive advantages to firms providing products/services having more environmentally preferable attributes. Each programmatic level solid waste opportunity would support the overall goal of reducing solid waste generation.

Impacts to Energy

Long-term beneficial impacts would be anticipated under this alternative. Fort Carson would continue building/grid metering and establish a microgrid under the SPIDERS program. The Installation would also continue implementing energy-efficient upgrades for appropriate structures, and acquiring systems with reduced energy requirements. Tenants would continue to be trained on how to minimize their energy demand footprint. Collectively, implementation of these energy reducing techniques would reduce overall energy use on the Installation.

Impacts to Heating and Cooling

There would be no impacts to heating and cooling under this alternative.

Impacts to Communications

There would be no impacts to communications under this alternative.

3.12.3 CUMULATIVE EFFECTS

As the Proposed Action Alternatives are a component of Fort Carson's net zero waste, water, and energy goals and serve to reduce waste, water, and energy use, overall impacts to potable water, wastewater, solid waste, energy, and heating and cooling would be anticipated to be beneficial. Despite the additional development activities occurring at Fort Carson, including the CAB garrison support facilities at the WRC, the Proposed Action Alternatives would serve to offset any impacts to utilities.

Each alternative would use minor amounts of potable water during construction activities, which would generally be for hydration purposes and would come from off the Installation. Presuming that most of the construction workforce would come from within the ROI, there would be no change in consumption. Therefore, there would be no impacts to potable water related to construction regardless of when the timing of the Proposed Action Alternatives would occur in relation to other future construction projects.

Of the alternatives considered, Alternatives 1, 2 and 3 would use the majority of potable water during operations, with Alternative 2 using the most. Alternative 2 would cause an increase of approximately 1.82 million gallons more per year during operations. Because this water consumption, collectively with other current and ongoing operations, is well within Fort Carson's overall CSU water budget, long-term minor cumulative impacts would occur. Should only Alternative 4 be implemented, the ROI would realize a long-term beneficial impact due to the potential reduction in use of approximately 100 million gallons per year.

There would be no wastewater discharge for construction of the Proposed Action Alternatives and, therefore, no cumulative impacts. During operations, wastewater long-term minor impacts would be expected within the ROI for Alternatives 1 and 2. Both of these alternatives would generate significantly more steam than wastewater due to the nature of operations within a WTE and biomass plant. Therefore, wastewater discharge would predominately be generated from WTE and biomass employees. Since these employees would be presumed to reside and/or work within the ROI, there would be no increase in wastewater from their activities. Minor increases in wastewater discharge would be expected from boiler maintenance activities. These impacts combined with the projects considered in Table 3.1-2, however, would remain less than significant and would be further offset through the implementation of Alternative 4. Operations related to Alternative 4 would create long-term beneficial impacts within the ROI as there would be less wastewater discharge into Clover Ditch. Alternative 4 would use approximately 100 million gallons of wastewater to irrigate vegetation areas on Fort Carson.

Each alternative and the construction associated with projects listed in Table 3.1-2 would result in short-term minor adverse impacts to stormwater during construction phases. Exposed soils during construction would be more susceptible to flow with stormwater runoff, which could result in increased sedimentation and turbidity to receiving waterbodies. During operational phases of each Proposed Action Alternative and for the land development projects listed in Table 3.1-2, there would be an aggregate increase in impervious surface areas associated with development. As a result, the increased impervious area would contribute to the degradation of water quality through the increase in the quantity of pollutants attributable to runoff. These cumulative impacts would be minor to moderate. Implementation of Fort Carson's stormwater program would minimize impacts to stormwater through adhering to its SWMP, NPDES permit and EISA 2007 requirements. Fort Carson's SWMP requires use of LID, which requires mitigation of the delta between the pre-development hydrology and the proposed impacted condition through BMP design. These BMPs are required to be coordinated with Fort Carson DPW-Stormwater prior to being constructed. Additionally, construction projects requiring coverage under a Construction General NPDES permit would require a site-specific SWPPP be prepared and implemented. Contractors failing to prepare and implement a SWPPP would be subject to significant fines and penalties by the EPA. Close coordination is required with Fort Carson DPW-Stormwater and the EPA for construction and operational activities for pre-, during and post-construction activities. Therefore, overall cumulative adverse impacts to stormwater would be anticipated to be minor.

Alternatives 1, 2, 3, 5 6, and 7 would result in cumulative long-term beneficial effects to onsite and regional energy demands. Specifically, Installation energy demands would be reduced commensurately based on the technology employed. These reductions would offset ROI energy requirements, thus reducing fuel use. Alternative 4 would not present any cumulative adverse impacts to energy resources.

Implementation of Alternative 1 would slow the pace of filling regional landfill space as significant quantities of Installation and Colorado Springs solid waste would be diverted and converted to fuel for use within the Installation's WTE plant. The close proximity of the proposed Fort Carson WTE plant would reduce overall transportation energy demands to and from regional landfills. For these reasons, Alternative 1 would be anticipated to have a long-term beneficial cumulative impact.

Implementation of Alternative 6 would have a beneficial cumulative impact to heating and cooling. Installation of GSHPs into existing and new facilities would improve heating and cooling efficiency throughout the Installation. The other Proposed Action Alternatives would not impact heating and cooling, therefore, no cumulative impacts would be anticipated.

As none of the Proposed Action Alternatives would impact communications, no cumulative adverse impacts would be anticipated.

3.12.4 PROPOSED IMPACT REDUCTION MEASURES

3.12.4.1 Mitigation

While no significant impacts are anticipated the following measures may still be implemented. In order to reduce potable water consumption during construction activities, non-potable water should be used for activities such as soil compaction and dust suppression. Use of non-potable water would reduce the Installation's potable water demand thus supporting overall potable water minimization efforts.

For Alternatives 1 and 2, it should be determine if non-potable water would be a viable alternative for use in WTE plant and/or biomass plant boilers. If feasible, the use of non-potable water in these boiler systems would reduce the Installation's potable water demands and further Fort Carson's potable water minimization efforts.

Fort Alternatives 1 and 2, any plant over 10MW would likely require the completion of additional interconnection studies. Studies, if required, would be completed prior to project implementation to more fully understand interconnection requirements.

For Alternative 2, incorporating BMPs in to the design of the biomass plant feedstock storage location and heavy equipment movement areas would reduce sedimentation caused by rainfall events. Use of non-potable water to clean PV panels could be used to reduce the Installation's potable water demands furthering Fort Carson's potable water use minimization efforts.

3.13 Hazardous and Toxic Substances

3.13.1 AFFECTED ENVIRONMENT

3.13.1.1 Regulatory Background and Definitions

Fort Carson is a non-National Priority List installation that is regulated under RCRA due to its classification as a Large Quantity Generator (LQG) of hazardous waste (EPA ID # CO2210020150). EPA classifies entities as a LQG of hazardous waste when they generate more than 2,200 pounds (1,000 kilograms) or more of hazardous waste or more than 2.2 pounds (1 kilogram) of acute hazardous waste per calendar month.

The CDPHE is the lead regulator of Fort Carson and is responsible for issuing and managing RCRA hazardous waste permits and ensuring compliance with state laws and regulations. Fort Carson currently holds a Hazardous Waste Part B Permit issued by CDPHE (# CO-06-09-29-01), which allows for storage of 7,070 gallons of hazardous waste for up to one year although nearly all hazardous wastes are stored in the 90-day storage area in accordance with LQG requirements (CDPHE, 2006). All activities on Fort Carson must conform with CDPHE-administered RCRA regulations, Fort Carson's Hazardous Waste Permit, 6 CCR 1007-3, Parts 2, 6, 99, 100, 101, 260-279, and AR 200-1 Environmental Protection and Enhancement.

Fort Carson's Hazardous Waste Part B Permit is in accordance with the Colorado Hazardous Waste Act, Section 25-15-301 through 316. The Permit was reissued on 29 October 2006, and will remain effective until 29 October 2016; unless changes at the Installation require modification. The Permit includes specifications about the location and volume of permitted storage areas of hazardous waste, treatment of hazardous waste reactive UXO, and corrective action activities at Fort Carson's SWMUs.

Colorado Hazardous Waste Regulations (6 CCR 1007-3, Parts 260-279) establish requirements for the proper identification, record keeping, reporting, and accumulation of hazardous waste. The regulations include the requirement of a Hazardous Waste Contingency Plan to provide training procedures and actions for all personnel involved in waste management. In addition, the regulations include the Universal Waste Rule (Part 273) for management standards for universal waste (e.g., batteries, bulbs, aerosol cans).

AR 200-1 *Environmental Protection and Enhancement*, directs installations to develop and implement HWMPs to include written procedures for all aspects of hazardous waste management (i.e., identification, storage, transportation, training, and recordkeeping). The Installation fulfills this requirement with the Fort Carson HWMP dated September 2007.

3.13.1.2 Environmental Compliance Management Plans

Fort Carson has a comprehensive program to manage hazardous waste, hazardous materials, and toxic substances. Several plans provide the methodology for management of hazardous materials and waste including, but not limited to:

- **Waste Minimization (Pollution Prevention [P2]) Plan.** The P2 Plan provides a comprehensive approach to waste and resource management that seeks to reduce impacts on the environment by reducing or eliminating the production of wastes and promoting energy efficiency and sustainable practices.
- **Spill Prevention Control and Countermeasures Plan (SPCC Plan).** The SPCC Plan provides procedures to follow for spill prevention and response measures should a spill occur. It includes a detailed oil and chemical inventory and contains oil and chemical storage areas within Fort Carson.

- **Hazardous Waste Management Plan (HWMP).** The HWMP is designed to ensure compliance with applicable Federal, state, local, permit, and Army regulations. The HWMP assigns responsibility and documents procedures for the identification, characterization, accumulation, storage, transportation, record keeping, and disposal of hazardous waste, universal waste, and certain excluded and non-regulated waste (Fort Carson, 2007b).
- **Waste Analysis Plan.** The Waste Analysis Plan identifies the hazardous wastes generated and outlines sampling and analysis procedures for making hazardous waste determinations. In accordance with the Part B Permit Attachment 3, the Waste Analysis Plan displays the estimated quantity of hazardous waste (pounds per year) that is typically or potentially generated annually at Fort Carson.
- **Treatment, Storage, and Disposal Facility (TSDF) and LQG Hazardous Waste Contingency Plans.** The Contingency Plans (TSDF and LQG) identify procedures and resources used to mitigate and provide response procedures for any unplanned discharge or release of hazardous waste. Additionally, the Contingency Plans establish responsibilities, duties, procedures, and resources to be employed in containing and mitigating such emergency events and is designed to minimize hazards from fires, explosions, or any unplanned sudden or non-sudden release of hazardous waste to the air, soil, surface water, or groundwater (Fort Carson, 2007b).
- **Treatment, Storage, and Disposal Facility (TSDF) Training Plan.** In accordance with Colorado Hazardous Waste Regulations 6 CCR 1007-3 Part 264, the Training Plan outlines the training program for personnel assigned to the permitted container storage unit within the Hazardous Waste Storage Facility (HWSF), personnel involved in management of the hazardous waste program, and compliance assurance.
- **Management Plans for Radon, Radioactive Materials, Asbestos, Lead, Polychlorinated Biphenyl (PCBs), and Installation Pest Management.** These plans provide procedures for identification, management, and mitigation of the applicable hazards.
- **Fort Carson 25-Year Sustainability Goal Plan.** The plan includes goals for sustainable energy and water resources, transportation, air quality, development, procurement, training lands, and zero waste. The Zero Waste goal is to reduce the total weight of solid and hazardous waste disposed of to zero by 2027. Reductions would be attributed to sustainable procurement practices, reduction in material use, and increase in reuse and recycling.

3.13.1.3 Hazardous Material Use

The primary activities and industrial operations involving hazardous materials at Fort Carson include vehicle and aircraft repair and maintenance, facility and grounds maintenance, training and combat readiness exercises, photographic and other craft shops, pest control services, medical (all hazardous and biohazardous waste generated by Evans Army Community Hospital is disposed of through a permitted contractor), water and wastewater treatment plants, and Defense Reutilization and Marketing Office (DRMO). These activities involve products such as solvents, paints, thinner, adhesives, fuel, oil and lubricants, fixer, unused chemicals, pesticides, biohazardous waste, and various used vehicle fluids. The majority of hazardous waste at the WWTP is generated from comprehensive laboratory analysis to ensure compliance with Fort Carson’s NPDES Permit (Fort Carson, 2007b).

Fort Carson submits a Biennial Hazardous Waste Report to CDPHE in March of every odd-numbered year. The Report includes the type and quantity of hazardous waste generated at the Installation. According to the HWMP (2007), Fort Carson generated approximately 68,000 pounds of hazardous waste in 2005 and 28,000 pounds in 2006. Fort Carson’s sustainability goal would continue to reduce annual volumes of solid and hazardous waste.

3.13.1.4 Hazardous Waste Management

Fort Carson's DPW – Environmental Division (DPW-ED) has overall responsibility for coordinating the hazardous waste management program to ensure compliance with state, Federal, permit, and Army regulations. DPW-ED is also responsible for training and regulatory reporting requirements and enforcement functions (Fort Carson, 2007b).

Fort Carson's HWMP outlines procedures for management, turn-in, and disposal of hazardous waste. The procedures include details about accumulation, storage, characterization, regulatory tracking, and recordkeeping of all hazardous waste generated at Fort Carson. All options for reuse or recovery must be exhausted before turning in any unused or serviceable materials as a hazardous waste. This includes looking for options to reuse within units, returning the material to the Directorate of Logistics Supply System for reissue, or turning the material into the DRMO for use or re-use by other government agencies. If it is determined that a hazardous waste cannot be re-used or recovered, hazardous wastes are stored in accumulation points such as Satellite Accumulation Points (SAPs) and Universal Waste Accumulation Points (UWAPs).

Currently, there are seven approved SAP locations on Fort Carson (GTA FEIS, 2009). A SAP is a DPW-ED-approved room or container designed for storage of less than 55 gallons of each hazardous waste stream at or near the point of generation (Fort Carson, 2007b). SAPs are inspected by SAP Managers weekly and when waste enters or exits the SAP. The inspection includes verifying that the containers are in the appropriate location and condition (i.e., not leaking, cracked, broken, etc.), closed, labeled, and not overfilled.

An UWAP is a DPW-ED-approved area or container that is labeled and used for the temporary storage of universal wastes such as aerosol cans, fluorescent bulbs, and batteries. Personnel placing items in the UWAP must be trained in proper universal waste management. SAP Managers or Environmental Officers are responsible for ensuring the UWAP is in full compliance with Federal, state and Army regulations.

The SAP Manager or individual turning in a waste is required to provide Material Safety Data Sheets (MSDSs) or laboratory analysis and WAYTI-FC Form-44-E, which provides information to the Directorate of Environmental Compliance and Management HWSF for characterizing and profiling all hazardous waste it receives. All hazardous waste must be turned into the HWSF at the end of the shift in which the waste was generated.

Fort Carson's HWSF is operated by DPW-ED personnel and located on Butts Road, across from Range 51. The HWSF consists of five buildings and includes:

- **Administrative Building (#9246) -** For personnel and operating record storage.
- **TSDF Building (#9248) -** Serves as the hazardous waste permitted container storage unit.
- **90-Day Storage Area (#9248) -** Indoor and outdoor storage area for hazardous wastes in accordance with LQG requirements.
- **Universal Waste Building (#9245) -** Area designated for universal waste storage and management for less than one year.
- **General Storage (#9249) -** Storage for supplies.

Once a hazardous waste is received at the HWSF, it is characterized, documented, packaged, labeled, weighed, and stored. Per Fort Carson's Hazardous Waste Part B Permit, storage of hazardous waste is allowed for up to one year but cannot exceed the maximum permitted storage capacity of 7,070 gallons. Although the permit allows for such long-term storage, nearly all of Fort Carson's hazardous wastes are stored in the 90-day storage area in accordance with LQG requirements (i.e., hazardous wastes are removed at least every 90 days).

The DRMO Hazardous Waste Disposal Representative manages the disposal and transportation of hazardous waste. This includes retaining documentation of the DoD Single Line Item Release/Receipt Document (DD Form 1348-1), Waste Profile Sheet, and the MSDS or laboratory analysis for use with coordinating final disposal with the disposal contractor. All hazardous wastes generated on Fort Carson, except for UXO wastes treated at the Explosive Ordnance Detachment (EOD) unit, are ultimately transported off-site by a DOT-approved hazardous waste transporter and disposed of at a RCRA-permitted TSDF. No hazardous waste of any kind is disposed of on-site at Fort Carson. Once the waste is shipped for final disposal, the HWSF maintains all documentation for three years, or as specified in the Hazardous Waste Permit.

3.13.1.5 Other Toxic Substances

Other toxic substances that could potentially be encountered at Fort Carson include asbestos, lead-based paint, PCBs, UXO, and underground storage tanks (USTs)/aboveground storage tanks (ASTs) containing toxic substances.

Asbestos-containing materials were prevalent in building construction until the 1970s. Although the use of asbestos has declined dramatically, asbestos is occasionally found in various building materials. Specifically, asbestos can potentially be found in floor tiles, pipe wrapping, ceilings, and insulation.

Lead-based paint is no longer used but may be found in older structures. Lead can potentially be found in chipped or cracked painted walls or in surrounding soils.

Transformers manufactured prior to 1976, and light ballasts manufactured before 1979, are assumed to contain PCB waste. There are no transformers containing PCBs remaining on the Installation (Granger, 2011).

UXO can only be treated by trained and qualified members of Fort Carson's EOD. The Range 121 Open Detonation Unit is used for treating hazardous waste reactive UXO at Fort Carson.

USTs and ASTs are used at Fort Carson for fueling facilities and used oil storage. Petroleum products are stored in numerous ASTs within the Main Post area and there are three commercial gas stations operated on Fort Carson; each station containing three USTs (Fort Carson, 2008). Storage tanks at Fort Carson are managed under the Installation's P2 Plan, SPCC Plan, and Federal and state regulations.

3.13.1.6 Existing Sites

All landfills have been closed and no waste is currently disposed of at Fort Carson, but as described in Fort Carson's Part B Hazardous Waste Permit, there are existing locations designed for hazardous wastes and locations that are in the process of being remediated. See Section 3.12, Utilities, for additional information about solid waste management at Fort Carson. Existing sites include (CDPHE, 2006):

- Fort Carson's HWSF as discussed in Section 3.13.1.4.
- Storage container units for hazardous waste storage, such as SAPs and UWAPs.
- Range 121 Open Detonation Unit, which is used to treat reactive hazardous wastes by open detonation. Reactive hazardous wastes have the potential to detonate or to have an explosive reaction or decomposition, such as UXO.

The Hazardous Waste Part B Permit identified 170 SWMUs identified during a RCRA Facility Assessment (RFA) as having possibly released hazardous waste or constituents to the environment. Sites applicable to the Proposed Action include (CDPHE, 2006):

- **SWMU No. 1 – Landfill 1.** Located south of the Main Post area. The municipal portion of the landfill is approximately 50 acres. Landfill 1 historically was a trench operation and mixed sanitary waste, waste oil, sludge, and construction debris that were disposed of at the landfill. Landfill 1 is still in the process of being remediated (IRP, 2012b). A contractor is scheduled to cap this landfill in the FY 2012 – 2014 timeframe. Once the landfill is capped, it would undergo long-term monitoring for at least 5 years. Cap designs are currently being reviewed by CDPHE. After the capping process is complete, small areas that are unsuitable to be capped could be fenced off, which would decrease utilization of these areas.

- **SWMU No. 5 - Landfill 5.** Landfill 5 is located in the northeast corner of the Main Post area, close to the Installation boundary. Construction debris, mixed sanitary waste, waste from the old mule barn area, coal cinders, ash, and waste petroleum, oil, and lubricants were historically disposed of in the 20-acre landfill. Two cover systems were selected to remedy Landfill 5 – an evapotranspiration cap and a multi-layer geosynthetic barrier with an asphalt surface. This surface allows for continued storage of heavy construction equipment and transportation vehicles from the area. Both systems are designed to control the release of hazardous constituents beyond the unit boundary by reducing or eliminating the infiltration of precipitation into the underlying waste materials. Landfill 5 has not contributed to groundwater contamination above screening levels downgradient of the landfill; therefore, no remediation is required. The compliance monitoring period is 30 years, which is consistent with post-closure requirements for landfills, as identified in 6 CCR 1007-3, Part 264, Subpart N.
- **SWMU No. 6 - Landfill 6**. Landfill 6 (13.6 acres) is located at the west side of the Main Post area near Installation housing. Construction debris, mixed sanitary waste, sludge, medical waste, municipal waste, and waste petroleum, oil, and lubricants were historically disposed of at the landfill. Removal of all waste within the landfill was selected as a remedy to control the release of hazardous constituents beyond the unit boundary. Landfill 6 is considered remedy complete.
- **SWMU No. 170.** Construction and Demolition Debris Landfill - The Construction and Demolition Debris Landfill is located south of the Main Post area, and is part of the Combined Landfill Area. Construction debris and other materials were formerly disposed of at the landfill. The remedy selected is placement of a RCRA Subtitle C alternative water balance cap. Post-closure monitoring would be required of groundwater, soil gas, erosion, settlement, cap thickness, vegetation, proper drainage, and percolation.

3.13.2 ENVIRONMENTAL CONSEQUENCES

An impact to hazardous and toxic substances would be considered significant if it results in considerable risk to human health or safety attributable to Army actions, including direct human exposure, substantial increase in environmental contamination or violation of applicable Federal, state, DoD, and local regulations.

3.13.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Action Alternatives would not be constructed. No construction activities would be required and the sites identified would not be affected. Hazardous waste generation amounts and types would remain consistent with current conditions. No impacts to Hazardous and Toxic Substances would be expected under the No Action Alternative.

3.13.2.2 Proposed Action Alternatives

3.13.2.2.1 Hazardous and Toxic Substances Impacts Common to All Proposed Action Alternatives

Use of Hazardous and Toxic Substances and Management

Hazardous and toxic substances that are common to all of the Proposed Action Alternatives include hazardous materials involved in construction equipment (i.e., front-end loaders, skidsteers, bulldozers, graders, excavators, dump trucks, cement trucks, and forklifts) such as fuel, oils, and other vehicle liquids (e.g., hydraulic fluid) with the potential to spill during use. Short-term impacts of equipment would be minor since hazardous materials used by equipment during construction would be managed by construction personnel according to the standard hazardous waste management practices outlined in the HWMP and in accordance with RCRA regulations. Additionally, general maintenance activities during operations would likely involve oils, lubricants, and metal spare parts. Such maintenance activities would have long-term minor impacts as they would not require the use of a significant amount of hazardous materials which would be handled in accordance with Federal, State, Army, and local regulations.

The Installation would continue to be regulated as a LQG of hazardous waste but Fort Carson's SPCC Plan would need to be updated to include all new sites where oil and hazardous substances are stored in quantities of 55 gallons or more. Depending on the amount of chemicals stored and used during operation of the Proposed Action Alternatives, Fort Carson would determine which permits and plans would need to be updated to reflect the change of conditions. For instance, the HWMP, NPDES, and SWPPP would need to be evaluated, and the SPCC Plan would need to include the quantity and storage of new oil and chemicals used. Additionally, the SPCC Plan would describe controls designed to prevent spills or minimize the impact of spills on the environment. Due to extensive outreach and training efforts on spill prevention, only minor spills (i.e., less than 5 gallons) would likely occur and major site contamination, cleanup, and actions to be taken in the event of a release resulting from the alternatives would not be anticipated.

Production of Hazardous Wastes and Management

As a LQG of hazardous waste, any new hazardous wastes generated from construction and operation of the proposed alternatives would be managed through the established HWMP and Part B Hazardous Waste Permit.

Construction equipment common to all Proposed Action Alternatives would likely include wheeled front-end loaders, skidsteers, bulldozers, graders, excavators, dump trucks, cement trucks, and forklifts. Although no demolition wastes would be involved in construction, small amounts of potentially hazardous waste materials (e.g., oils, fuel, solvents, and paints) would be generated due to the increase presence and use of construction-related Hazardous and Toxic Materials and Wastes (HTMW) from construction equipment; this would be a short-term, minor impact. A small increase in construction vehicle traffic would increase the likelihood for release of vehicle operating fluids (e.g., oil, diesel, gasoline, antifreeze, etc.) and maintenance of vehicles would generate waste. Construction wastes would be handled by the construction contractor in accordance with the HWMP. All wastes would be collected and transported off-site by licensed contractors for recycling, treatment, or disposal. Fort Carson would implement standard construction BMPs to minimize the potential for spills and for the proper management and storage of hazardous waste in accordance with RCRA regulations. Preventative measures, such as providing fencing around the construction site, establishing contained storage areas, responding immediately to spills, and controlling the flow of construction equipment and personnel would help reduce the potential for a release of hazardous materials to occur.

All Proposed Action Alternatives, except Alternative 3, do not contain any known contamination. During construction activities, if contaminants are encountered, the hazardous materials would be handled according to Fort Carson's HWMP and in consultation with the CDPHE. Remediation, if required, would be administered by Fort Carson's DPW-ED and in accordance with Federal and state regulations. Discussion of locations identified as sites of concern are discussed further under Alternative 3 in Section 3.13.2.2.4.

Maintenance activities for all alternatives would generally involve the use of oil and lubricants, spare parts, cleaning activities, and miscellaneous products to maintain the equipment. When hazardous wastes, such as oily rags, are generated during maintenance activities, facility personnel would manage the waste according to the Fort Carson HWMP. Impacts due to maintenance activities impacts would be minor.

3.13.2.2.2 Alternative 1

Use of Hazardous and Toxic Substances and Management

The proposed WTE plant would have minor short-term and long-term impacts on the use of hazardous and toxic substances. The WTE plant would involve hazardous and toxic substances typically used in construction and maintenance activities, which are common to all alternatives and discussed in Section 3.13.2.2.1.

The WTE plant would include air pollution control systems which involve hazardous and toxic substances such as chemicals in the selective catalytic reactors (SCR) or non-selective catalytic reagents (NSCR) system. Additionally, chemical additives would potentially be used to prevent fouling of the cooling towers (e.g., biocides and fungicides to control growth of bacteria and fungus on the cooling tower plates and fins). As with any industrial facility, the potential exists for inadvertent releases of chemicals or other accidents. Impacts from chemical use during operations would be long-term and minor. Safety systems would prevent and control a chemical release and personnel would be trained in accident prevention and control measures. In addition, protective measures, such as providing secondary containment around hazardous material storage areas, would be incorporated into the final design of the WTE plant, as necessary and appropriate. These measures would be expected to minimize the potential for impacts from spills of hazardous materials. Depending on the amount of chemicals stored and used during operation of the WTE plant, Fort Carson would determine which permits and plans would need to be updated to reflect the change of conditions. See Section 3.13.2.2.1 for additional details about changes to plans and permits.

Production of Hazardous Wastes and Management

The proposed WTE plant would have short-term minor and long-term significant but mitigable impacts on hazardous and toxic waste management.

The proposed WTE plant would be located in the Gate 19 area (see Figure 2-1a), which is not known to have any contamination. Although not anticipated, if suspected contamination is encountered during construction activities, construction personnel would handle such hazardous materials in the manner described in 3.13.2.2.

During construction, site work would include site clearing and grading, access roads, and site stabilization. Since no buildings or other structures currently exist at the site, no demolition would be necessary. Construction would also involve production of an access gate and road, fencing to contain blowing debris, and the structures encompassed in the 40-acre WTE plant. Impacts due to construction of the proposed WTE plant would be temporary and minor.

Wastes generated by the WTE plant during operations would include wastes from operational employees and equipment, maintenance activities, materials from the feedstock screening process, and ash.

Operation of the WTE plant would produce general universal wastes (e.g., fluorescent light bulbs and batteries), which would be managed consistent with HWMP procedures. It is possible that a UWAP would be established near the point of generation at the WTE plant, and then transported to the Universal Waste Building at the HWSF on Fort Carson. Sanitary wastewater would be disposed through a connection to the municipal wastewater system.

During operations, minor amounts hazardous wastes would be produced due to maintenance activities (i.e., oils and solvents), which would result in minor long-term impacts. Non-hazardous feedstock (waste) would be hauled to the plant from Fort Carson's HWSF and the surrounding Colorado Springs area. Fort Carson's Part B Hazardous Waste Permit would need to be modified since it currently does not allow for the Installation to accept off-Post waste. Large appliances and other non-combustible materials would be separated from the feedstock for disposal in an off-Post landfill. Since hazardous waste could be encountered in the feedstock, a separate management plan would be required for waste sorting activities and the HWMP would need to be updated accordingly. Such non-combustible hazardous waste would be removed from the feedstock and disposed of as a hazardous waste according to Federal, state, Army, and local regulations. It is possible that not all hazardous wastes would be screened out during sorting which would result in the combustion of such hazardous waste and emission of hazardous particulates into the air. Refer to Section 3.3.2.2.2 Air Quality for additional details about air emissions. Emission control equipment such as SCR and other more effective technologies would be designed to remove acid gases, heavy metals, organic chemicals, and PM in order to prevent the escape of such combusted hazardous waste into the air. Therefore, significant but mitigable adverse impacts to hazardous waste management are anticipated.

Ash would be the major by-product of the WTE plant. Ash and non-combustible materials would account for 10 - 20 percent of waste tonnage to be disposed of in an off-Post landfill. WTE facilities are exempt from hazardous waste requirements as a treatment, storage, or disposal facility, but the ash produced would be subject to hazardous waste determination under RCRA (CDPHE, 2009). Ash residue would be handled through an ash management process, which would screen the ash residue, remove metals, and store the ash for off-Post disposal. Additionally, metals removed from the ash would be separated into ferrous and non-ferrous materials for storage and transport to a recycling facility. The ash management process would be enclosed to provide proper containment of ash residue. Prior to disposal, the ash product from the WTE plant would be tested for hazardous constituents using the Toxic Characteristic Leaching Procedure. Although the ash is not anticipated to be hazardous, it would be handled as a hazardous waste pending a successful test to ensure it can be disposed of as general solid waste (Davis, 2012). The solid waste could be sent to an off-Post landfill or to a re-use facility where it could be converted to landfill roadbed material, road aggregate, or asphalt-mixture. If the ash is found to contain hazardous constituents, it would be handled and disposed as a hazardous waste to an off-Post treatment facility. It is anticipated that operation of the WTE plant would not overload off-Post landfills or treatment facilities and Fort Carson would incorporate procedures to properly manage such wastes according to Federal and state regulations. Fort Carson's HWMP would need to be updated to provide a process to handle the ash and the non-combustible items removed from the feedstock. Additionally, the WTE plant could be considered a treatment operation, which would likely require a modification of the Part B Hazardous Waste Permit and potentially additional requirements by the state. Such modifications would likely require a 30-day public comment period. Significant but mitigable adverse impacts to hazardous waste management are anticipated.

3.13.2.2.3 Alternative 2

Use of Hazardous and Toxic Substances and Management

Hazardous materials would be present in equipment used for both construction and operation of the proposed biomass plant. Operations would require similar equipment used in construction (as described in Section 3.13.2.2.1) but would be limited to front-end loaders, backhoes, fork lifts, and conveyer belts to move the biomass about the site, and heavy-duty trucks to deliver the biomass to the site. This equipment uses hazardous materials such as fuel, oils, and other vehicle liquids with the potential to spill during construction and operations. Additionally, maintenance of equipment during operations would likely involve oils, lubricants, and metal spare parts. Short-term impacts from the use of hazardous materials in equipment would be minor as discussed in Section 3.13.2.2.1.

As discussed in Section 2.4.2.2, the biomass plant could be sited at three alternative locations. Alternative 2a and Alternative 2b would require the same acreage and would be approximately the same size; therefore, use of hazardous materials and impacts would generally be the same as discussed earlier (short-term and long-term minor). Alternative 2c would occupy an approximately 23-acre area of which 16.5 acres would be required to accommodate biomass operations. Additionally, the plant would only be 2.5MW compared to 13MW in Alternative 2a and 2b. Generally, the smaller size of the plant in

Alternative 2c would require the use of less hazardous materials necessary for construction, operations, and maintenance. Impacts associated with Alternative 2c would be short-term and long-term minor.

During operation of the biomass plant, chemicals would be used in the air pollution control systems and the cooling tower. Similarly to Alternative 1 discussed in Section 3.13.2.2.2, additives would potentially include biocides and fungicides, which prevent fouling of the cooling towers (e.g., control growth of bacteria and fungus on the cooling tower plates and fins), as well as chemicals for the air pollution control system such as the SCR or NSCR system. Impacts from chemical use during operations would be minor, as these chemicals are already in use in other cooling towers at Fort Carson. Refer to Section 3.13.2.2.2 for further information about management of hazardous chemicals.

Production of Hazardous Wastes and Management

The proposed biomass plant would have short-term and long-term minor impacts to hazardous waste and management.

During construction, site work would include site clearing and grading, construction of stormwater management controls (e.g., ditches, berms, and sedimentation basins), access roads, and site stabilization. The majority of the site would need to be leveled to create level areas for fuel storage and equipment areas. Because no buildings or other structures currently exist at the site, no demolition would be necessary. Although none of the potential sites identified for the biomass plant are known to be contaminated, if suspected contamination is encountered during earth-moving construction activities, the hazardous materials would be handled in accordance with Federal, state, Army, and local regulations; as described in Section 3.13.2.2.1. Thus, impacts from hazardous waste disposal during construction would be short-term and minor.

Wastes produced by the biomass plant during operations would include wastes from operational employees and equipment, wastewater, materials from the biomass fuel screening process, maintenance activities, and ash.

The biomass plant would be manned continuously during operations. Wastes from the approximately 30 operational personnel would be similar to the WTE plant (Section 3.13.2.2.2) and include solid waste and sanitary wastewater. Universal waste wastewater, and potentially hazardous waste from maintenance activities would also be generated. Solid waste generated by personnel would be managed according to existing solid waste management procedures (see Section 3.12, Utilities). The biomass plant would produce general universal wastes (e.g. fluorescent light bulbs and batteries), which would be managed consistent with HWMP procedures. It is possible that a UWAP would be established near the point of generation at the biomass plant and the universal waste would be transported to the Universal Waste Building at the HWSF on Fort Carson.

The primary operational wastewater source from the plant would be associated with the cooling tower system (Feasibility Study, 2010). As discussed in Section 3.13.2.2.2, biocides and fungicides may be added to the water to control bacterial and fungal growth on the tower plates and fins which can impact water quality. Additionally, additives from air pollution control systems such as SCRs can also impact water quality in the cooling system. Impacts from hazardous waste produced by chemical use during operations would be minor as these chemicals would be used in the process during operations and would only require disposal during maintenance activities.

During operations, minor amounts of hazardous wastes (i.e., oils and solvents) would be produced due to maintenance activities, which would result in long-term minor impacts. Refer to Section 3.13.2.2.1 for further discussion of impacts.

Fort Carson's Part B Hazardous Waste Permit with CDPHE would need to be updated to include the new facility. Any future process change would require modifications to the permit (i.e., change in feedstock from virgin timber to wood pallets). Moderate adverse impacts to hazardous waste management are anticipated.

Although the ash product is not anticipated to contain hazardous material, it would be necessary to test the material for its chemical characteristics on at least an annual basis (NREL, 2010). Once it is determined to be non-hazardous, it could be disposed as general solid waste which could be sent to an off-Post landfill or to a re-use facility where it could be converted to landfill roadbed material, road aggregate, or asphalt-mixture. If testing indicates the ash is hazardous, the ash would be handled as a hazardous waste according to the HWMP. Fort Carson's HWMP would need to be updated to provide a process to handle the ash and the non-combustible items removed from the biomass fuel. Impacts due to the generation of ash would be long-term and minor.

The three alternative locations for the proposed biomass plant (see Section 2.4.2.2) do not have any known contamination but if encountered during construction, hazardous materials would be handled as discussed in Section 3.13.2.2.1. Since Alternative 2a and Alternative 2b would be approximately the same size, hazardous waste generation would be similar; therefore impacts would be consistent with previous discussion (short-term and long-term minor). Alternative 2c would have a smaller footprint and occupy an approximately 23-acre area of which 16.5 acres would be required to accommodate biomass operations. Additionally, the plant would only be 2.5MW compared to 13MW in Alternative 2a and 2b. Generally, the smaller size of the plant in Alternative 2c would produce less hazardous waste due to less consumption of hazardous materials required for construction, operations, and maintenance. Impacts associated with Alternative 2c would be short-term and long-term minor.

Although the exact amount of hazardous waste generation is not known at this time, the biomass plant would be expected to generate relatively small amounts of hazardous wastes and Fort Carson would remain a LQG of hazardous waste under RCRA. No greater than minor impacts to hazardous waste management would be expected during operations.

3.13.2.2.4 Alternative 3

Use of Hazardous and Toxic Substances and Management

The proposed PV systems would involve construction, operation, and maintenance operations using with equipment and products described in Section 3.13.2.2.1. Such activities would use hazardous materials such as fuel, oils, and other potentially hazardous liquids with the ability to spill during construction and operations. Short-term and long-term impacts of equipment would be minor as discussed in Section 3.13.2.2.1.

PV systems typically contain heavy metals such as lead (solder), cadmium, and selenium. These materials are a part of any PV array but are only present in small quantities. As the potential for a release of these materials to the environment is minimal since they are contained within the equipment, this would have a long-term, negligible impact.

Production of Hazardous Wastes and Management

Alternative 3 contains 13 proposed PV sites throughout Fort Carson (see Figure 2-1a and Figure 2-1b). Four potential PV locations are known to have previous contamination, which include Chiles, SWMU 1-170, SWMU 5 Site 1, and SWMU 5 Site 2. The Chiles PV site would be located in an area within SWMU 6. Although SWMU 6 is considered remedy complete, there is a waterline along the Chiles ditch that still has some contamination present underneath it. Construction would be avoided in the ditch area so it is unlikely that contaminants would be disturbed during construction or operation (IRP, 2012a). If encountered, personnel would handle and dispose of any media (e.g., soil, water) as a hazardous waste as described in Section 3.13.2.2.1. Refer to Section 3.13.1.6 for a detailed description of the SWMUs applicable to Alternative 3. If a SWMU is selected, Fort Carson would revisit the landfill closure agreements and documentation with CDPHE to ensure closure conditions, as applicable, are being met or require revisions. If revisions are required, Fort Carson would coordinate with CDPHE to maintain compliance. CDPHE would need to approve the designs for PV projects on a SWMU. A 45-day review period followed by a 90day public comment period would likely be required. Additionally, the Magrath Avenue site is located in a former range training area that would require a survey for hazardous and toxic materials prior to construction. Any cleanup of potentially hazardous materials would be conducted per Federal and state regulations and as discussed in Section 3.13.2.2.1.

Alternative 3 would result in short-term, minor impacts due to the increased presence and use of construction-related HTMW. During construction, a small increase in construction vehicle traffic would increase the likelihood for a release of vehicle operating fluids (e.g., oil, diesel, gasoline, antifreeze, etc.) and maintenance materials. Implementation of standard construction BMPs would minimize this potential impact.

During operation, in the event of severe damage to any of the PV systems, a small amount of hazardous materials might be released to the environment. As previously discussed, PV systems typically contain very small quantities of heavy metals such as lead (solder), cadmium, and selenium which could be managed through the existing waste stream at Fort Carson. As the potential for a release of these materials to the environment is minimal since they are contained within the equipment and would only occur when equipment needs to be replaced, this would have a long-term, negligible impact. During operation, Fort Carson would conduct ongoing and regular maintenance of the PV systems. Following any catastrophic event, Fort Carson would repair any damage to the PV systems and rapidly remediate any minor releases in accordance with Federal, State, and local requirements. No batteries or generators are proposed for storage or continuation of PV system power.

At the end of their useful life (estimated to be 25 years), the PV systems would be decommissioned. If waste PV systems are sent to a municipal waste incinerator, the heavy metals would gasify and could be released to the atmosphere. If waste PV systems are sent to a municipal solid waste landfill for disposal, they have the potential to leach heavy metals into the groundwater (Markvart and Castaner, 2003). To avoid such adverse effects, Fort Carson would recycle or dispose of the waste PV systems in compliance with all existing Federal, state, and local regulations governing the characterization and disposal of waste; therefore, no significant adverse effects associated with the disposal of the PV systems are expected.

Fort Carson would work with the CDPHE regarding development of the PV sites and the terms and conditions to satisfy conditions of its Part B Permit. Alternative 3 would not result in a substantial increase in the generation of hazardous substances or waste, increase the exposure of persons to hazardous or toxic substances, increase the presence of hazardous or toxic materials in the environment, or place substantial restrictions on property use due to hazardous waste, materials, or site remediation.

3.13.2.2.5 Alternative 4

Use of Hazardous and Toxic Substances and Management

The proposed expansion of the existing reclaimed water system would have short-term and long-term minor impacts. Alternative 4 would involve construction equipment consistent with equipment described in Section 3.13.2.2.1, which would have a temporary and minor impact. Additionally, maintenance activities could involve minor amounts of hazardous substances (e.g., oils, lubricants, paints) which would have a minor impact. No other hazardous or toxic substances are anticipated to be used during construction and operation.

Production of Hazardous Wastes and Management

The proposed expansion of the existing reclaimed water system would have short-term and long-term minor impacts to hazardous waste and management.

During construction, minor amounts of construction debris would potentially be generated during the expansion of the existing reclaimed water system. This would include construction debris (e.g., soil, piping material) from expansion of the reclaimed water distribution lines (piping). Construction debris would be handled as solid waste (refer to Section 3.12) since the sites identified for the expansion are not known to be contaminated. Note that the western end of the pipeline travels through SWMU 33, which is a No Further Action site. If suspected contamination is encountered during construction, the contaminated media would be handled as described in Section 3.13.2.2.1.

Removal and replacement of the existing 12-inch asbestos cement pipe reclaimed water transmission line from the WWTP to the golf course with the proposed 16-inch PVC or HDPE transmission pipe would be managed in accordance with the Asbestos Management Plan to avoid potential adverse impacts.

During operations, minor amounts of hazardous wastes (i.e., oils and solvents) would be produced due to maintenance activities, which would result in long-term minor impacts. Refer to Section 3.13.2.2.1 for further discussion of impacts.

3.13.2.2.6 Alternative 5

Use of Hazardous and Toxic Substances and Management

Impacts from the proposed construction and operation of wind turbines would be short-term and long-term minor. The only hazardous and toxic substances used during construction and operations would be associated with construction equipment, vehicle use, and products for maintenance activities (as discussed in Section 3.13.2.2.1). Petroleum products (e.g., oil, hydraulic fluid, gear grease) would be used for operation of the turbines and substation/transformer equipment. See Section 3.13.2.2.1 for additional details about the potential hazards and impacts.

Production of Hazardous Wastes and Management

The proposed wind turbines would have short-term and long-term minor impacts. The site identified for wind power is the Wildhorse site located in Training Area 48 (see Figure 2-2b). No contamination is known to exist at this location but if encountered, would be handled as discussed in Section 3.13.2.2.1.

Wind power would generate waste streams associated with construction equipment, vehicle use, and maintenance activities. Hazardous materials such as petroleum products (e.g., oil, hydraulic fluid, and gear grease), solvents, and paints would be used for the turbines and substation/transformer equipment. Hazardous wastes associated with the use of such materials would be managed in accordance with applicable regulations as discussed in Section 3.13.2.2.1. Since only small amounts of hazardous wastes would be produced due to maintenance, minor impacts are anticipated.

3.13.2.2.7 Alternative 6

Use of Hazardous and Toxic Substances and Management

The programmatic alternatives (GSHP and PV panels) would involve hazardous materials associated with construction equipment and maintenance activities which are discussed in Section 3.13.2.2.1 and would have a short-term minor and long-term negligible impact. If a SWMU is selected, Fort Carson would revisit the landfill closure agreements and documentation with CDPHE to ensure closure conditions, as applicable, are being met or require revisions. If revisions are required, Fort Carson would coordinate with CDPHE to maintain compliance. CDPHE would need to approve the designs for PV projects on a SWMU. A 45-day review period followed by a 90-day public comment period would likely be required.

The type of GSHP technology is dependent on project design. Some GSHP technologies do not have hazardous material components while others use brine fluids (i.e., glycol) that have hazardous constituents. If Fort Carson pursues the use of a GSHP system that uses a hazardous substance, preventative measures and procedures would be identified to properly manage the substances and avoid impacts associated with leakage of any such materials. Since GSHP's could be added to existing buildings, project design would require the Installation of a new supply air ductwork. Depending on the age and type of building, hazardous and toxic materials (i.e., asbestos, lead-based paint) could be encountered. In which case, procedures in the HWMP and the Asbestos Management Plan would be followed to avoid potential impacts. Impacts associated with operation of the GSHP's would be negligible since the materials would be consistent with existing processes currently in use at Fort Carson.

As discussed in further detail in Section 3.13.2.2.4, PV systems typically contain heavy metals which are only present in small quantities. As the potential for a release of these materials to the environment is minimal since they are contained within the equipment, this would have a long-term, negligible impact.

Production of Hazardous Wastes and Management

The additional sites identified for Alternative 6 do not have any known contamination. But as discussed in Section 3.13.2.2.1, if encountered, the hazardous materials would be managed in accordance with Federal, State, Army, and local regulations.

Construction of the GSHP's would involve excavation and bore-hole drilling of the wells which is not expected to produce a significant amount of hazardous waste. Hazardous wastes associated with construction equipment and vehicles would be consistent with the discussion in Section 3.13.2.2.1 and have a temporary, minor impact.

Operation of the GSHP would involve hazardous wastes associated with maintenance activities, which are discussed further in Section 3.13.2.2.1. If GSHPs are designed to use hazardous materials (i.e., glycol), then there could be hazardous wastes associated with the materials. In which case, Fort Carson would implement BMPs and procedures to manage and avoid significant impacts. Operations and maintenance activities would have long-term and minor impacts.

Refer to Section 3.13.2.2.4 for details about hazardous wastes associated with construction and operation of the PV panels, which would have short-term minor and long-term negligible impacts.

3.13.2.2.8 Alternative 7

Use of Hazardous and Toxic Substances and Management

Alternative 7 would potentially involve upgrading incandescent light bulbs to energy-efficient compact fluorescent bulbs which contain Mercury. Since the compact fluorescent bulbs have a greater lifespan, they would be changed and disposed of less frequently which therefore would require less use of new bulbs. Thus, impacts associated with the use of hazardous and toxic substances would be negligible.

Production of Hazardous Wastes and Management

Implementation of Alternative 7 would have minor adverse impacts on the production of hazardous and toxic substances. There is the potential for lead paint and asbestos to be encountered since the projects would primarily occur within building interiors, developed portions of building exteriors, and modifications to existing utility infrastructure. If such substances are encountered, they would be managed in accordance with the applicable management plans (i.e., asbestos and lead management plans). Additionally, any hazardous waste generated would be managed by Fort Carson's DPW-ED in conformance with the hazardous waste management plan. Behavioral and conservation measures regarding waste, water, and energy would potentially reduce waste generation, including hazardous waste; therefore, no impacts are anticipated.

3.13.3 CUMULATIVE EFFECTS

Construction and operation of the Proposed Action Alternatives in combination with planned and ongoing projects (i.e., the New Mini Mall/Troop Store, Commissary, Elementary School, etc.) would cumulatively generate hazardous wastes that would require proper handling and disposal, thus reducing the overall waste disposal capacities or regional waste disposal facilities. Additionally, development associated with the CAB stationing including garrison support facilities at the WRC would involve a temporary increase in waste generation and potentially hazardous wastes from demolition activities. This could present a cumulative adverse impact if activities occur concurrently with the Proposed Action Alternatives. Increased training activities from the current CAB stationing and previous BRAC actions have resulted in an increase generation of hazardous wastes.

It is anticipated that the Proposed Action Alternatives contribution to these impacts would be minor and that cumulative impacts to hazardous and toxic substances at Fort Carson would be less than significant. Additionally, in combination with Fort Carson's Sustainability Program, the Net Zero Project would greatly reduce waste generation at Fort Carson which would have a positive effect.

3.13.4 PROPOSED IMPACT REDUCTION MEASURES

3.13.4.1 Mitigation

The proposed WTE plant associated with Alternative 1 has the potential for significant impacts associated with potentially hazardous ash waste and air emissions resulting from the combustion of residual hazardous material not removed from the municipal waste in the combustion stream. Such impacts would be mitigated through the use of air emission control devices such as SCR or other technologies to reduce potential WTE hazardous waste pollution. No potential for adverse significant impacts are anticipated for Alternatives 2 through 7; therefore, no mitigation would be required for these alternatives.

Since construction and operation activities for the Proposed Action Alternatives would result in an increase in use of hazardous materials and subsequently hazardous wastes, Fort Carson would continue to implement existing hazardous waste management plans to minimize impacts. New management plans would need to be created for the alternative chosen to determine adequate procedures to manage the hazardous materials and wastes associated with the project. In addition, if a SWMU is selected as part of Alternative 3 or 6, Fort Carson would revise the landfill closure agreement and documentation with CDPHE.

4. SUMMARY OF ENVIRONMENTAL CONSEQUENCES

This section summarizes the anticipated level of impact to the VECs under the No Action and Proposed Action Alternatives as discussed in Chapter 3. Table 4-1 also outlines measures identified in Chapter 3 for the Proposed Action Alternatives to reduce and avoid adverse effects by alternative. The level of cumulative impact displayed in the table represents the implementation of all the Proposed Action Alternatives scenarios as discussed in Chapter 2 (i.e., only one large 10MW or greater energy plant would be constructed) in combination with the projects listed in Section 3.1.

Table 4-1. Summary of Potential Environmental Effects from Baseline Conditions

Alternative	Activity	Level of Impact	Cumulative Impact	Impact Reduction Measures[1]
Land Use				
No Action	N/A	Negligible	Negligible	Not applicable.
Alt. 1	Construction	Less than significant	Less than significant	None identified.
	Operations	Less than significant		
Alt. 2a	Construction	Less than significant	Less than significant	None identified.
	Operations	Less than significant		
Alt. 2b	Construction	Less than significant	Less than significant	None identified.
	Operations	Less than significant		
Alt. 2c	Construction	Less than significant	Less than significant	None identified.
	Operations	Less than significant		
Alt. 3	Construction	Less than significant	Less than significant	In order to reduce potential adverse impacts from PV panel glare, Fort Carson could include the following measures in PV design and operations: • Installing sun screens to minimize or block a specific reflection. • Adjusting the tilt and positioning of PV panels to reduce impacts on sensitive receptors. • Utilizing anti-reflective coating in PV design.
	Operations	Less than significant		
Alt. 4	Construction	Less than significant	Negligible	None identified.
	Operations	Negligible		
Alt. 5	Construction	Less than significant	Less than significant	None identified.
	Operations	Less than significant		
Alt. 6	Construction	Less than significant	Less than significant	See Alternative 3, Land Use.
	Operations	Less than significant		
Alt. 7	Construction	Negligible	Negligible	None identified.
	Operations	Negligible		

Table 4-1. Summary of Potential Environmental Effects from Baseline Conditions

Alternative	Activity	Level of Impact	Cumulative Impact	Impact Reduction Measures[1]
Air Quality and Greenhouse Gases				
No Action	N/A	Negligible	Less than significant	Not applicable.
Alt. 1	Construction	Less than significant	Less than significant	In order to reduce air quality impacts, construction would be in full compliance with Colorado regulatory requirements and include the use of compliant practices or products, including: • Odor Emission (5 CCR 1001-4); • Open Burning, Prescribed Fire, and Permitting (5 CCR 1001-11); and • Control of Emission of Ozone Depleting Compounds (5 CCR 1001-19). During construction, measures to prevent unnecessary amounts of PM from becoming airborne would be implemented, including: • Using water for control of dust, the grading of roads, or the clearing of land; • Covering open equipment for conveying or transporting material likely to create objectionable air pollution when airborne; and • Removing spilled or tracked dirt or other materials promptly from paved roads. For plant operations, the following BMPs would be conducted to reduce adverse impacts and to comply with applicable air pollution control regulations: • BACT review for each criteria pollutant and GHG; • MACT review for regulated HAPs and designated categories; • Predictive air dispersion modeling; • Establishing procedures for measuring and recording emissions and/or process rates; • Meeting the NSPS and NESHAP requirements; and • A public involvement process **Mitigation measures for air quality may be required to reduce impacts to less than significant in compliance with existing regulations, necessary permits, and plans.**
	Operations	**Potentially significant but mitigable**		
Alt. 2a	Construction	Less than significant	Less than significant	See Alternative 1, Air Quality and Greenhouse Gases.
	Operations	**Potentially significant but mitigable**		

Table 4-1. Summary of Potential Environmental Effects from Baseline Conditions

Alternative	Activity	Level of Impact	Cumulative Impact	Impact Reduction Measures[1]
Alt. 2b	Construction	Less than significant	Less than significant	See Alternative 1, Air Quality and Greenhouse Gases.
	Operations	**Potentially significant but mitigable**		
Alt. 2c	Construction	Less than significant	Less than significant	See Alternative 1, Air Quality and Greenhouse Gases for impact reduction measures during construction. In addition, Fort Carson would comply with the existing best practices within the Installation's Title V permit to comply with air pollution control regulations.
	Operations	Less than significant		
Alt. 3	Construction	Less than significant	Beneficial	See Alternative 1, Air Quality and Greenhouse Gases for impact reduction measures during construction.
	Operations	Beneficial		
Alt. 4	Construction	Less than significant	Negligible	See Alternative 1, Air Quality and Greenhouse Gases for impact reduction measures during construction.
	Operations	Negligible		
Alt. 5	Construction	Less than significant	Beneficial	See Alternative 1, Air Quality and Greenhouse Gases for impact reduction measures during construction.
	Operations	Beneficial		
Alt. 6	Construction	Less than significant	Beneficial	See Alternative 1, Air Quality and Greenhouse Gases for impact reduction measures during construction.
	Operations	Beneficial		
Alt. 7	Construction	Less than significant	Beneficial	See Alternative 1, Air Quality and Greenhouse Gases for impact reduction measures during construction.
	Operations	Beneficial		

Table 4-1. Summary of Potential Environmental Effects from Baseline Conditions

Alternative	Activity	Level of Impact	Cumulative Impact	Impact Reduction Measures[1]
Noise				
No Action	N/A	Negligible	Negligible	Not applicable.
Alt. 1	Construction	Negligible	Less than significant	BMPs would be implemented during construction to reduce potential adverse impacts to sensitive receptors, including: • Construction would primarily occur during normal weekday business hours in areas adjacent to noise sensitive land uses such as residential areas; and • Construction equipment mufflers would be properly maintained and in good working order. To avoid the potential for significant adverse noise impacts from operations, as necessary, Fort Carson would: • **Perform a preconstruction noise study to determine a baseline noise level at the closest property line and adjacent buildings.** • **Design the plant, through building and other equipment specifications (such as silencers, mufflers, engineered sound enclosures, etc.), to reduce noise levels as measured at the property line adjacent to residential neighbors or at facilities which house patients, to less than 65 dBA between the hours of 6 a.m. and 9 p.m., or 55 dBA between the hours of 9 p.m. to 6 a.m.** • **Perform a post-construction sound survey at the site. If the noise attributable to the operation of the facility is not less than 65 dBA between the hours of 6 a.m. and 9 p.m., or 55 dBA between the hours of 9 p.m. to 6 a.m. for locations identified, additional noise controls shall be installed within one-year of the in-service date to meet this level.**
	Operations	**Potentially significant but mitigable**		
Alt. 2a	Construction	Negligible	Less than significant	See Alternative 1, Noise.
	Operations	**Potentially significant but mitigable**		
Alt. 2b	Construction	Negligible	Less than significant	See Alternative 1, Noise.
	Operations	**Potentially significant but mitigable**		
Alt. 2c	Construction	Negligible	Less than significant	See Alternative 1, Noise.
	Operations	**Potentially significant but mitigable**		

Table 4-1. Summary of Potential Environmental Effects from Baseline Conditions

Alternative	Activity	Level of Impact	Cumulative Impact	Impact Reduction Measures[1]
Alt. 3	Construction	Less than significant	Negligible	See Alternative 1, Noise, for a list of construction BMPs.
	Operations	Negligible		
Alt. 4	Construction	Less than significant	Negligible	See Alternative 1, Noise, for a list of construction BMPs.
	Operations	Negligible		
Alt. 5	Construction	Negligible	Less than significant	See Alternative 1, Noise, for a list of construction BMPs.
	Operations	Less than significant		
Alt. 6	Construction	Less than significant	Negligible	See Alternative 1, Noise, for a list of construction BMPs.
	Operations	Negligible		
Alt. 7	Construction	Less than significant	Negligible	See Alternative 1, Noise, for a list of construction BMPs.
	Operations	Negligible		
Geology and Soils				
No Action	N/A	Negligible	Negligible	Not applicable.
Alt. 1	Construction	Less than significant	Less than significant	BMPs would be implement during construction to reduce the potential for wind-borne and water-borne erosion, including: • Use of silt fences; • Use of wind breaks; • Topsoil sequestration; • Reseeding the temporarily disturbed area and reestablishing native vegetation; and • Adherence to BMPs in INRMP, Appendix J of SWPPP.
	Operations	Negligible		
Alt. 2a	Construction	Less than significant	Less than significant	See Alternative 1, Geology and Soils.
	Operations	Negligible		
Alt. 2b	Construction	Less than significant	Less than significant	See Alternative 1, Geology and Soils.
	Operations	Negligible		
Alt. 2c	Construction	Less than significant	Less than significant	See Alternative 1, Geology and Soils.
	Operations	Negligible		
Alt. 3	Construction	Less than significant	Less than significant	See Alternative 1, Geology and Soils. In addition, during operations design modifications could be required at PV sites to minimize erosion caused from runoff. Modification could include installation of gutters, splash plates, or additional rock placed beneath the drip line of the panels.
	Operations	Less than significant		
Alt. 4	Construction	Less than significant	Less than significant	See Alternative 1, Geology and Soils.
	Operations	Negligible		

Table 4-1. Summary of Potential Environmental Effects from Baseline Conditions

Alternative	Activity	Level of Impact	Cumulative Impact	Impact Reduction Measures[1]
Alt. 5	Construction	Less than significant	Less than significant	See Alternative 1, Geology and Soils.
	Operations	Less than significant		
Alt. 6	Construction	Less than significant	Less than significant	See Alternative 3, Geology and Soils.
	Operations	Less than significant		
Alt. 7	Construction	Less than significant	Less than significant	See Alternative 1, Geology and Soils.
	Operations	Negligible		
Water Resources				
No Action	N/A	Negligible	Negligible	Not applicable.
Alt. 1	Construction	Less than significant	Less than significant	To reduce adverse impacts to surface waters and groundwater during construction, BMPs would be implemented and include: • Re-seed areas of bare soil with vegetation, layer mulch, gravel, or wood chips to minimize bare soil available for sediment transport during storm event; • Place a protective layer (e.g., rubber mats) on top of temporary access roads utilized during construction to prevent or reduce erosion in areas of highly erodible soils or sensitive areas, such as wetlands; • Maximize use of existing roads in planning site access; • Locate equipment, maintenance, and fueling areas away from surface waters; • Adherence to Fort Carson's SWPPP and SPCC Plan; and • Controlling sedimentation and turbidity and restoring stream crossings to their original grade to stabilize streambanks post construction.
	Operations	Less than significant		
Alt. 2a	Construction	Less than significant	Less than significant	See Alternative 1, Water Resources.
	Operations	Less than significant		
Alt. 2b	Construction	Less than significant	Less than significant	See Alternative 1, Water Resources.
	Operations	Less than significant		

Table 4-1. Summary of Potential Environmental Effects from Baseline Conditions

Alternative	Activity	Level of Impact	Cumulative Impact	Impact Reduction Measures[1]
Alt. 2c	Construction	Less than significant	Less than significant	See Alternative 1, Water Resources.
	Operations	Less than significant		
Alt. 3	Construction	Less than significant	Less than significant	See Alternative 1, Water Resources, for a discussion of impact reduction measures during and after construction. Project footprints and access roads would be sited to avoid impacts to wetland and surface water resources. Prior to construction, surface waters or wetlands would be field-located.
	Operations	Less than significant		
Alt. 4	Construction	Less than significant	Less than significant	See Alternative 1, Water Resources, for a discussion of impact reduction measures during and after construction. Additional impact reduction measures to surface water resources would include: • Restoring stream crossings to their original grade to stabilize streambanks post construction; • Strategic placement of silt fencing; and • Temporary drainage controls.
	Operations	Negligible		
Alt. 5	Construction	Less than significant	Less than significant	See Alternative 1, Water Resources, for a discussion of impact reduction measures during and after construction. Project footprints and access roads would be sited to avoid impacts to wetland and surface water resources. Prior to construction, surface waters or wetlands would be field-located.
	Operations	Negligible		
Alt. 6	Construction	Less than significant	Less than significant	See Alternative 3, Water Resources, for a discussion of impact reduction measures during and after construction. Project footprints and access roads would be sited to avoid impacts to wetland and surface water resources. Prior to construction, surface waters or wetlands would be field-located.
	Operations	Less than significant		
Alt. 7	Construction	Less than significant	Beneficial	See Alternative 1, Water Resources, for a discussion of impact reduction measures during and after construction.
	Operations	Beneficial		

Table 4-1. Summary of Potential Environmental Effects from Baseline Conditions

Alternative	Activity	Level of Impact	Cumulative Impact	Impact Reduction Measures[1]
Biological Resources				
No Action	N/A	Negligible	Negligible	Not applicable.
Alt. 1	Construction	Less than significant	Less than significant	General BMPs during construction that would be implemented to reduce adverse impacts to biological resources include: • Implementation of noxious weeds control strategy (i.e., physical/mechanical methods, biological control, chemical methods, cultural methods, and educational tools); • Stabilization of areas temporarily disturbed during construction with native seed mixes or approved species; • Erosion control BMPs (e.g., silt fencing); • BMPs preventing releases of toxic materials (e.g., providing secondary containment around equipment refueling areas); and • To minimize potential impacts to water resources, a General Permit would require the preparation of a SWPPP. This plan includes BMPs for erosion control and pollution prevention requirements. The BMPs would reduce temporary impacts by controlling sedimentation and turbidity and restoring stream crossings to their original grade to stabilize streambanks post construction. To avoid violations of the MBTA during construction, Fort Carson would as necessary: • Conduct initial land clearing associated with construction outside of the migratory bird nesting season (i.e., 1 April through 15 August) to avoid the "take" of any migratory birds or their nests or eggs; • Conduct bird nest surveys of the potentially-impacted area(s) in order to determine if the take of any migratory birds or their nests or eggs could occur should Fort Carson be unable to conduct land clearing activities outside of the nesting season; and • Should any nests be found, Fort Carson would take appropriate measures to develop the site while avoiding any violations of the MBTA. To reduce impacts to protected avian species, to the extent possible, Fort Carson would locate the WTE plant and disturbance footprints away from far western portion of the Gate 19 site to avoid black-tailed prairie dog colonies and burrowing owls.
	Operations	Less than significant		
Alt. 2a	Construction	Less than significant	Less than significant	See Alternative 1, Biological Resources.
	Operations	Less than significant		

Table 4-1. Summary of Potential Environmental Effects from Baseline Conditions

Alternative	Activity	Level of Impact	Cumulative Impact	Impact Reduction Measures[1]
Alt. 2b	Construction	Less than significant	Less than significant	See Alternative 1, Biological Resources, for a discussion of general construction BMPs and impact reduction measures regarding the MBTA.
	Operations	Less than significant		
Alt. 2c	Construction	Less than significant	Less than significant	See Alternative 1, Biological Resources, for a discussion of general BMPs and impact reduction measures regarding the MBTA.
	Operations	Less than significant		
Alt. 3	Construction	Less than significant	Less than significant	See Alternative 1, Biological Resources, for a discussion of general construction BMPs and impact reduction measures regarding the MBTA. In addition, the following impact reduction measures would be implemented by Fort Carson: • To the extent possible, Fort Carson would locate the PV systems to avoid black-tailed prairie dog habitat (Gate 2 South, Ray Nixon, and Tent City sites only) to reduce the potential for impacting protected avian species; • A vegetation survey would be conducted in potential disturbance areas of the Wildhorse site in order to identify potential locations of Colorado Species of Concern plants known to occur in the area. Vegetation surveys would be used to avoid prime habitat and locations with high density populations of rare plant species during siting of PV panels; and • **If an overhead powerline is required, a raptor-proof system would be installed to avoid adverse impacts to raptors including eagles protected by the Bald and Golden Eagle Protection Act (Wildhorse site).**
	Operations	**Potentially significant but mitigable**		
Alt. 4	Construction	Less than significant	Less than significant	See Alternative 1, Biological Resources, for a discussion of general construction BMPs and impact reduction measures regarding the MBTA. In addition, should crossing of aquatic habitat be unavoidable during pipeline installation, contours within these features would be restored to their original grades and stabilized as necessary.
	Operations	Negligible		

Table 4-1. Summary of Potential Environmental Effects from Baseline Conditions

<table>
<tr><th>Alternative</th><th>Activity</th><th>Level of Impact</th><th>Cumulative Impact</th><th>Impact Reduction Measures[1]</th></tr>
<tr><td rowspan="2">Alt. 5</td><td>Construction</td><td>Potentially significant but mitigable</td><td rowspan="2">Less than significant</td><td rowspan="2">See Alternative 1, Biological Resources, for a discussion of general construction BMPs and impact reduction measures regarding the MBTA.
Fort Carson would also implement the following measures during operations:
• To minimize the impacts of bat mortality from collisions with wind turbines, turbine activity would be reduced, as necessary, during vulnerable times of year to the extent practicable.
• To minimize adverse impacts to rare plant species, a vegetation survey would be conducted in potential disturbance areas of the Wildhorse site in order identify potential locations of Colorado Species of Concern plants known to occur in the area. Vegetation surveys would be used to avoid prime habitat and locations with high density populations of rare plant species during siting of PV panels.
• If an overhead powerline is required, a raptor-proof system would be installed to avoid adverse impacts to raptors including eagles protected by the Bald and Golden Eagle Protection Act.
• In order to avoid or minimize “take” of migratory birds and raptors from collisions with wind turbines, Fort Carson would consult USFWS on operational and bird deterrent measures including protection measures outlined in the USFWS’ “Land-Based Wind Energy Guidelines.” As necessary, a project-specific Avian and Bat Protection Plan would be prepared to avoid and minimize adverse effects to birds and bats, incorporate adaptive management, and (if applicable) document compensation measures that would be taken.</td></tr>
<tr><td>Operations</td><td>Potentially significant but mitigable</td></tr>
<tr><td rowspan="2">Alt. 6</td><td>Construction</td><td>Potentially significant but mitigable</td><td rowspan="2">Less than significant</td><td rowspan="2">See Alternative 1, Biological Resources, for a discussion of general construction BMPs and impact reduction measures regarding the MBTA.
Also see Alternative 3, Biological Resources for a list of site-specific impact reduction measures.
If an overhead powerline is required, a raptor-proof system would be installed to avoid adverse impacts to raptors including eagles protected by the Bald and Golden Eagle Protection Act (Wildhorse, Fremont, and Highway 115 sites).</td></tr>
<tr><td>Operations</td><td>Less than significant</td></tr>
<tr><td rowspan="2">Alt. 7</td><td>Construction</td><td>Negligible</td><td rowspan="2">Less than significant</td><td rowspan="2">See Alternative 1, Biological Resources, for a discussion of general construction BMPs.</td></tr>
<tr><td>Operations</td><td>Negligible</td></tr>
</table>

Table 4-1. Summary of Potential Environmental Effects from Baseline Conditions

Alternative	Activity	Level of Impact	Cumulative Impact	Impact Reduction Measures[1]
Cultural Resources				
No Action	N/A	Negligible	Negligible	Not applicable.
Alt. 1	Construction	Negligible	Negligible	None identified.
	Operations	Negligible		
Alt. 2a	Construction	Negligible	Negligible	None identified.
	Operations	Negligible		
Alt. 2b	Construction	Negligible	Negligible	None identified.
	Operations	Negligible		
Alt. 2c	Construction	Negligible	Negligible	None identified.
	Operations	Negligible		
Alt. 3	Construction	**Potentially significant but mitigable**	Less than significant	**A cultural resource survey would be completed following the guidance of the ICRMP if unsurveyed sites within this alternative are selected (Wildhorse, Ray Nixon and Fremont sites only). If surveys determine there would be impacts to cultural resources, the mitigation measures presented in the ICRMP would be implemented to avoid or reduce the impacts to less than significant levels.**
	Operations	Less than significant		
Alt. 4	Construction	Negligible	Negligible	None identified.
	Operations	Negligible		
Alt. 5	Construction	**Potentially significant but mitigable**	Less than significant	See Alternative 3, Cultural Resources regarding the Wildhorse site.
	Operations	Less than significant		
Alt. 6	Construction	**Potentially significant but mitigable**	Less than significant	See Alternative 3, Cultural Resources.
	Operations	Less than significant		
Alt. 7	Construction	**Potentially significant but mitigable**	Less than significant	**As the projects could involve modifications to existing buildings, the Fort Carson CRM Program personnel would be coordinated with prior to construction activities to ensure historic resources are not adversely affected.**
	Operations	Less than significant		
Socioeconomics				
No Action	N/A	Less than significant	Less than significant	Not applicable.
Alt. 1	Construction	Beneficial	Beneficial	Barriers and no trespassing signs would be placed around construction sites to deter children from playing in these areas and construction vehicles, equipment, and materials would be stored in fenced areas and secured when not in use.
	Operations	Negligible		

Table 4-1. Summary of Potential Environmental Effects from Baseline Conditions

Alternative	Activity	Level of Impact	Cumulative Impact	Impact Reduction Measures[1]
Alt. 2a	Construction	Beneficial	Beneficial	See Alternative 1, Socioeconomics.
	Operations	Negligible		
Alt. 2b	Construction	Beneficial	Beneficial	See Alternative 1, Socioeconomics.
	Operations	Negligible		
Alt. 2c	Construction	Beneficial	Beneficial	See Alternative 1, Socioeconomics.
	Operations	Negligible		
Alt. 3	Construction	Beneficial	Beneficial	See Alternative 1, Socioeconomics.
	Operations	Negligible		
Alt. 4	Construction	Beneficial	Beneficial	See Alternative 1, Socioeconomics.
	Operations	Negligible		
Alt. 5	Construction	Beneficial	Beneficial	See Alternative 1, Socioeconomics.
	Operations	Negligible		
Alt. 6	Construction	Beneficial	Beneficial	See Alternative 1, Socioeconomics.
	Operations	Negligible		
Alt. 7	Construction	Beneficial	Beneficial	See Alternative 1, Socioeconomics.
	Operations	Negligible		
Transportation				
No Action	N/A	Negligible	Negligible	Not applicable.
Alt. 1	Construction	Less than significant	Less than significant	Fort Carson would implement the following measures during construction: • Direct all construction vehicles to access the Installation via the gates closest to each project site; • Minimize construction vehicle movement during peak traffic hours; • Place construction staging areas where they would least interfere with traffic; and • Equip vehicles with backing alarms, two-way radios, and Slow Moving Vehicle signs when appropriate.
	Operations	Less than significant		
Alt. 2a	Construction	Less than significant	Less than significant	See Alternative 1, Transportation.
	Operations	Less than significant		
Alt. 2b	Construction	Less than significant	Less than significant	See Alternative 1, Transportation.
	Operations	Less than significant		
Alt. 2c	Construction	Less than significant	Less than significant	See Alternative 1, Transportation.
	Operations	Less than significant		
Alt. 3	Construction	Less than significant	Less than significant	See Alternative 1, Transportation.
	Operations	Negligible		

Table 4-1. Summary of Potential Environmental Effects from Baseline Conditions

Alternative	Activity	Level of Impact	Cumulative Impact	Impact Reduction Measures[1]
Alt. 4	Construction	Less than significant	Less than significant	See Alternative 1, Transportation.
	Operations	Negligible		
Alt. 5	Construction	Less than significant	Less than significant	See Alternative 1, Transportation.
	Operations	Negligible		
Alt. 6	Construction	Less than significant	Less than significant	See Alternative 1, Transportation.
	Operations	Negligible		
Alt. 7	Construction	Negligible	Less than significant	See Alternative 1, Transportation.
	Operations	Negligible		
Airspace				
No Action	N/A	Negligible	Negligible	Not applicable.
Alt. 1	Construction	Negligible	Less than significant	To avoid the potential for significant adverse impacts to airspace, Fort Carson would: • **Construct as far away from the airfield as possible on the eastern edge of the proposed site by the Installation boundary.** • **If feasible, construct smoke stack(s) no higher than 150 feet AGL and should be conditioned so as to eliminate the possibility of releasing excess heat, PM or condensation or the possibility of creating condensation through the normal process of heat being exposed to moisture naturally occurring in the atmosphere.** • **Conduct FAA consultation for compliance to the regulations and validation of continued safe flight operations.**
	Operations	**Potentially significant but mitigable**		
Alt. 2a	Construction	Negligible	Less than significant	See Alternative 1, Airspace.
	Operations	**Potentially significant but mitigable**		
Alt. 2b	Construction	Negligible	Less than significant	None identified.
	Operations	Less than significant		
Alt. 2c	Construction	Negligible	Less than significant	See Alternative 1, Airspace.
	Operations	**Potentially significant but mitigable**		
Alt. 3	Construction	Negligible	Less than significant	None identified.
	Operations	Less than significant		
Alt. 4	Construction	Negligible	Less than significant	None identified.
	Operations	Negligible		

Table 4-1. Summary of Potential Environmental Effects from Baseline Conditions

Alternative	Activity	Level of Impact	Cumulative Impact	Impact Reduction Measures[1]
Alt. 5	Construction	**Potentially significant but mitigable**	Less than significant	**The FAA would be consulted for compliance to the regulations and validation of continued safe flight operations in the siting and design of turbines. Coordination with the DoD Clearinghouse would also be required regarding avoiding adverse impacts to the DoD mission including the use of training ranges and airspace.**
	Operations	**Potentially significant but mitigable**		
Alt. 6	Construction	Negligible	Less than significant	None identified.
	Operations	Less than significant		
Alt. 7	Construction	Negligible	Negligible	None identified.
	Operations	Negligible		
Utilities				
No Action	N/A	Negligible	Negligible	Not applicable.
Alt. 1	Construction	Less than significant	Less than significant	In order to reduce potable water consumption during construction activities, non-potable water should be used for activities such as soil compaction and dust suppression. Use of non-potable water would reduce the Installation's potable water demand thus supporting overall potable water minimization efforts. The Army would determine if non-potable water would be a viable alternative for use in the WTE plant and/or biomass plant boilers. If feasible, non-potable water would be used in these boiler systems to reduce Installation potable water demands and further Installation potable water minimization efforts. Any plant over 10MW would likely require the completion of additional interconnection studies. Studies, if required, would be completed prior to project implementation to more fully understand interconnection requirements.
	Operations	Less than significant		
Alt. 2a	Construction	Less than significant	Less than significant	See Alternative 1, Utilities. In addition, biomass plant feedstock storage location and heavy equipment movement areas would be designed using BMPs that would reduce sedimentation caused by rainfall events.
	Operations	Less than significant		
Alt. 2b	Construction	Less than significant	Less than significant	See Alternative 2a, Utilities.
	Operations	Less than significant		
Alt. 2c	Construction	Less than significant	Less than significant	See Alternative 2a, Utilities.
	Operations	Less than significant		

Table 4-1. Summary of Potential Environmental Effects from Baseline Conditions

Alternative	Activity	Level of Impact	Cumulative Impact	Impact Reduction Measures[1]
Alt. 3	Construction	Less than significant	Less than significant	See Alternative 1, Utilities, for non-potable water use during construction. In addition, use of non-potable water to clean PV panels during operations could be used to reduce Installation potable water demands furthering potable water use minimization efforts.
	Operations	Less than significant		
Alt. 4	Construction	Less than significant	Beneficial	See Alternative 1, Utilities, for non-potable water use during construction.
	Operations	Beneficial		
Alt. 5	Construction	Less than significant	Less than significant	See Alternative 1, Utilities, for non-potable water use during construction.
	Operations	Negligible		
Alt. 6	Construction	Less than significant	Less than significant	See Alternative 3, Utilities.
	Operations	Less than significant		
Alt. 7	Construction	Less than significant	Beneficial	See Alternative 1, Utilities, for non-potable water use during construction.
	Operations	Beneficial		
Hazardous and Toxic Substances				
No Action	N/A	Negligible	Negligible	Not applicable.
Alt. 1	Construction	Less than significant	Less than significant	Fort Carson would implement standard construction BMPs to minimize the potential for spills and for the proper management and storage of hazardous waste in accordance with RCRA regulations (e.g., providing fencing around the construction site, establishing contained storage areas, responding immediately to spills, and controlling the flow of construction equipment and personnel). During operations of the plant, Fort Carson would: • Implement protective measures, such as providing secondary containment around hazardous material storage areas into the final design of the plant, as necessary and appropriate. • Create and follow any necessary new management plans for the plant to determine adequate procedures to manage the hazardous materials and wastes associated with the facility. • **Use SCR and other more effective air pollution control technologies which would be designed to remove acid gases, heavy metals, organic chemicals, and particulate matter in order to prevent the escape of combusted hazardous waste into the air.**
	Operations	**Potentially significant but mitigable**		
Alt. 2	Construction	Less than significant	Less than significant	See Alternative 1, Hazardous and Toxic Substances.
	Operations	Less than significant		

Table 4-1. Summary of Potential Environmental Effects from Baseline Conditions

Alternative	Activity	Level of Impact	Cumulative Impact	Impact Reduction Measures[1]
Alt. 2b	Construction	Less than significant	Less than significant	See Alternative 1, Hazardous and Toxic Substances.
	Operations	Less than significant		
Alt. 2c	Construction	Less than significant	Less than significant	See Alternative 1, Hazardous and Toxic Substances.
	Operations	Less than significant		
Alt. 3	Construction	Less than significant	Less than significant	See Alternative 1, Hazardous and Toxic Substances, for general BMPs during construction. In addition the following measures would be implemented for Alternative 3: • Construction of the Chiles site would be avoided in the ditch area so it is unlikely that contaminants would be disturbed during construction or operation. • If a SWMU is selected, Fort Carson would revise the landfill closure agreement and documentation with CDPHE. If revisions are required, Fort Carson would coordinate with CDPHE to maintain compliance. • Conduct a survey for hazardous and toxic materials prior to construction at the Magrath Avenue site due to its location in a former training area.
	Operations	Less than significant		
Alt. 4	Construction	Less than significant	Less than significant	See Alternative 1, Hazardous and Toxic Substances, for general BMPs during construction.
	Operations	Less than significant		
Alt. 5	Construction	Less than significant	Less than significant	See Alternative 1, Hazardous and Toxic Substances, for general BMPs during construction.
	Operations	Less than significant		
Alt. 6	Construction	Less than significant	Less than significant	See Alternative 1, Hazardous and Toxic Substances, for general BMPs during construction and operation. Also see Alternative 3, Hazardous and Toxic Substances, for a list of site-specific impact reduction measures.
	Operations	Less than significant		
Alt. 7	Construction	Less than significant	Less than significant	See Alternative 1, Hazardous and Toxic Substances, for general BMPs during construction.
	Operations	Less than significant		

1. Bolded entries indicate the potential for significant adverse impacts to the resource and the specific mitigation measure that would be employed to reduce the impact to less than significant.

AGL=Above Ground Level; BACT=Best Available Control Technology; BMP=best management practice; CCR=Colorado Code of Regulations; CDPHE=Colorado Department of Public Health and Environment; dBA=A-weighted decibel; FAA=Federal Aviation Administration; GHG=greenhouse gas; HAP=Hazardous Air Pollutant; ICRMP=Integrated Cultural Resources Management Plan; INRMP=Integrated Natural Resources Management Plan; MACT=Maximum Achievable Control Technology; MBTA=Migratory Bird Treaty Act; NESHAP=National Emission Standards for Hazardous Air Pollutants; NSPS=New Source Performance Standards; PM=particulate matter; PV=photovoltaic; RCRA=Resource Conservation Recovery Act; SPCC=Spill Prevention Control and Countermeasures; SWMU=Solid Waste Management Unit; SWPPP=Stormwater Pollution Prevention Plan; USFWS=U.S. Fish and Wildlife Service; WTE=waste-to-energy

5. LIST OF ACRONYMS

Acronym	**Definition**
a.m.	ante meridiem (i.e. before noon)
A/D	Approach/Departure
ADT	average daily traffic
AADT	annual average daily traffic
AAP	Army Alternative Procedures
ACHP	Advisory Council on Historic Preservation
ACP	access control point
ACUB	Army Compatible Use Buffer
ADP	Area Development Plan
AFB	Air Force Base
AGL	Above Ground Level
APE	Area of Potential Effect
AQCC	Air Quality Control Commission
AQCR	Air Quality Control Region
AR	Army Regulation
ARTCC	Air Route Traffic Control Center
AST	aboveground storage tank
ATC	Air Traffic Control
BAAF	Butts Army Air Field
BACT	Best Available Control Technology
BLM	Bureau of Land Management
BMP	Best Management Practice
C&D	construction and demolition debris
CAA	Clean Air Act
CAB	Combat Aviation Brigade
CAS	Close Air Support
CBWG	Colorado Bat Working Group
CCR	Colorado Code of Regulations
CDDs	chlorinated dibenzo-p-dioxin and tetrachlorodibenzo-p-dioxin
CDFs	chlorinated dibenzofurans and dibenzofurans
CDPHE	Colorado Department of Public Health and Environment
CEP	Central Energy Plant
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CNHP	Colorado Natural Heritage Program
CO	carbon monoxide
CO_2	carbon dioxide

CO_2e	carbon dioxide equivalents
COARNG	Colorado Army National Guard
COS	Colorado Springs Municipal Airport
COSHPO	Colorado State Historic Preservation Office
CPW	Colorado Parks and Wildlife
CRM	Cultural Resources Management
CSU	Colorado Springs Utilities
CWA	Clean Water Act
dB	decibel
dBA	A-weighted decibel
DC	direct current
DME	Distance Measurement Equipment
DNL	Day-night Average Sound Level
DoD	Department of Defense
DPW	Directorate of Public Works
DPW-ED	Directorate of Public Works – Environmental Division
DRMO	Defense Reutilization and Marketing Office
DZ	Drop Zone
EA	Environmental Assessment
e.g.	exemplī grātiā (for example)
IICEP	Intergovernmental Coordination for Environmental Planning
EGS	enhanced geothermal system
EIS	Environmental Impact Statement
EISA	Energy Independence and Security Act
EO	Executive Order
EOD	Explosive Ordnance Detachment
EPA	United States Environmental Protection Agency
ESCO	energy services company
ESP	electrostatic precipitator
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FCSS	Fort Carson Support Services
FL	Flight Level
FY	Fiscal Year
gal/MWh	gallons per megawatt hours
GCR	General Conformity Rule
GHG	greenhouse gas
gl/ft^2	gallons per square foot
gpd	gallons per day
gpm	gallons per minute

gpy	gallons per year
GSHP	Ground-source heat pump
GVWR	Gross vehicle weight rating
HAP	hazardous air pollutant
HCl	hydrochloric acid
HPDE	high density polyethylene
HTMW	Hazardous and Toxic Materials and Wastes
HWMP	Hazardous Waste Management Plan
HWSF	Hazardous Waste Storage Facility
I	Interstate
IFR	Instrument Flight Rules
ILS	Instrument Landing System
INRMP	Integrated Natural Resources Management Plan
ISA	International Standard Atmosphere
ISWMP	Integrated Solid Waste Management Plan
IWTP	Industrial Wastewater Treatment Plant
JTAC	Joint Tactical Attack Controller
l/ft^2	liters per square foot
LEED	Leadership in Engineering and Environmental Design
Leq	Equivalent Sound Level
LEW	Low Erosivity Waiver
LID	Low Impact Development
LOS	level of service
lpd	liters per day
LQG	Large Quantity Generator
MBTA	Migratory Bird Treaty Act
MMBTU	million metric British thermal units
MOA	Military Operations Area
MS4	Municipal Separate Storm Sewer System
MSDS	Material Safety Data Sheets
MSL	Mean Sea Level
MSW	municipal solid waste
MVA	mega-volt amperes
MWh	megawatt-hour
NAAQS	National Ambient Air Quality Standards
NAS	National Airspace System
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NM	Nautical Mile
NNSR	Nonattainment New Source Review

NOx	oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NREL	National Renewable Energy Laboratory
NRHP	National Register of Historic Places
NSA	Noise Sensitive Area
NSCR	non-selective catalytic reagents
NSPS	New Source Performance Standards
NWI	National Wetland Inventory
O_3	ozone
p.m.	Post Meridiem (i.e. after noon)
P2	Pollution Prevention
Pb	lead
PCB	Polychlorinated Biphenyl
PCMS	Piñon Canyon Maneuver Site
PCS	power conditioning system
PM	particulate matter
PM_{10}	particulate matter less than 10 microns in diameter
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
ppb	parts per billion
ppm	parts per million
PSD	Prevention of Significant Deterioration
PTE	potential to emit
PUB	Pueblo Memorial Airport
PV	Photovoltaic
PVC	polyvinyl chloride
PX	Post Exchange
RA	Restricted Area
RCRA	Resource Conservation and Recovery Act
REC	renewable energy certificates
ROI	Region of Influence
ROW	right-of-way
SAP	Satellite Accumulation Points
SCR	selective catalytic reactors
SH	State Highway
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SO2	sulfur dioxide
SPCC	Spill Prevention Control and Countermeasures
SWMP	Stormwater Management Plan

SWMU	Solid Waste Management Unit
SWPPP	Stormwater Pollution Prevention Plan
TCP	Traditional cultural property
TMDL	Total Maximum Daily Load
tpy	tons per year
TSDF	Treatment, Storage, and Disposal Facility
U.S.	United States
UFC	Unified Facilities Criteria
USACE	United States Army Corps of Engineers
USAEC	United States Army Environmental Command
USC	United States Code
USFWS	United States Fish and Wildlife Service
UST	underground storage tank
UV	ultraviolet
UWAP	Universal Waste Accumulation Points
UXO	unexploded ordnance
VEC	valued environmental component
VFD	variable frequency drive
VFR	Visual Flight Rules
VOC	volatile organic compounds
VOR	Very High Frequency Omni-Directional Range
WAPA	Western Area Power Administration
WARM	Waste Reduction Model
WTE	waste-to-energy
WWTP	Wastewater Treatment Plant

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Appendices

APPENDIX A
AGENCY COORDINATION AND PUBLIC INVOLVEMENT

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A.1 Agency Scoping Letters

January 27, 2012

U.S. Army Environmental Command

Subject: Notice of Scoping – Fort Carson Net Zero Waste, Water, and Energy Implementation EA

To All Concerned:

Headquarters, Department of Army (DA) and Fort Carson are preparing an Environmental Assessment (EA) to identify and address potential environmental impacts associated with the implementation of DA Net Zero Energy, Water, and Waste initiatives at Fort Carson, Colorado. Fort Carson is located south of Colorado Springs, Colorado, east of the Rocky Mountain Front Range, and occupies portions of El Paso, Pueblo, and Fremont counties.

Net Zero Background

In April, 2011, the Assistant Secretary of the Army for Installations, Energy, and Environment announced that Fort Carson was selected as one of the Army's pilot installations for the integrated implementation of Net Zero goals across all three Net Zero areas (energy, water, and waste). The Army Net Zero initiative is a holistic approach to addressing energy, water, and waste at Army installations. The Army Net Zero approach is comprised of five interrelated steps: reduction, re-purpose, recycling and composting, energy recovery, and disposal.

Proposed Action

The Proposed Action is to implement the Army's Net Zero waste, water, and energy goals at Fort Carson to secure the installation's mission moving into the future. In implementing Net Zero at Fort Carson, the installation would exceed Federal and state energy, water, and waste reduction mandates while achieving enhanced energy and water security, increased efficiency, and operating cost reductions. Fort Carson would evaluate and implement where feasible: (1) producing as much renewable energy on the installation as it uses annually; (2) limiting the consumption of freshwater resources and returning water back to the same watershed so as not to deplete the groundwater and surface water resources of that region in quantity or quality; and (3) reducing, reusing, and recovering waste streams, converting them to resource value with zero solid waste landfilling. As part of the Proposed Action, Fort Carson would implement policies, procedures, and best management practices (BMPs) similar in nature to their current sustainability program to maximize resource re-utilization, limit waste generation, increase resource re-purposing, and increase water and energy utilization efficiencies in new and existing facilities.

Scope of the EA Analysis

The EA is being prepared in accordance with National Environmental Policy Act of 1969 (NEPA), the Council on Environmental Quality (CEQ) regulations for implementing NEPA (40 Code of Federal Regulations (CFR) 1500 -1508), and DA regulations 32 CFR 650 *Environmental Protection and Enhancement* and 32 CFR 651 *Environmental Analysis of Army Actions*. The following Valued Environmental Component (VECs) were identified by the Army during internal scoping as having the potential for adverse impacts and will be analyzed within the EA document: Land Use, Air Quality and Greenhouse Gas, Noise, Geology and Soils, Water Resources, Biological Resources, Cultural Resources, Socioeconomics, Traffic and Transportation, Airspace, Utilities, and Hazardous and Toxic Substances.

Alternatives

During the initial planning stages, Fort Carson evaluated all land areas within the installation for suitability of Net Zero projects. Factors considered for determining a suitable site included mission compatibility, grid access and electrical tie-in potential (for renewable energy projects), on-installation energy/water generation potential for increased energy and water security, geophysical factors, environmental factors, safety and unexploded ordnance, project financeability and use of proven technologies, compliance with Federal Mandates and Department of Defense or Army goals, utility considerations and conflicts among Net Zero goals. Six Proposed Action alternatives are being considered for evaluation in the EA Net Zero implementation at Fort Carson, along with the No Action Alternative.

- **Alternative 1**: Construction and Operation of an up to 13 MegaWatt (MW) Waste-to-Energy (WTE) Plant (Figure 1)
- **Alternative 2**: Construction and Operation of an up to 13 MW Biomass Plant (Figure 1)
- **Alternative 3**: Use of Photovoltaic (PV) Technology (Figures 1 & 2)
- **Alternative 4**: Expansion of the Existing Non-Potable Water System (Figure 3)
- **Alternative 5**: Construction and Operation of Wind Turbines (Figure 2)
- **Alternative 6**: Implementation of Future Renewable Energy Development (geothermal or additional solar energy Net Zero projects) within Net Zero Footprints (Figure 4)

As part of Net Zero implementation at Fort Carson, the Army may choose to implement one or a combination of these alternatives. As both Alternatives 1 and 2, however, involve the construction and operation of a full-scale energy plant, only one of these two alternatives would be selected for implementation. Additionally, as Alternative 6 involves a programmatic approach to future renewable energy development, a checklist of environmental screening criteria will be developed and considered in the EA as part of Alternative 6 to assess and capture future impacts as specific projects are identified and sited in the future and tiered off this programmatic alternative.

Scoping Information

Interested parties are invited to identify the issues, within their statutory responsibilities, that should be considered in the EA on or before Wednesday, March 14, 2012. Please send your comments regarding the scope and content of the EA, along with the name and address of an appropriate contact person to:

Brad Johnson
NEPA Coordinator
1626 Evans St, Bldg 1219
Fort Carson, CO 80913-4362
bradley.b.johnson1.civ@mail.mil

In addition, Fort Carson will be hosting an agency scoping meeting on February 29, 2012, 1:00pm- 5:00pm in in the Princeton Classroom (Room 225) of Building 1219. The purpose of the meeting will be to provide an overview of the Army's Net Zero initiative, explain the purpose and need for the Proposed Action, and to provide an overview of the alternatives being considered within the EA.

Thank you for your interest and assistance in this regard.

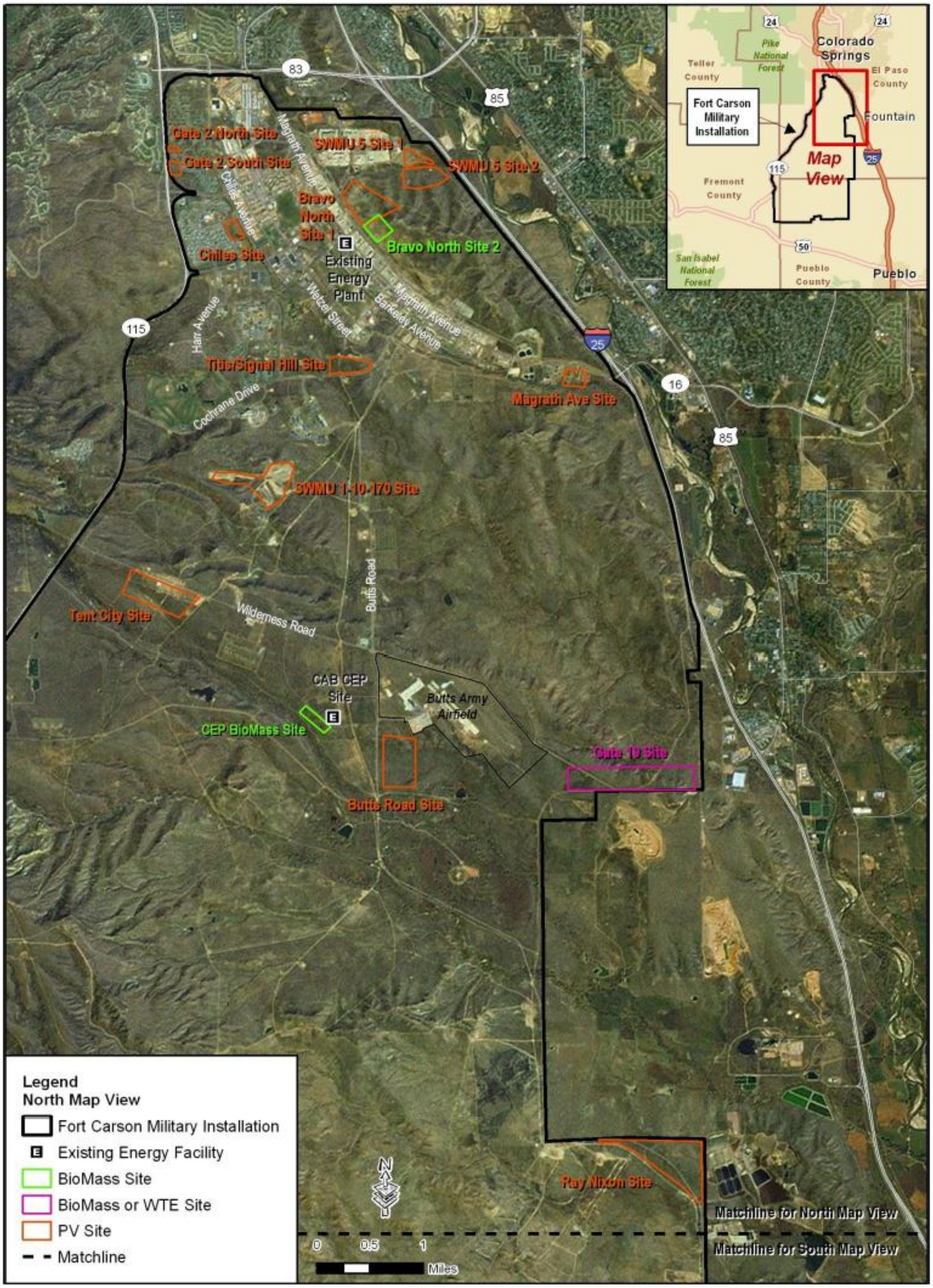

Figure 1. Proposed Net Zero Energy Sites (North Map View)

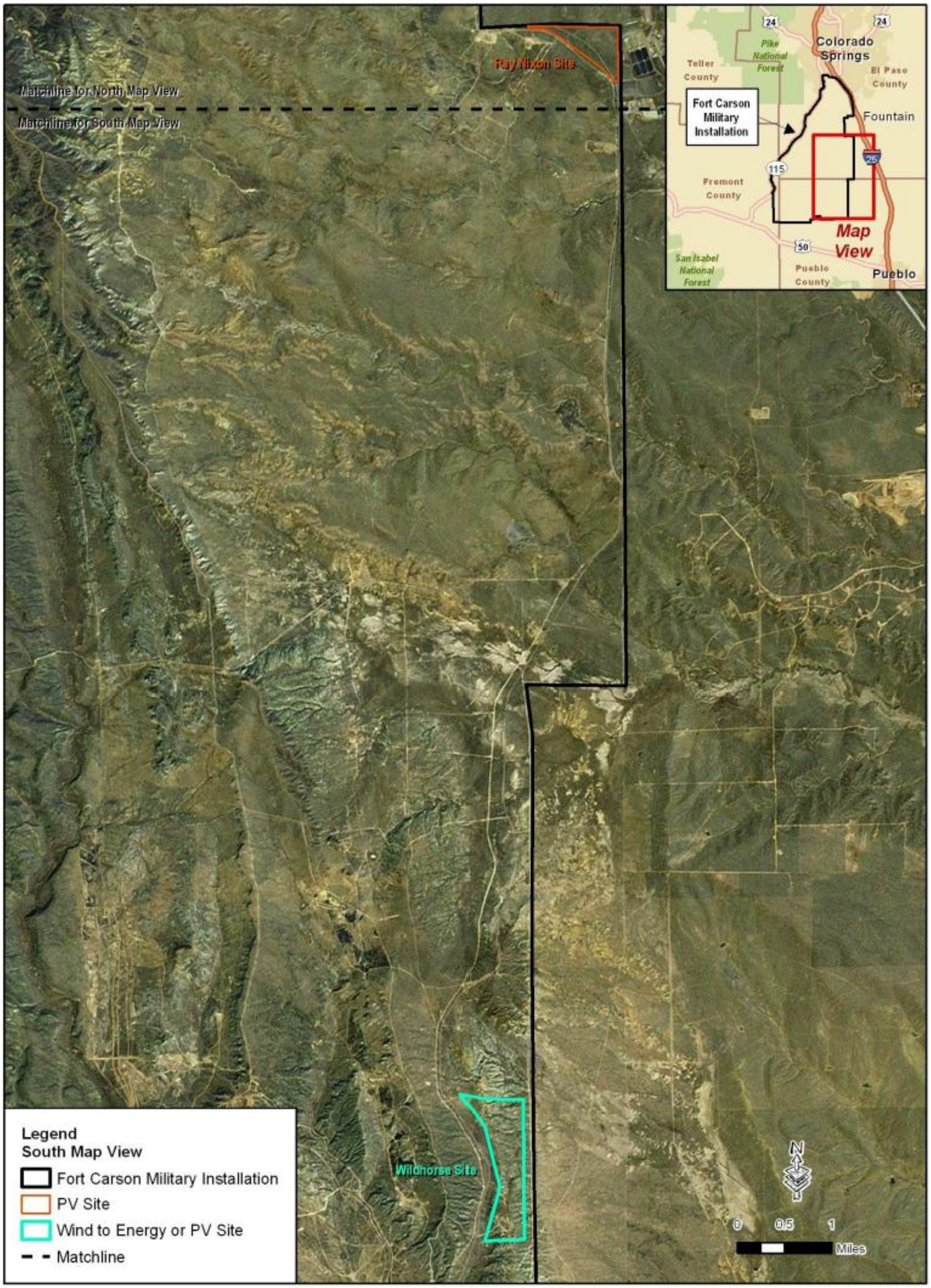

Figure 2. Proposed Net Zero Energy Sites (South Map View)

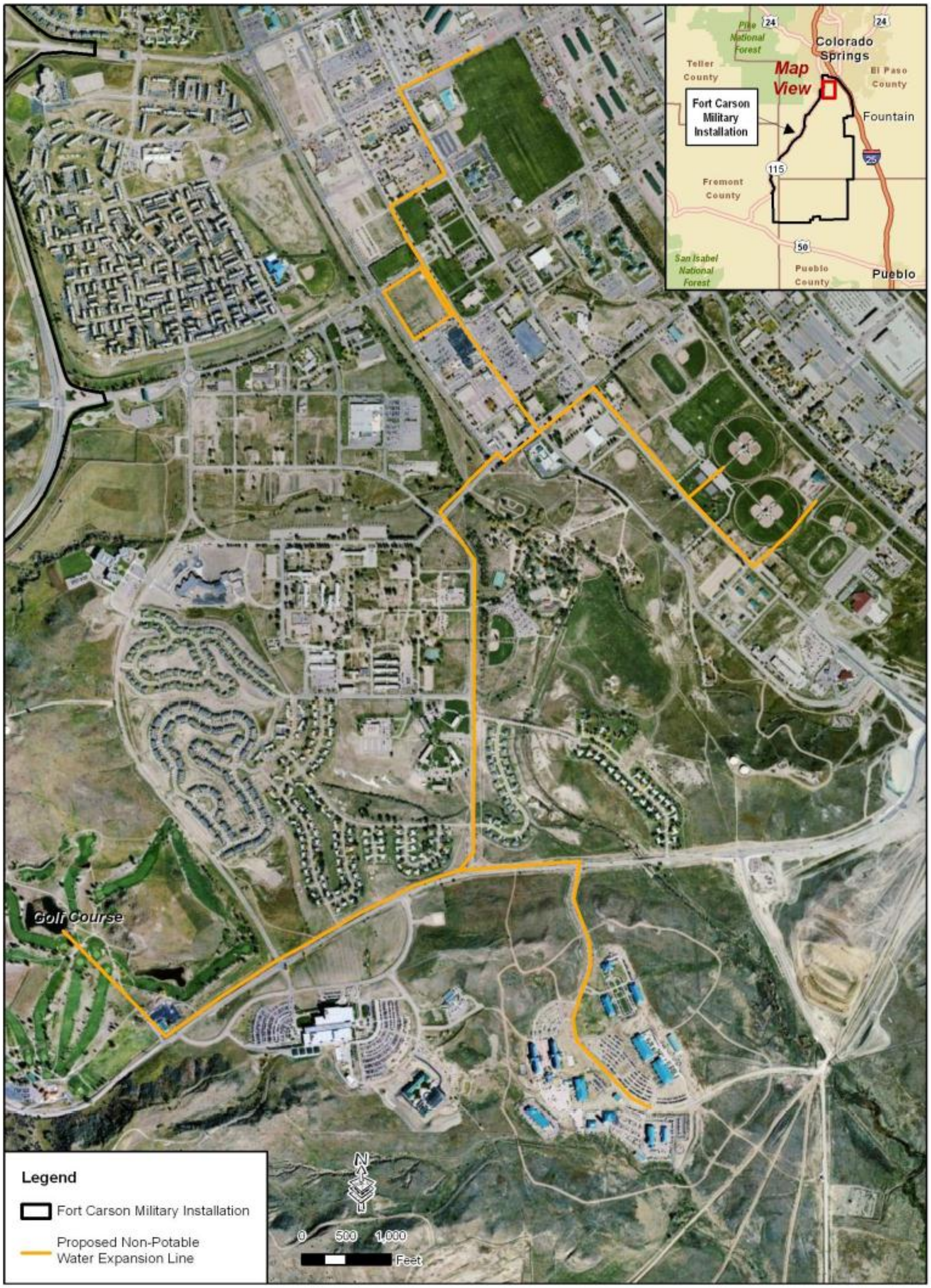

Figure 3. Proposed Non-Potable Water System Expansion

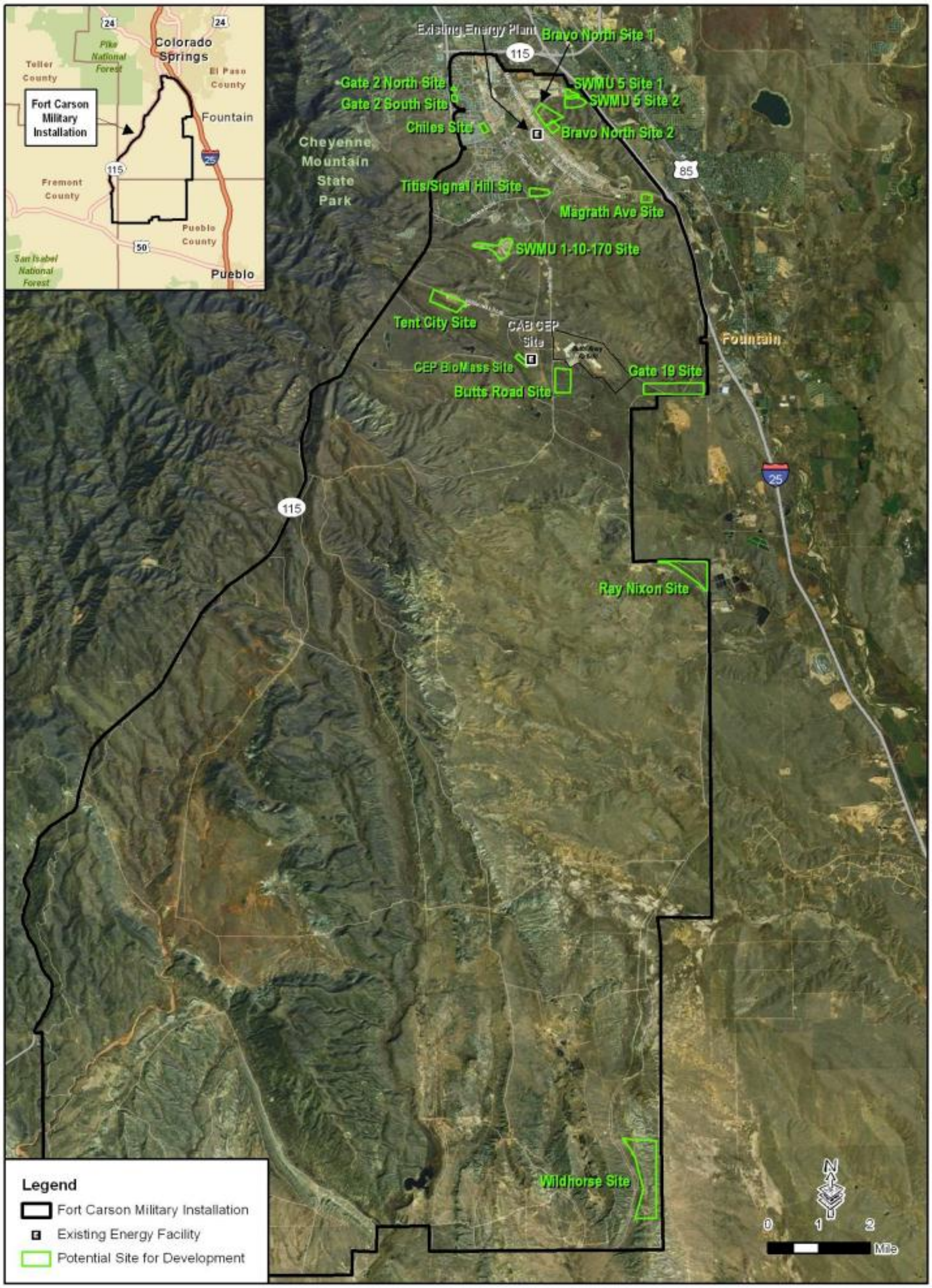

Figure 4. Proposed Future Renewable Energy Development Sites

A.2 USFWS Scoping Response

U.S. FISH AND WILDLIFE SERVICE
☐ CONCUR NO EFFECT
☐ CONCUR NOT LIKELY TO ADVERSELY AFFECT
☒ NO COMMENT
Susan C. Linner MAR - 6 2012
COLORADO FIELD SUPERVISOR (DATE)
Susan C. Linner

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January 27, 2012

U.S. Army Environmental Command

2012TA0251

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A.3 SHPO Scoping Response

HISTORY Colorado

February 24, 2012

Brad Johnson
NEPA Coordinator
1626 Evans Street, Building 1219
Fort Carson, Colorado 80913-4362

Re: Notice of Scoping – Fort Carson Net Zero Waste, Water, and Energy Implementation EA (CHS #61348)

Dear Mr. Johnson,

Thank you for your correspondence dated January 27, 2012 (received by our office on February 8, 2012) regarding the subject project.

In order to determine the effect of the proposed project on cultural resources, we recommend that you coordinate your National Environmental Policy Act (NEPA) studies with the studies required under Section 106 of the National Historic Preservation Act (NHPA). According to 36 CFR 800.8 of Section 106, "Federal agencies are encouraged to coordinate compliance with section 106 and the procedures in this part with any steps taken to meet the requirements of the National Environmental Policy Act."

Please be aware that the requirements of NEPA are separate and distinct from those of Section 106 of the NHPA. Unless the Federal agency notifies our office in advance that they intend to use NEPA to comply with Section 106 of NHPA, a complete Section 106 review should be completed. The findings from the Section 106 studies can inform the NEPA studies, such as including mitigation measures identified under Section 106 into the NEPA decision document. Once we receive the Section 106 studies, we will be able to fully complete our reviews under both Section 106 and NEPA.

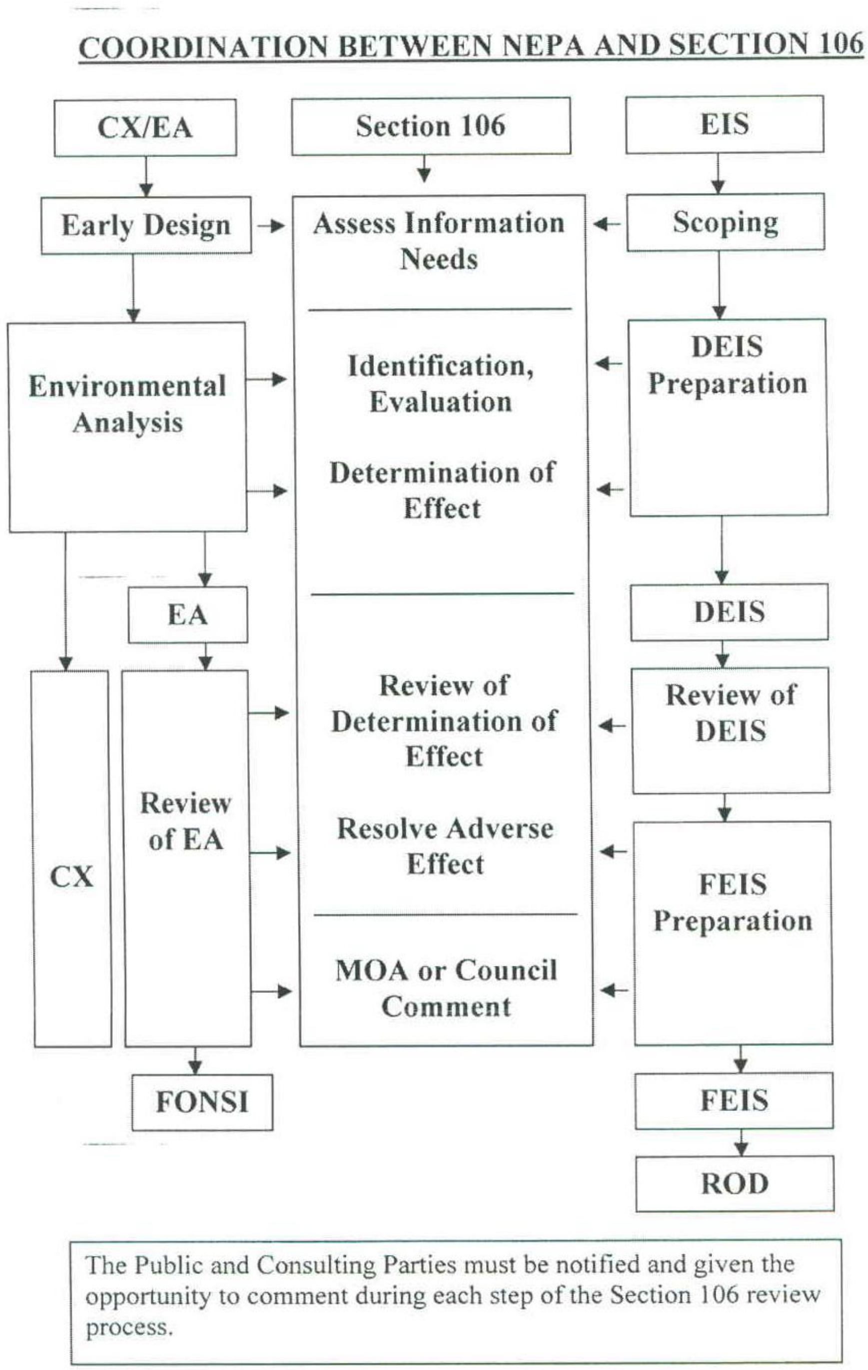
We recommend that you begin the Section 106 review process as early as possible by initiating the identification of consulting parties and inviting them to participate in the process as well as consulting regarding the establishment of an appropriate Area of Potential Effects (APE). Also, Section 110 of the National Historic Preservation Act states that Federal agencies should "coordinate with the earliest phases of any environmental review carried out under the National Environmental Policy Act."

We have enclosed a flow chart that explains the coordination between NHPA and NEPA. If we may be of further assistance, please contact Mark Tobias, Section 106 Compliance Manager, at (303) 866-4674 or mark.tobias@state.co.us.

Sincerely,

for Edward C. Nichols
State Historic Preservation Officer
ECN/MAT

WWW.HISTORYCOLORADO.ORG
HISTORY COLORADO CENTER 1200 BROADWAY DENVER COLORADO 80203


COORDINATION BETWEEN NEPA AND SECTION 106
CX/EA
Section 106
EIS
Early Design
Assess Information Needs
Scoping
Environmental Analysis
Identification, Evaluation
Determination of Effect
DEIS Preparation
EA
DEIS
CX
Review of EA
Review of Determination of Effect
Resolve Adverse Effect
MOA or Council Comment
Review of DEIS
FEIS Preparation
FONSI
FEIS
ROD
The Public and Consulting Parties must be notified and given the opportunity to comment during each step of the Section 106 review process.

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APPENDIX B
FORT CARSON NET ZERO PROJECT CHECKLIST

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FORT CARSON NET ZERO ENERGY PROJECT CHECKLIST

PROJECT/PROPOSED ACTION TITLE:
PROPONENT INFORMATION:
WORK ORDER NUMBER:

DESCRIPTION AND LOCATION:

Enter project grid coordinates or attach a location map.

Enter acreage of footprint disturbance.

Name the watershed where the proposed project is located.

Describe type of activity (construction).

Describe type of activity (use).

Describe any other relevant project components.

FORM COMPLETED BY: ________________________ **DATE:** _________________

After providing a detailed description of the proposed project, proponents are to complete the attached Checklist based on all available information and thorough environmental analysis as early in the planning process as possible. Comment sections are provided for discussion of potential mitigation regarding each valued environmental component (VEC).

Information contained within this Checklist may support a finding as to whether the proposed project falls within the scope of the Fort Carson Net Zero Waste, Water, and Energy Implementation Environmental Assessment's (Net Zero EA) programmatic Alternative 6, *Implement Future Renewable Energy Development within Net Zero Footprints Identified by the Army*. Fort Carson NEPA staff should be provided a copy of this checklist and consulted prior to project activity to ensure project compliance with NEPA. Fort Carson NEPA staff are to review each project description and checklist and certify whether the proposed project may be "tiered" off the programmatic Alternative 6 of the Net Zero EA. Project managers should also maintain this checklist as part of the proposed project administrative record. Submission of the checklist as early in the planning process as possible is recommended.

NEPA Review: Based on the information contained within this Checklist and an independent assessment of potential impacts to the environment, it is determined that the Proposed Action is not sufficient to warrant preparation of a separate EA. The Proposed Action would not degrade the existing environment, is not environmentally controversial, nor would it adversely affect environmentally sensitive resources. Anticipated impacts associated with this project are comparable with those addressed in the *Fort Carson Net Zero Waste, Water, and Energy Implementation EA, 2012*.

Form Reviewed by: ____

Signature:__________________________________ **Date:**_______________

Note: No other NEPA Review Form is required to supplement the above certification.

Land Use

Yes	No	
☐	☐	Would the proposed project pose a conflict to land use or adjacent land uses?
☐	☐	Would the proposed project adversely reduce and/or alter training land uses?
☐	☐	Could impacts to land use from the proposed project be greater than those described in Section 3.2, Land Use, Alternative 6 discussion of the *Fort Carson Net Zero Waste, Water, and Energy Implementation EA*?
☐	☐	Was "yes" answered to any of the above questions? *If "yes", provide specific mitigation measures, practices, or procedures that would be implemented to reduce impacts.*

Comments:____

____

____

Air Quality

Yes	No	
☐	☐	Would the proposed project pose a violation of National Ambient Air Quality Standards or adversely affect the attainment status of the region?
☐	☐	Would the proposed project be within the carbon monoxide maintenance area? If yes, prepare a record of non-applicability (RONA) and attach it to the checklist
☐	☐	Would the proposed project generate substantial greenhouse gas emissions (>25,000 metric tons of carbon dioxide equivalents per year)?
☐	☐	Would the proposed project require any new stationary sources such as boilers or generators?
☐	☐	Would the proposed project affect Part V Permit conditions or require and operating permit?
☐	☐	Could impacts to air quality and greenhouse gas from the proposed project be greater than those described in Section 3.3, Air Quality and Greenhouse Gas, Alternative 6 discussion of the *Fort Carson Net Zero Waste, Water, and Energy Implementation EA*?
☐	☐	Was "yes" answered to any of the above questions? *If "yes", provide specific mitigation measures, practices, or procedures that would be implemented to reduce impacts.*

Comments:____

____

____

Noise

Yes	No	
☐	☐	Would the proposed project generate noise that would highly annoy communities within or along the perimeter of the Installation?
☐	☐	Would the proposed project violate any Federal, state, or local noise ordinance?
☐	☐	Could the proposed project generate adverse long-term noise impacts?
☐	☐	Could impacts to the noise environment from the proposed project be greater than those described in Section 3.4, Noise, Alternative 6 discussion of the *Fort Carson Net Zero Waste, Water, and Energy Implementation EA?*
☐	☐	Was "yes" answered to any of the above questions? *If "yes", provide specific mitigation measures, practices, or procedures that would be implemented to reduce impacts.*

Comments:____

____

____

Geology and Soils

Yes	No	
☐	☐	Is the site located on previously undisturbed ground? If no, what existing site disturbances are present?
☐	☐	Would the proposed project disturb soils that are susceptible to soil erosion?
☐	☐	Would the proposed project be constructed on soils with high clay content (i.e. shrink-swell characteristics)?
☐	☐	Would the proposed project permanently alter geology or topography?
☐	☐	Could impacts to geology and soils from the proposed project be greater than those described in Section 3.5, Geology and Soils, Alternative 6 discussion of the *Fort Carson Net Zero Waste, Water, and Energy Implementation EA?*
☐	☐	Was "yes" answered to any of the above questions? *If "yes", provide specific mitigation measures, practices, or procedures that would be implemented to reduce impacts.*

Comments:____

____

____

____

Water Resources

Yes	No	
☐	☐	Is any part of the proposed project footprint near a waterway (ditch, stream, wetland, etc.) or within an area prone to flooding?
☐	☐	Would the proposed project result in ground disturbance of 1 acre or greater or would the proposed project result in increased impervious surfaces? Indicate the acres of ground disturbance impact: Temporary Permanent
☐	☐	Would the proposed project involve either direct or indirect discharge (or runoff) of sediment into a waterway or storm sewer?
☐	☐	Would the proposed project result in diversion or obstruction of stream flow?
☐	☐	Could the proposed project result in potential impacts to surface water quality resulting in long-term impacts (chemical, physical, or biological effects) that would adversely alter the historical baseline or a change in surface water impairment status?
☐	☐	Would the potential exist to impact groundwater?
☐	☐	Could impacts to water resources from the proposed project be greater than those described in Section 3.6, Water Resources, Alternative 6 discussion of the *Fort Carson Net Zero Waste, Water, and Energy Implementation EA*?
☐	☐	Was "yes" answered to any of the above questions? *If "yes", provide specific mitigation measures, practices, or procedures that would be implemented to reduce impact.*

Comments:____

____

____

Biological Resources

Yes	No	
☐	☐	Could the proposed project significantly contribute to the introduction, continued existence, or spread of noxious weeds or non-native invasive species known to occur in the area (Executive Order (EO) 13112)?

☐ ☐ Will the proposed project involve vegetation removal (habitat fragmentation or conversion)? If "yes", indicate the acres of vegetation impact: Temporary Permanent

☐ ☐ Does the proposed project location contain wildlife habitat?

☐ ☐ Would the loss or impairment of habitat represent a substantial portion of local habitat?

☐ ☐ Would the affected habitat be suitable for nesting by migratory birds protected by the Migratory Bird Treaty Act?

☐ ☐ Would the affected habitat be suitable for nesting by bald or golden eagles protected under the Bald and Golden Eagle Protection Act?

☐ ☐ Does onsite habitat contain black-tailed prairie dog colonies, which can be prey items for bald and golden eagles and possible habitat for the Colorado-Threatened burrowing owl?

☐ ☐ Could impacts to biological resources from the proposed project be greater than those described in Section 3.7, Biological Resources, Alternative 6 discussion of the *Fort Carson Net Zero Waste, Water, and Energy Implementation EA*?

☐ ☐ Was "yes" answered to any of the above questions? *If "yes", provide specific mitigation measures, practices, or procedures that would be implemented to reduce impact.*

Comments:____

Cultural Resources

Yes No

☐ ☐ Would the project involve earth-moving or excavation activities?

☐ ☐ Would the project alter a potentially historic building/district or its immediate surroundings?

☐ ☐ Would the project potentially restrict access or increase safety concerns of Native Americans using Traditional Cultural Properties or Sacred Sites?

☐ ☐ Does the area require a cultural resource survey because it has not been addressed in previous surveys (requires consultation with the Fort Carson Cultural Resources Manager to determine the answer)?

☐ ☐ Does the area contain archaeological, architectural, or historic resources that are eligible for the National Register of Historic Places or resources of Native American significance such as Traditional Cultural Properties or Sacred Sites (requires consultation with the Fort Carson Cultural Resources Manager to determine the answer)?

☐ ☐ Could impacts to cultural resources from the proposed project be greater than those described in Section 3.8, Cultural Resources, Alternative 6 discussion of the *Fort Carson Net Zero Waste, Water, and Energy Implementation EA*?

☐ ☐ Was "yes" answered to any of the above questions? *If "yes", provide specific mitigation measures, practices, or procedures that would be implemented to reduce impact.*

Comments:____

Socioeconomics

Yes No

☐ ☐ Could the proposed project cause a public health hazard?

☐ ☐ Does the proposed project have the potential to create a disproportionate environmental health or safety risk to children?

☐ ☐ Does the proposed project have the potential to create a disproportionate environmental, economic, social, or health impacts on minority or low-income populations (EO 12898)?

☐ ☐ Could the proposed action adversely affect housing, schools, or community services?

☐ ☐ Could impacts to socioeconomics from the proposed project be greater than those described in Section 3.9, Socioeconomics, Alternative 6 discussion of the *Fort Carson Net Zero Waste, Water, and Energy Implementation EA*?

☐ ☐ Was "yes" answered to any of the above questions? *If "yes", provide specific mitigation measures, practices, or procedures that would be implemented to reduce impact.*

Comments:____

Traffic and Transportation

Yes No

☐ ☐ Would the proposed project cause an increase in traffic volumes or delays to levels that impair a roadway's handling capacity or increase traffic safety hazards?

☐ ☐ Could the proposed project cause road failure resulting in rutting, cracking, or other pavement problems that requires substantial maintenance or construction activities?

☐ ☐ Could impacts to traffic and transportation from the proposed project be greater than those described in Section 3.10, Traffic and Transportation, Alternative 6 discussion of the *Fort Carson Net Zero Waste, Water, and Energy Implementation EA*?

☐ ☐ Was "yes" answered to any of the above questions? *If "yes", provide specific mitigation measures, practices, or procedures that would be implemented to reduce impact.*

Comments:____

Airspace

Yes No

☐ ☐ Would the proposed project cause a violation of Federal Aviation Administration regulations that undermines the safety of military, civil, or commercial aviation?

☐ ☐ Would the proposed project infringe on current military, private, or commercial flight activity and flight corridors?

☐ ☐ Could impacts to airspace from the proposed project be greater than those described in Section 3.11, Airspace, Alternative 6 discussion of the *Fort Carson Net Zero Waste, Water, and Energy Implementation EA*?

☐ ☐ Was "yes" answered to any of the above questions? *If "yes", provide specific mitigation measures, practices, or procedures that would be implemented to reduce impact.*

Comments:____

Utilities

Yes No

☐ ☐ Would the proposed project require the need for additional utilities to operate, including electrical, sewer, fiber optics, gas, water?

☐ ☐ Would the proposed project cause an impairment of utility service to local communities, homes, or businesses?

☐ ☐ Could impacts to utilities from the proposed project be greater than those described in Section 3.12, Utilities, Alternative 6 discussion of the *Fort Carson Net Zero Waste, Water, and Energy Implementation EA*?

☐ ☐ Was "yes" answered to any of the above questions? *If "yes", provide specific mitigation measures, practices, or procedures that would be implemented to reduce impact.*

Comments:____

Hazardous and Toxic Substances

Yes No

☐ ☐ Has the proposed project site been determined by Range Control to need UXO clearance?

☐ ☐ Does the area contain contamination concerns?

☐ ☐ Is the proposed project located on an solid waste management unit (SWMU)? If yes, the Colorado Department of Public Health and Environment (CDPHE) would need to approve the design and a 45-day review period followed by a 90-day public comment period would likely be required.

☐ ☐ Would the proposed project result in an increased risk to the health and safety of Soldiers, Fort Carson personnel, or contractors?

☐ ☐ Would the proposed project impair the Installation's ability to meet Federally-mandated or Army objectives for waste minimization and pollution prevention or exceed the existing facility or system capacity for hazardous waste/hazardous material management?

☐ ☐ Could impacts to hazardous and toxic substances from the proposed project be greater than those described in Section 3.13, Hazardous and Toxic Substances, Alternative 6 discussion of the *Fort Carson Net Zero Waste, Water, and Energy Implementation EA?*

☐ ☐ Was "yes" answered to any of the above questions? *If "yes", provide specific mitigation measures, practices, or procedures that would be implemented to reduce impact.*

Comments:____

Cumulative Effects

Yes No

☐ ☐ Would this project, in combination with past projects tiered off this EA or foreseeable projects, cause any resource-specific significance threshold (as described in Section 3.1.2 and Table 3.1-1 of the *Fort Carson Net Zero Waste, Water, and Energy Implementation EA)* to be exceeded?

Comments:____

Other Considerations

Yes* No

☐ ☐ Is the proposed project or its potential impacts considered controversial to the public?

☐ ☐ Is the proposed project or its potential impacts considered environmentally controversial?

☐ ☐ Could the proposed project result in high or uncertain environmental risks?

Comments:____

****Note: A "Yes" to any of the Other Considerations (above) may warrant further NEPA analysis and Fort Carson NEPA staff should be consulted.***

APPENDIX C
FORT CARSON NET ZERO WASTE, WATER, AND ENERGY IMPLEMENTATION
AIR STUDY

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PRELIMINARY DRAFT

Air Quality Study
Fort Carson Net Zero Waste, Water, and Energy Implementation

Prepared by

LPES, Inc.
Timothy Lavallee, P.E.
tlavallee@lpesinc.com
(757) 357-0730

18 July 2012

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1.0 TABLE OF CONTENTS

2.0 LIST OF TABLES

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Air pollution is the presence in the outdoor atmosphere of one or more contaminants such as to be injurious to humans, plants or animals, or to interfere with the comfortable enjoyment of life. Air quality as a resource incorporates several components that describe the levels of overall air pollution within a region, and sources of and regulations governing air emissions. Below is a discussion of the National Ambient Air Quality Standards (NAAQS), local ambient air quality, regional climate, and greenhouse gases (GHG).

1.0 AFFECTED ENVIRONMENT

1.1 NATIONAL AMBIENT AIR QUALITY STANDARDS AND ATTAINMENT STATUS

The United States Environmental Protection Agency (EPA) Region 8 and Colorado Department of Public Health and Environment (CDPHE) regulate air quality in Colorado. The Clean Air Act (CAA) (42 U.S.C. 7401–7671q), as amended, gives EPA the responsibility to establish the primary and secondary NAAQS (40 CFR Part 50) that set acceptable concentration levels for seven criteria pollutants: particulate matter less than 10 microns (PM_{10}), particulate matter less than 2.5 microns ($PM_{2.5}$), sulfur dioxide (SO_2), carbon monoxide (CO), oxides of nitrogen (NO_x), ozone (O_3), and lead (Pb). Short-term standards (i.e., 1-, 8-, and 24-hour periods) have been established for pollutants contributing to acute health effects, while long-term standards (i.e., annual averages) have been established for pollutants contributing to chronic health effects. Each state has the authority to adopt standards stricter than those established under the Federal program; however, the State of Colorado accepts the Federal standards.

Federal regulations designate air quality control regions (AQCRs) that have concentrations of one or more of the criteria pollutants that exceed the NAAQS as nonattainment areas. Federal regulations designate AQCRs with levels below the NAAQS as attainment areas. Maintenance areas are AQCRs that have previously been designated nonattainment and have been redesignated to attainment for a probationary period through implementation of maintenance plans. According to the severity of the pollution problem, nonattainment areas can be categorized as marginal, moderate, serious, severe, or extreme.

Fort Carson is within the San Isabel Intrastate AQCR (40 CFR 81.12). The majority of Fort Carson is located within El Paso County, with portions in Fremont and Pueblo counties. Both Fremont and Pueblo counties are classified as attainment for all criteria pollutants (EPA, 2012a). The Colorado Springs Urbanized Area in El Paso County is in attainment for all NAAQS criteria pollutants. However, it is classified as a maintenance area for CO due to a violation of the 8-hour CO standard in 1988. This CO maintenance area includes the majority of Fort Carson's Main Post area including areas north of Titus Boulevard and Specker Avenue. This designation is currently set to run through 2015 when the area is expected to become full attainment for CO (CDPHE, 2009). In December 2009, the CDPHE approved a Revised Carbon Monoxide Attainment/Maintenance Plan for the Colorado Springs Attainment/Maintenance Area, which is the current State Implementation Plan (SIP) for the area (CDPHE, 2009).

Existing ambient conditions near Fort Carson can be estimated from measurements conducted at air quality monitoring stations close to the Installation (Table 1-1). With the exception of the 8-hour O_3 NAAQS, most recent air quality measurements are below the NAAQS. The reported measurement for the 8-hour level exceeds the NAAQS of 0.075 parts per million (ppm). However, the 3-year average of the fourth highest daily maximum 8-hour average O_3 concentrations over each year has not exceed 0.08 ppm, hence the attainment status. This exceedence is expected because the region is likely to become an

O_3 nonattainment area. Nitrogen dioxide (NO_2) and SO_2 are not expected to be pollutants of concern in this region and are not monitored.

Table 1-1. Air Quality Standards and Monitored Data near Fort Carson

Pollutant	Air Quality Standards[a]	Monitored Data near Fort Carson[b]
CO		
1-Hour Maximum[c] (ppm)	35	3
8-Hour Maximum[c] (ppm)	9	1
NO_2		
1-Hour (ppb)	100	*<no data>*
O_3		
8-Hour Maximum[d] (ppm)	0.075	0.075
SO_2		
1-Hour Maximum[c] (ppb)	75	*<no data>*
24-Hour Maximum[c] (ppb)	140	*<no data>*
$PM_{2.5}$		
24-Hour Maximum[e] ($\mu g/m^3$)	35	18
Annual Arithmetic Mean[f] ($\mu g/m^3$)	15.0	5.6
PM_{10}		
24-Hour Maximum[c] ($\mu g/m^3$)	150	45

a - Source: 40 CFR 50.1-50.12.
b - Source: EPA, 2012c.
c - Not to be exceeded more than once per year
d- The 3-year average of the fourth highest daily maximum 8-hour average O_3 concentrations over each year must not exceed 0.08 ppm.
e - The 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor must not exceed 35 ug/m^3.
f - The 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from must not exceed 15.0 ug/m^3.
ppb = parts per billion
ppm = parts per million
$\mu g/m^3$ = micrograms per cubic meter
NO_2 = Nitrogen dioxide

1.2 INSTALLATION-WIDE EMISSIONS

Title V of the CAA requires states to establish an air operating permit program (40 CFR Part 70). The permits required by these regulations are often referred to as Title V or Part 70 permits. Based on the Installation's potential to emit (PTE), Fort Carson is a major source of air emissions for NO_x, CO, and carbon dioxide equivalents (CO_2e). Additionally, Fort Carson contains one of the special categories (fossil fuel burning boilers that total more than 250 million British thermal units [MMBtu] per hour) identified in the Prevention of Significant Deterioration (PSD) provisions subject to a 100 tons per year (tpy) major source threshold. Stationary sources of air emissions at Fort Carson include boilers, generators, paint booths, engine testing, and landfills. An Installation-wide Title V permit (No. 95OPEP110) was issued in July 2007 that is currently in the process of being renewed. The Title V permit limits the amount of pollutants from significant emission sources in various ways, depending on the source type (e.g., restricting operating hours, fuel type, throughput amount, and emission rates). In addition, the permit limits use of smoke munitions and the generation of fog oil smoke for training exercises, activities that are typically unique to the military. As part of the Title V permit requirements, Fort Carson must complete a comprehensive emissions statement annually. Table 1-2 summarizes the 2010 Installation-wide actual emissions and PTE of criteria pollutants, hazardous air pollutants (HAPs) and GHGs at Fort Carson.

Table 1-2. Criteria Pollutants and GHG Emissions at Fort Carson

	Criteria Pollutants and HAPs						
Emissions (tons per year [tpy])	**SO_2**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**VOC**	**Total HAPs**
Actual Emissions	1.1	536.9	77.3.	77.3	61.9	19.6	7.8
PTE	72.5	733.2	162.1	162.1	335.8	145.4	18.5
	GHGs						
				CO_2e			**Total CO_2e**
Emissions (tpy)	**CO_2**	**N_2O**	**CH_4**	**CO_2**	**N_2O**	**CH_4**	
Actual Emissions	50,187.7	0.9	1,083.2	185659.3	936.8	24934.1	211,517.711
PTE	306,454.2	6.8	1,093.3	306,454.2	2,011.3	25,146.1	333,465.5

Source: U.S. Army Fort Carson, 2012.

CH4 = methane; CO_{2e} = carbon dioxide equivalent; CO_2= carbon dioxide; HAPs = hazardous air pollutants; N_2O = nitrous oxide; PM_{10} =; particulate matter less than 10 microns in diameter; $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter; NOx = oxides of nitrogen; SO_2 = sulfur dioxide; tpy = tons per year; VOC = volatile organic compounds

1.3 OVERVIEW OF PERMITTING REQUIREMENTS

CDPHE oversees programs for permitting the construction and operation of new or modified stationary source air emissions in Colorado. Colorado air permitting is required for many industries and facilities that emit regulated pollutants. Based on the size of the emissions units and type of pollutants emitted (criteria pollutants or HAPs), CDPHE sets permit rules and standards for emissions sources. This section outlines the primary Federal and state permitting regulations. A discussion of how they apply under the individual alternatives is discussed in Section 2.0 Environmental Consequences.

The air quality permitting process begins with the application for a construction permit. The biomass plant and the waste-to-energy (WTE) plant would require permits to construct in one form or another.

There are three types of construction permits available through the CDPHE for the construction and temporary operation of new emissions sources: PSD permits in Attainment Areas; Major Source Construction Permits in Nonattainment Areas (Nonattainment New Source Review [NNSR]); and Minor New Source Construction Permits. Notably, no other components of any of the alternatives such as Photovoltaic (PV) arrays, non-potable water line expansion, geothermal systems, and wind turbines would require air permits.

PSD and NNSR permits are both part of the CDPHE permitting program. Thresholds that determine the type of construction permit that might be required depend on both the quantity and type of emissions. Any net increase of criteria pollutants that would result in a "major modification" would subject Fort Carson to the PSD review requirements (40 CFR §52.21). Thresholds requiring either an NNSR or a PSD permit for a modification to an existing major source at Fort Carson are outlined in Table 1-3. Notably NNSR major modification thresholds for NO_x and VOC would apply if or when El Paso County were to become a nonattainment area under the 2008 O_3 standard.

Table 1-3. Major Modification Thresholds of Criteria Pollutants at Fort Carson

	Major Modification Threshold (tpy)	
Pollutant	**PSD**[a]	**NNSR**[a]
CO	100	
NO_x	40	(40)
SO_2	40	
PM	25	
PM_{10}	15	
$PM_{2.5}$	15	
VOCs	40	(40)
CO_2e	75,000	

Source: 5 CCR 1001-5 and 40 CFR Part 52

[a] NNSR major modification thresholds for NO_x and VOC would apply if the region were to become a nonattainment area under the 2008 O_3 standard.

CO_{2e} = carbon dioxide equivalent; CO = carbon monoxide; NNSR = nonattainment new source review; NOx = oxides of nitrogen; PM_{10} =; particulate matter less than 10 microns in diameter; $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter; PSD = prevention of significant deterioration; tpy = tons per year; VOC = volatile organic compounds

Prevention of Significant Deterioration. The PSD regulations, found at Rule 5 Code of Colorado Regulations (CCR) 1001-5 Part D, specify that a major new stationary source or major expansion project to an existing major source within an air quality attainment area must undergo PSD review. The PSD process would apply to all pollutants for which the region is in attainment (all criteria pollutants, HAPs, and GHGs). The PSD permitting process typically takes 18–24 months to complete. Sources subject to a PSD review are typically required to complete the following:

- Best Available Control Technology (BACT) review for each criteria pollutant and GHG
- Maximum Achievable Control Technology (MACT) review for regulated HAPs and designated categories
- Predictive air dispersion modeling
- Establishing procedures for measuring and recording emissions and/or process rates

- Meeting the New Source Performance Standards (NSPS) and National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements
- A public involvement process

Nonattainment New Source Review. NNSR permits are required for any major new sources or major modifications to existing major sources intended to be constructed in an area designated as nonattainment. Currently, when undergoing a physical or operational change, a source determines major NSR applicability through a two-step analysis. First, determine if the increased emissions from a particular proposed project alone are above the thresholds. If the emissions increase is below the threshold, a NNSR permit would not be required. If the emissions increase is above the threshold, then determine through a procedure called "netting" if the project's net emissions plus all contemporaneous increases and decreases in the previous 5 years at the source are above the thresholds. If this determination results in an increase that is lower than the threshold, a NNSR permit would not be required. For example, if a new boiler plant were to be constructed and the total emissions were less than that of an old boiler plant that was decommissioned, it is possible NNSR could be avoided.

NNSR permits are legal documents that specify what construction is allowed; what emissions limits must not be exceeded; reporting, recordkeeping, and monitoring requirements; and often how the source can be operated. The NNSR permitting process typically takes 18–24 months. Specifically, typical requirements for a NNSR permit can include the following:

- BACT review for qualifying attainment criteria pollutants
- Lowest Achievable Emissions Rate (LAER) review for qualifying nonattainment pollutants
- MACT review for HAPs
- Predictive air dispersion modeling
- Acquiring emissions offsets for all contemporaneous emissions increases that have occurred or are expected to occur
- A public involvement process

Most notably, NNSR requires the acquisition of emissions offsets for new major sources in nonattainment areas. If no emissions offsets are available, for example in a brand-new nonattainment area such as El Paso County, it is possible that the NNSR permit to construct would not be granted. This determination would be made during the permitting process.

Minor New Source Review. A Minor Source Construction Permit would be required to construct minor new sources with the PTE less than those outlined in Table 1-3, minor modifications of existing sources, and major sources not subject to NNSR or PSD permit requirements. The Minor NSR permitting process typically takes 4–5 months to complete. Due to the oil and gas boom and staffing restrictions at CDPHE, however, Fort Carson is experiencing 6-8 month response time. Sources subject to Minor NSR could be required to complete the following:

- BACT review for each criteria pollutant
- MACT review for regulated HAPs and designated categories
- Predictive air dispersion modeling upon request by CDPHE
- Establish procedures for measuring and recording emissions and process rates.

Operation Permits. Under CDPHE's Title V Facility Permit regulations (5 CCR 1001-5 I.B.32), a Title V Significant Permit Modification is required for facilities whose emissions increases exceed the emissions thresholds outlined in Table 1-3. In addition, a Significant Permit Modification would be required if it became necessary to establish Federally enforceable limitations to reduce potential emissions below these thresholds. A minor permit modification would be required if emissions were below these thresholds and a Federally enforceable limit was not necessary. Submission of an application for these permit modifications would be required within one year of the first operation of a new emissions source.

In addition to the permitting requirements to construct and operate new or modified emissions sources, NSPS and NESHAPs set emissions control standards for categories of new stationary emissions sources of both criteria pollutants and HAPs. The NSPS process requires EPA to list categories of stationary sources that cause or contribute to air pollution that might reasonably be anticipated to endanger public health or welfare. The NSPS program sets uniform emissions limitations for many industrial sources. The CAA Amendments of 1990, under revisions to Section 112, require EPA to list and promulgate NESHAPs to reduce the emissions of HAPs, such as formaldehyde, benzene, xylene, and toluene from categories of major and area sources (40 Code of Federal Regulations [CFR] Part 63). New stationary sources whose PTE exceeds either 10 tpy of a single HAP, or 25 tpy of all regulated HAPs, would be subject to MACT requirements.

1.4 OVERVIEW OF GREENHOUSE GASES

Gases that trap heat in the atmosphere are often called GHGs. These GHGs contribute to an increase in the temperature of the earth's atmosphere by affecting the earth's radiation budget that is the balance of incoming and outgoing solar radiation. The principal GHGs that enter the atmosphere because of human activities are:

- ***Carbon Dioxide (CO_2).*** CO_2 enters the atmosphere through the burning of fossil fuels (oil, natural gas, and coal), solid waste, trees and wood products, and also as a result of other chemical reactions (e.g., manufacture of cement). CO_2 is also removed from the atmosphere (or "sequestered") when it is absorbed by plants as part of the biological carbon cycle.
- ***Methane (CH_4).*** CH_4 is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from livestock and other agricultural practices and by the decay of organic waste in Municipal Solid Waste (MSW) landfills.
- ***Nitrous Oxide (N_2O).*** N_2O is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste.
- ***Fluorinated Gases***. Hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are synthetic, powerful GHGs that are emitted from a variety of industrial processes. Fluorinated gases are sometimes used as substitutes for ozone-depleting substances. These gases are typically emitted in smaller quantities, but because they are potent GHGs, they are sometimes referred to as High Global Warming Potential gases.

CO_2e is the amount of CO_2 by weight emitted into the atmosphere that would produce the same estimated radiative forcing as a given weight of another radiatively active gas. CO_{2e} are computed by multiplying the weight of the gas being measured (for example, CH_4) by its estimated global warming potential (which is 21 for CH_4).

Fossil fuel consumption in the transportation sector (on-road motor vehicles, off-highway mobile sources, and aircraft) is the single largest source of GHG emissions, accounting for approximately half of GHG emissions globally. Industrial and commercial sources are the second largest contributors of GHG emissions with about one-fourth of total emissions and the generation of electrical power is a substantial part of that total.

Regulatory Review and Permitting. Currently, EPA has promulgated two regulations that 1) require the reporting of GHG emissions annually; and 2) require new or modified sources that occur after January 2, 2011, to address BACT. The final rules apply to fossil fuel suppliers and industrial gas suppliers, direct GHG emitters and manufacturers of heavy-duty and off-road vehicles and engines. The rule does not require control of GHGs, rather it requires only that sources above certain threshold levels monitor and report emissions. In addition, EPA also recently promulgated the Tailoring Rule that established a CO_2e threshold for permitting purposes (i.e., construction and operation) of 75,000 tpy for modifications and 100,000 tpy for new sources. This rule "tailors" the major source permitting rules outlined above (i.e., PSD and NNSR) to apply to GHGs.

Executive Order (EO) 13514. EO 13514 *Federal Leadership in Environmental, Energy, and Economic Performance,* expands on the energy reduction and environmental performance requirements for Federal agencies identified in EO 13423. The goal of EO 13514 is *to establish an integrated strategy towards sustainability in the Federal Government and to make reduction of GHG emissions a priority for Federal agencies*. The GHG emissions generated directly and indirectly by an entity such as a Federal agency can be classified into "scopes," based on the source of the emissions:

- Scope 1 emissions are direct GHG emissions from sources that are owned or controlled by the entity. Scope 1 includes emissions from fossil fuels burned on site, emissions from owned or leased vehicles, and other direct sources.
- Scope 2 emissions are indirect GHG emissions resulting from the generation of electricity, heating and cooling, or steam generated off site but purchased by the entity, and the transmission and distribution losses associated with some purchased utilities.
- Scope 3 emissions include indirect GHG emissions from sources not owned or directly controlled by the entity but related to the entity's activities. Scope 3 GHG emissions sources currently required for Federal GHG reporting includes employee travel and commuting, contracted solid waste disposal, and contracted wastewater treatment.

In response to EO 13514, the U.S. Department of Defense has set the goal to reduce Scope 1 and 2 GHGs by 34 percent and Scope 3 GHGs by 13.5 percent by Fiscal Year 2020.

2.0 ENVIRONMENTAL CONSEQUENCES

The environmental consequences for air quality include overview of the general conformity rule (GCR) followed by a discussion of the direct and indirect effects and a regulatory review for each alternative.

2.1 GENERAL CONFORMITY

To determine whether the GCR applies, all direct and indirect sources of emissions were estimated and combined for the Net Zero projects within the CO maintenance area. Direct emissions are emissions that would be caused or initiated by a Federal action and occur at the same time and place as the action. Indirect emissions are defined as reasonably foreseeable emissions that would be caused by the action, but could occur later in time or be farther removed in distance from the action itself. More specifically, project-related construction and operational emissions were estimated for:

- Alternative 2b: Construct and Operate an up to 13 megawatt (MW) Biomass Plant in Bravo North Site 2
- Alternative 3: Construction and Operation of PV Systems at Gate 2 North and South, Chiles, solid waste management unit (SWMU) 5 (Sites 1 and 2), Magrath Avenue, and Titis/Signal Hill.
- Alternative 4: Expansion of the Existing Non-Potable Water System
- Alternative 6: Implement Future Renewable Energy Development within Net Zero Footprint Identified by the Army

Upper bound assumptions were made to estimate emissions during the year of maximum construction. Construction activities including the use of construction equipment, worker vehicles (e.g., bulldozers, backhoes) were included in the analysis. The total construction emissions of CO during the maximum year of construction would be substantially less than the applicability thresholds (Table 2-1). Small changes in the siting of these facilities, the final design, and moderate changes in the quantity and types of equipment used would not have a substantial influence on the emission estimates, and would not change this applicability determination under the GCR.

If Alternative 2b (Construct and Operate a 13MW Biomass Plant in Bravo North Site 2) were selected, operational emissions of CO in any given year would be more than the applicability thresholds. However, if this alternative were ultimately selected it would be exempt from the GCRs as it includes modified stationary sources that would require a permit under the PSD program (40 CFR 93-153(d)(1)). Therefore, a formal conformity demonstration would not be required. All other alternatives would have either no operational emissions or they are located outside the CO maintenance area. Therefore, for all alternatives, the general conformity requirements do not apply, and no formal conformity determination is required. Detailed methodologies for estimating air emissions and a draft Record of Non-applicability (RONA) are provided in Attachment A and B.

Table 2-1. Total Annual Emissions Subject to the GCR

Activity	Estimated Annual CO Emissions Within the CO Maintenance Area (tpy)	Applicability Threshold (tpy)	Exceeds Applicability Threshold?
Construction[a]	35	100	No
Operational			
Alternative 2b: Construct and Operate an up to 13MW Biomass Plant in Bravo North Site 2	152	100	**Yes**
All other alternatives	None		No

Sources: EPA, 1995; CARB, 2007; and NREL, 2010.
Note: [a] Upper bound estimate of year of maximum construction

Under the GCR only reasonably foreseeable emissions are to be accounted for. Reasonably foreseeable emissions are projected future indirect emissions that are identified at the time the conformity determination is made; the location of such emissions is known; and the emissions are quantifiable (40 CFR 93.152). Notably, an ongoing net decrease in CO emissions is expected after the construction phase due to the reduction in off-site fossil fuel combustion to generate electricity for the Installation. However, since the exact location of these emissions is unknown, they are not considered reasonably foreseeable under the GCRs and have been excluded from this analysis.

2.2 NO ACTION ALTERNATIVE

The No Action Alternative would result in no changes to air quality as the Net Zero Projects at Fort Carson would not be implemented. No construction activities would be undertaken, and no changes in operations would take place. A general conformity analysis and the permitting of stationary sources would not be required. However, under the No Action Alternative, regional growth and contemporaneous actions would continue including the Combat Aviation Brigade (CAB) and Grow the Army actions at Fort Carson. These actions would have some level of impact to air quality has and have been evaluated in two separate NEPA documents: *Final EIS for Implementation of Fort Carson Grow the Army Stationing Decisions* (2009) and *the EA for the Implementation of Combat Aviation Brigade (CAB) Stationing at Fort Carson* (ongoing). Notably, if the No Action Alternative were ultimately selected the overall net decrease in both criteria pollutants and GHGs due to reduction in the use of off-Post fossil-fuel-based electricity would not be realized.

2.3 ALTERNATIVE 1

Alternative 1 would have both short-term minor and long-term moderate adverse impacts on air quality. Short-term impacts would be due to air emissions generated during construction, and long-term impacts would be due to operational emissions from the proposed WTE plant. Implementing Alternative 1 constitutes an overall net decrease in both criteria pollutants and GHGs due to reduction in the use of off-Post fossil-fuel-based electricity. These indirect reductions in emissions would be appreciably greater than direct operational emissions from the proposed WTE plant. However, because the proposed plant would in and of itself constitute a major stationary source of air emissions, effects to air quality are considered moderately adverse within this EA. Notably, the PTE for the proposed WTE plant would exceed the major modification threshold for the Installation and PSD review would be required.

Direct Effects. Mobile and stationary equipment would be used for the construction of the proposed plant. Several pieces of construction equipment would generate emissions due to the combustion of diesel fuel and gasoline. PM in the form of fugitive dust may occur during site grading and construction activities. The impacts on the environment during construction would be minimal, localized, and temporary. These effects would be minor.

Depending on the characteristics of the MSW and combustion conditions in the WTE plant, PM, metals, acid gases (hydrochloric acid [HCl], SO_2), CO, NO_x, and toxic organics would be emitted. A brief discussion on each of the pollutants is provided below. Different air emissions are controlled by different pollution technologies. A detailed discussion of control technologies for each of the pollutants as discussed in the next section.

- ***Particulate Matter.*** The amount of PM emitted depends on the waste characteristics, the physical nature of the combustor design, and its operation. Under normal combustion conditions, solid fly ash particulates formed from inorganic, noncombustible constituents in MSW are released into the flue gas. Most PM is captured by air pollution controls and is not emitted to the atmosphere.
- ***Metals.*** Metals are present in a variety of MSW streams, including paper, newsprint, yard wastes, wood, batteries, and metal cans. The metals are emitted in association with PM (e.g., arsenic [As], cadmium [Cd], chromium [Cr], and Pb) and as vapors, such as mercury (Hg). Due to the variability in MSW composition, metal concentrations are highly variable.
- ***Acid Gases.*** The chief acid gases of concern are HCl and CO_2. Hydrogen fluoride, hydrogen bromide, and sulfur trioxide are also generally present, but at much lower concentrations. Concentrations of HCl and CO_2 flue gases directly relate to the chlorine and sulfur content in the waste. The major sources of chlorine in MSW are paper and plastics. Sulfur is contained in many constituents, such as asphalt shingles, gypsum wallboard, and tires.
- ***Carbon Monoxide (CO).*** CO emissions result when not all of the carbon in the waste is oxidized to CO_2. High levels of CO indicate that the combustion gases were not held at a sufficiently high temperature in the presence of oxygen for a long enough time to convert CO to CO_2.
- ***Oxides of nitrogen (NO_x).*** NO_x are products of all fuel/air combustion processes. Nitric oxide is the primary component of NO_x; however, NO_2 and N_2O are also formed in smaller amounts.

Because of the relatively low temperatures at which WTE facilities operate, 70 to 80 percent of NO_x formed is associated with nitrogen in the waste.

- ***Organic Compounds.*** A variety of organic compounds, including chlorinated dibenzo-p-dioxin/chlorinated dibenzofurans, 2,3,7,8-tetrachlorodibenzo-p-dioxin, and dibenzofurans (CDDs/CDFs), chlorobenzene, polychlorinated biphenyls, chlorophenols, and polyaromatic hydrocarbons are present in MSW or can be formed during the combustion and post-combination processes. Organics in the flue gas can exist in the vapor phase or can be condensed or absorbed on fine particulates. Control of organics is accomplished through proper design and operation of both the combustor and the air pollution control devices.

Table 2-2 outlines the estimated uncontrolled PTE from the proposed WTE facility. The plant is in the preplanning stages and these emissions are estimates using EPA's *AP-42 - Compilation of Air Pollutant Emission Factors, Section 2.1 Refuse Combustion*. Emission calculations are shown in Attachment A. During the permitting process, detailed emission, calculations would be required based on the final design and controls.

Table 2-2. Estimated Uncontrolled PTE from the Proposed WTE Plant

Pollutant	**Uncontrolled**	**Major Modification Threshold**	**Exceeds Major Modification Threshold**
Particulate Matter (PM)	4,221.2	25	**Yes**
Sulfur Dioxide (SO_2)	581.9	40	**Yes**
Oxides of Nitrogen (NO_x)	598.7	40	**Yes**
Carbon Monoxide (CO)	77.9	100	**Yes**
Lead (Pb)	35.8	0.6	**Yes**
HAPs			
Arsenic (As)	0.7349	10	No
Cadmium (Cd)	1.8331	10	No
Chromium (Cr)	1.5085	10	No
Mercury (Hg)	0.9418	10	No
Nickel (Ni)	1.3202	10	No
Hydrochloric Acid (HCl)	1,076.3	10	**Yes**
CDD/CDF	2.81E-04	10	No
Total HAPs	1082.7	25	**Yes**
GHGs			
Carbon Dioxide (CO_2)	319,533.5	75,000	**Yes**

Source: EPA, 1996.

CDD/CDF = total tetra- through octa- chlorinated dibenzo-p-dioxin/chlorinated dibenzofurans, 2,3,7,8-tetrachlorodibenzo-p-dioxin, and dibenzofurans.

A wide variety of control technologies are used to control emissions from WTE plants. The control of PM, along with metals that have adsorbed onto the PM, is most frequently accomplished through the use of an

Electrostatic Precipitators (ESP) or fabric filters (FF). Although other PM control technologies (e.g., cyclones, electrified gravel beds, and venturi scrubbers) are available, they are seldom used on existing systems, and it is anticipated that they will not be frequently used in future systems. The control of acid gas emissions (i.e., CO_2 and HCl) is most frequently accomplished through the application of acid gas control technologies such as spray drying or dry sorbent injection, followed by a high-efficiency PM control device. Some facilities use a wet scrubber to control acid gases. It is anticipated that dry systems (spray drying and dry sorbent injection) will be more widely used than wet scrubbers on future systems. Each of these technologies is discussed in more detail below.

- ***Electrostatic Precipitators (ESPs).*** ESPs consist of a series of high-voltage discharge electrodes and grounded metal plates through which PM-laden flue gas flows. Negatively charged ions formed by this high-voltage field attach to PM in the flue gas, causing the charged particles to migrate toward, and be collected on, the grounded plates.
- ***Fabric Filters (FFs).*** FFs are also used for PM and metals control, particularly in combination with acid gas control and flue gas cooling. FFs (also known as "baghouses") remove PM by passing flue gas through a porous fabric that has been sewn into a cylindrical bag. Once the pressure drop across the bags in a given compartment becomes excessive, that compartment is generally taken off-line, mechanically cleaned, and then placed back on-line.
- ***Spray Dryers (SDs).*** SDs are the most frequently used acid gas control technology for WTE in the United States. When used in combination with an ESP or FF, the system can control CDD/CDF, PM (and metals), SO_2, and HCl emissions. In the spray drying process, lime slurry is injected through either a rotary atomizer or dual-fluid nozzles. The water in the slurry evaporates to cool the flue gas, and the lime reacts with acid gases to form calcium salts that can be removed by a PM control device.
- ***Dry Sorbent Injection (DSI).*** This type of technology has been developed primarily to control acid gas emissions. However, when combined with flue gas cooling and either an ESP or FF, sorbent injection processes may also control CDD/CDF and PM emissions from WTE facilities. Two primary subsets of DSI technologies exist. The more widely used of these approaches, referred to as duct sorbent injection, involves injecting dry alkali sorbents into the flue gas downstream of the combustor outlet and upstream of the PM control device. The second approach, referred to as furnace sorbent injection, injects sorbent directly into the combustor.
- ***Wet Scrubbers.*** Many types of wet scrubbers have been used for controlling acid gas emissions from WTE plants. These include spray towers, centrifugal scrubbers, and venturi scrubbers. Wet scrubbing technology has primarily been used in Japan and Europe. Currently, it is not anticipated that many new WTE plants being built in the United States will use this type of acid gas control system. Wet scrubbing normally involves passing the flue gas through an ESP to reduce PM, followed by a 1- or 2-stage absorber system.
- ***NO_x Control Techniques.*** The control of NO_x emissions can be accomplished through either combustion controls or add-on controls. Combustion controls include staged combustion, low excess air, and flue gas recirculation. Add-on controls that have been tested include selective noncatalytic reduction (SNCR), selective catalytic reduction, and natural gas reburning.
- ***Mercury Controls (Hg).*** Unlike other metals, Hg exists in vapor form at typical operating temperatures. As a result, collection of Hg is highly variable. Several Hg control technologies have been used on waste combustors. These control technologies include the injection of activated carbon or sodium sulfide into the flue gas prior to the DSI- or SD-based acid gas control system, or the use of activated carbon filters.

Table 2-3 outlines the estimated PTE from the proposed WTE facility using the above controls alone or in combination. Notably, the plant is in the preplanning stages and these emissions are estimates using EPA's *AP-42 - Compilation of Air Pollutant Emission Factors, Section* 2.*1 Refuse Combustion.* Emission calculations are shown in Attachment A. Due to the combustion process, CO is not normally a pollutant of concern for WTE. During the permitting process detailed emission calculations would be required based on the final design and controls.

Table 2-3. Estimated Controlled PTE from the Proposed WTE Plant

	ESP	**DSI/ESP**	**SD/ESP**	**DSI/FF**	**SD/FF**	**Major Modification Threshold**	**Exceeds Major Modification Threshold**
Pollutant	**Emissions (tpy)**						
Particulate Matter (PM)	35.3	9.9	11.8	30.1	10.4	25	No
Sulfur Dioxide (SO_2)	581.9	159.9	109.8	240.5	93.2	40	**Yes**
Oxides of Nitrogen (NO_x) w/SNCR	389.2	389.2	389.2	389.2	389.2	40	**Yes**
Carbon Monoxide (CO)	77.9	77.9	77.9	77.9	77.9	100	No
Lead (Pb)	0.5045	0.4877	0.1539	0.0499	0.0439	0.6	No
HAPs							
Arsenic (As)	0.0036	0.7349	0.0023	0.0017	0.0007	10	No
Cadmium (Cd)	0.1086	0.0149	0.0126	0.0039	0.0046	10	No
Chromium (Cr)	0.0190	0.0052	0.0436	0.0336	0.0050	10	No
Mercury (Hg)	0.9418	0.6660	0.5483	0.3700	0.3700	10	No
Nickel (Ni)	0.0188	0.0054	0.0454	0.0240	0.0087	10	No
Hydrochloric Acid (HCl)	1,076.3	46.8	77.0	107.0	35.5	10	**Yes**
CDD/CDF	2.81E-04	1.97E-04	1.04E-04	2.69E-05	1.11E-05	10	No
Total HAPs	1,077.4	48.2	77.7	107.4	35.9	25	**Yes**
GHGs							
Carbon Dioxide (CO_2)	319,533.5	319,533.5	319,533.5	319,533.5	319,533.5	75,000	**Yes**

Source: EPA, 1996.

ESP = Electrostatic Precipitator

DSI/ESP = Duct Sorbent Injection/Electrostatic Precipitator

SD/ESP = Spray Dryer/Electrostatic Precipitator

DSI/FF = Duct Sorbent Injection/Fabric Filter

SD/FF = Spray Dryer/Fabric Filter

CDD/CDF = total tetra- through octa- chlorinated dibenzo-p-dioxin/chlorinated dibenzofurans, 2,3,7,8-tetrachlorodibenzo-p-dioxin, and dibenzofurans.

Permitting and Regulatory Review. Permitting scenarios may vary based on the final design, timing of the project, and the types of controls ultimately selected. These may differ in specific features from the ones described in this report. However, during the final design stage and the permitting process either 1) the actual equipment, controls, or operating limitations would be selected to reduce the PTE below the major source threshold, 2) NNSR permitting process would require emission offsets be obtained from other previously decommissioned sources within the region, or 3) the PSD permitting process would insure the NAAQS was not exceeded and the emissions from the projects would be included in the regional emissions inventory ensuring it would not interfere with the ability of the state to maintain the NAAQS. This cap-and-trade type system is inherent to Federal and state air regulations, and leads to a forced reduction in regional emissions in nonattainment areas or the preservation of clean air in attainment regions. Therefore, regardless of the ultimate permitting scenario effects would be less than significant.

Permitting requirements for proposed stationary sources are based on their overall PTE of criteria pollutants. The uncontrolled PTE of all attainment pollutants (NO_x, CO, SO_2, and PM) and controlled PTE of NO_x, and SO_2 would exceed the PSD threshold (Tables 2-2 and 2-3). Therefore, PSD review would be required. In addition, the controlled and uncontrolled PTE of NO_x would exceed the NNSR major modification thresholds and NNSR may become required if the region were to become a nonattainment area under the 2008 O_3 standard. A Title V Significant Permit Modifications would be required within one year of the first operation of the proposed WTE plant.

The WTE would meet the NSPS requirements outlined in 40 CFR Part 60 Subpart Eb - *Standards of Performance for Large Municipal Waste Combustors for Which Construction is Commenced After September 20, 1994 or for Which Modification or Reconstruction is Commenced After June 19, 1996.* The subpart Eb standards establish requirements for metals (PM, Cd, Pb, Hg, opacity), organics (dioxins/ furans), acid gases (SO_2, HCl), operating practices (CO, flue gas temperature, load level), NO_x, and facility siting requirements. The standards also require control of fugitive ash emissions.

GHGs. Net GHG emissions consist of GHG emissions from the transportation, processing, and combustion of the MSW in the WTE plant minus GHG emissions avoided from the reduction in the use of fossil-fuel-based electricity and off gasses from landfilling the MSW. EPA Waste Reduction Model (WARM) was used to calculate the life-cycle GHG emissions of the baseline landfill scenario and the WTE scenario outlined under Alternative 1. The total GHG emissions of the baseline landfill scenario were estimated to be 427,558 tpy CO_2e. The total reduction of GHG emissions associated with the WTE scenario outlined under Alternative 1 was estimated to be 60,989 tpy CO_2e. Therefore, implementation of Alternative 1 would constitute a net decrease of 488,547 tpy CO_2e of Scope 2 GHG emissions. These GHG emissions savings are primarily due from the reduction of off-site fossil-fuel-based generation of electricity and CH_4 produced from the landfills. This is equivalent to removing the annual GHG emissions from 81,176 passenger vehicles or 2,314 railway cars of coal. These effects would be moderately beneficial, and would allow the Installation to meet fully its 34 percent reduction goals under EO 13514.

Although there would be a net reduction in GHG emissions due to Alternative 1, the proposed WTE plant would directly emit 319,534 tpy Scope 1 GHG emissions. This would be greater than the major modification threshold of 75,000 tpy under the Tailoring Rule; therefore, a PSD and BACT review for GHGs would be required. BACT for GHGs is rapidly evolving. In the final design stages and the permitting process extra care would be taken to insure compliance with all GHG permitting regulations.

Indirect Effects. The Emissions & Generation Resource Integrated Database (eGRID) is a comprehensive inventory of environmental attributes of electric power systems, which provides a detailed emissions profile, covering NO_x, SO_2, and GHG broken down by state and region. Energy grid based emission factors are not available for other criteria pollutants. Because of the required air pollution controls, emissions of criteria pollutants from WTE plants are generally lower than those generated by fossil-fuel-based power plants (Table 2-4). There would be additional indirect long-term beneficial effects from reductions in the use of fossil-fuel-based electricity. The primary reductions would be from NO_x and SO_2 emissions; however, similar reductions would be likely for all criteria pollutants.

Table 2-4. Potential Indirect Emissions Reductions from a 40MW WTE Plant

	Emissions (tpy)		
Pollutant	**Fossil Fuel Combustion**	**Proposed WTE Plant**	**Potential Reductions**
Oxides of Nitrogen (NO_x)	473.6	389.2	84.4
Sulfur Dioxide (SO_2)	438.4	93.2	345.2

Source: EPA, 2011; and EPA, 1996.

Best Management Practices (BMPs). BMPs would be required for both construction and operational emissions associated with the WTE Plant. The construction projects would be accomplished in full compliance with Colorado regulatory requirements, through the use of compliant practices or products. These requirements appear in 5 CCR 1001-1**,** Air Quality Control Commission (AQCC) Regulations. General regulatory requirements associated with comment construction activities include the following:

- Odor Emission (5 CCR 1001-4)
- Open Burning, Prescribed Fire, and Permitting (5 CCR 1001-11)
- Control of Emission of Ozone Depleting Compounds (5 CCR 1001-19)

In addition to those outlined above, no person shall handle, transport, or store any material in a manner that may allow unnecessary amounts of air contaminants to become airborne. During construction, reasonable measures may be required to prevent unnecessary amounts of PM from becoming airborne, including:

- Use of water for control of dust, the grading of roads, or the clearing of land;
- Paving of roadways and maintaining them in a clean condition;
- Covering open equipment for conveying or transporting material likely to create objectionable air pollution when airborne; and,
- Promptly removing spilled or tracked dirt or other materials from paved streets

BMPs associated with operation of the proposed WTE plant would include:

- BACT review for each criteria pollutant and GHGs
- MACT review for regulated HAPs and designated categories
- Predictive air dispersion modeling
- Establishing procedures for measuring and recording emissions and/or process rates
- Meeting the NSPS and NESHAP requirements
- A public involvement process

In addition, air permits may be required for land disturbance areas (5 CCR 1001-5). This listing is not all-inclusive; Fort Carson and any contractors would comply with all applicable Colorado air pollution control regulations.

2.4 ALTERNATIVE 2

Alternatives 2a, 2b, and 2c would have both short- and long-term minor adverse impacts on air quality. Short-term impacts would be due to air emissions generated during construction, and long-term impacts would be due to operational emissions from the proposed biomass plant. Notably, implementing Alternative 2a, 2b, and 2c would constitute an overall net decrease in both criteria pollutants and GHGs due to reduction in the use of off-Post fossil-fuel-based electricity. These indirect reductions in emissions would be appreciably greater than operational emissions from the proposed biomass plant. However, because the proposed plant would in and of itself constitute a new stationary source of air emissions, effects to air quality are considered minor. Notably, the PTE for the proposed 13MW biomass plant would exceed the major modification threshold for the Installation and PSD review would be required.

Direct Effects. Mobile and stationary equipment would be used for the construction of the proposed plant. Several pieces of construction equipment would generate emissions due to the combustion of diesel fuel and/or gasoline. PM in the form of fugitive dust may occur during site grading and construction activities. The impacts on the environment during construction would be minimal, localized, and temporary. These effects would be minor.

Table 2-5 summarizes the potential operational emissions of criteria air pollutants and HAPs for a 13 and a 2.5MW biomass plant. The following emission sources were accounted for in the analysis:

- Woody Biomass Grate Boiler
- Woody Biomass Handling and Processing
- Fly Ash Handling
- Boiler Support Material Handling
- Portable Wood Chipper Combustion Emissions
- Additional Emergency Equipment (generators, etc.)

Table 2-5. Estimated PTE from the Proposed Biomass Plant

	Alternative 2a and 2b - 13MW Plant			Alternative 2c - 2.5MW Plant		
Pollutant	**Emissions (tpy)**	**Major Modification Threshold**	**Exceeds Major Modification Threshold**	**Emissions (tpy)**	**Major Modification Threshold**	**Exceeds Major Modification Threshold**
Particulate Matter (PM)	52	25	**Yes**	10	25	**No**
Particulate Matter Less than 10 Microns (PM_{10})	43	15	**Yes**	8	15	**No**
Particulate Matter Less than 2.5 Microns ($PM_{2.5}$)	39	15	**Yes**	8	15	**No**
Sulfur Dioxide (SO_2)	22	40	**No**	4	40	**No**
Oxides of Nitrogen (NO_x)	100	40	**Yes**	19	40	**No**
Carbon Monoxide (CO)	152	100	**Yes**	29	100	**No**
Total HAPs	<10	10	**No**	<10	10	**No**
GHGs						
Carbon Dioxide (CO_2)	156,000	75,000	**Yes**	30,000	75,000	**No**

Source: NREL, 2010.

The actual emissions would vary based on the fuel type and combustion type (e.g., biomass moisture and heating value) and combustion technique being utilized (e.g., stoker or fluidized bed boiler). For example, a fluidized bed boiler is more efficient at combusting woody biomass than a stoker boiler. To offset this, a stoker may be required to implement pollution control equipment with higher removal efficiencies. The emission estimates reflect a general estimate of potential emissions from a 13 and a 2.5MW biomass plant utilizing a stoker boiler design versus a fluidized bed boiler design, and reflect a boiler heat input design of approximately 175 and 33 MMBTU per hour with ESP for particulate removal, and SNCR for NO_x reductions. A grate type boiler (i.e., stoker) would typically not combust woody biomass as efficiently as a fluidized bed boiler, thus emissions of CO would be higher. Therefore, the emissions reflect an oxidation catalyst to reduce further CO emissions.

Permitting and Regulatory Review. As with the WTE plant, permitting scenarios may vary based on the final design, timing of the project, and the types of controls ultimately selected. These may differ in specific features from the ones described in this report. However, during the final design stage and the permitting process either 1) the actual equipment, controls, or operating limitations would be selected to reduce the PTE below the major source threshold, 2) NNSR permitting process would require emission offsets be obtained from other previously decommissioned sources within the region, or 3) the PSD permitting process would insure the NAAQS was not exceeded and the emissions from the projects would be included in the regional emissions inventory ensuring it would not interfere with the ability of the state to maintain the NAAQS. This cap-and-trade type system is inherent to Federal and state air regulations, and leads to a forced reduction in regional emissions in nonattainment areas or the preservation of clean air in attainment regions. Therefore, regardless of the ultimate permitting scenario effects would be less than significant.

- **Alternative 2a and 2b.** The PTE of all attainment pollutants except SO_2 (NO_x, CO, and PM) would exceed the PSD threshold (Table 2-5). Therefore, PSD review would be required. In addition, the PTE of NO_x would exceed the major modification thresholds; therefore, NNSR may become required if the region were to become a nonattainment area under the 2008 O_3 standard. A Title V Significant Permit Modification would be required within one year of the first operation of the proposed biomass plant.
- **Alternative 2c.** The PTE of all attainment pollutants would be below the PSD threshold (Table 2-5). Therefore, PSD review would not be required. In addition, the PTE of NO_x would not exceed the major modification thresholds; therefore, NNSR would not be required if the region were to become a nonattainment area under the 2008 O_3 standard. Because the major source threshold would not be exceeded, only a Title V Minor Permit Modification would be required within one year of the first operation of the proposed biomass plant.

EPA has also developed NSPS and MACT emission standards for criteria pollutants and HAPs that restrict the level of emissions from biomass facilities. Included in these standards are emissions limits for NO_x, SO_2, PM and selected HAPs. The NSPS apply to boilers with heat inputs in excess of 100 MMBTU per hour and the MACT standards apply to sources with potential HAP emissions that exceed 10 tpy for a single HAP or 25 tpy for all HAPs combined. During the final design stages, Fort Carson would comply with all applicable NSPS and MACT emission standards.

GHGs. Net GHG emissions consist of GHG emissions from the transportation, processing, and combustion of the wood waste in the biomass plant minus GHG emissions avoided from the reduction in the use of fossil fuel based electricity. The CO_2 emissions from burning of biomass are considered part of the Earth's natural carbon cycle and the electrical power generation from this project would displace CO_2 and other GHGs from other electrical generation sources. The EPA WARM model was used to calculate GHG emissions of Alternative 2.

- **Alternative 2a and 2b.** The net decrease of Scope 2 GHG emissions from the 13MW biomass plant was estimated to be 48,066 tpy CO_2e. This reduction is equivalent to removing the annual GHG emissions from 8,698 passenger vehicles. These GHG emissions savings are primarily due from the reduction of off-site fossil-fuel-based generation of electricity. These effects would be minor beneficial, and would help the Installation to meet partially its 34 percent reduction goals under EO 13514. Although there would be a net reduction in GHG emissions, the proposed 13MW biomass plant would directly emit approximately 156,000 tpy Scope 1 GHG emissions. This would be greater than the major modification threshold of 75,000 tpy under the Tailoring Rule; therefore, a PSD and BACT review for GHG would be required.

- **Alternative 2c.** The net decrease of Scope 2 GHG emissions from the 2.5MW biomass plant was estimated to be 9,243 tpy CO_2e. The reduction from the plant is equivalent to removing the annual GHG emissions from 1,672 passenger vehicles. These effects would be minor beneficial, and would help the Installation to meet partially its 34 percent reduction goals under EO 13514. The proposed 2.5MW biomass plant would directly emit approximately 30,000 tpy Scope 1 GHG emissions. This would be less than the major modification threshold; therefore, a PSD and BACT review for GHG would not be required.

Indirect Effects. Because of the required air pollution controls, emissions of criteria pollutants from biomass plants are generally lower than those generated by fossil-fuel-based power plants (Table 2-6). There would be additional long-term beneficial effects from indirect reductions from the use of fossil-fuel-based electricity. The primary reductions would be from NO_x and SO_2 emissions; however, similar reductions would be likely for all criteria pollutants.

Table 2-6. Potential Indirect Emissions Reductions from a 13MW and 2.5MW Biomass Plant

	Emissions (tpy)		
Pollutant	**Fossil Fuel Combustion**	**Proposed Biomass Plant**	**Potential Reductions**
13MW Plant			
Oxides of Nitrogen (NO_x)	154	100	54
Sulfur Dioxide (SO_2)	143	22	121
2.5MW Plant			
Oxides of Nitrogen (NO_x)	30	19	11
Sulfur Dioxide (SO_2)	27	4	23

Source: EPA, 2011; and EPA, 1996.

Best Management Practices. BMPs would be required for both construction and operational emissions associated with the biomass plant. The construction projects would be accomplished in full compliance with Colorado regulatory requirements, through the use of compliant practices or products. These requirements appear in 5 CCR 1001-1, AQCC Regulations. They include the following:

- Odor Emission (5 CCR 1001-4)
- Open Burning, Prescribed Fire, and Permitting (5 CCR 1001-11)
- Control of Emission of Ozone Depleting Compounds (5 CCR 1001-19)

BMPs associated with operation of the new 13MW biomass plant under Alternatives 2a and 2b would include:

- BACT review for each criteria pollutant and GHG
- MACT review for regulated HAPs and designated categories
- Predictive air dispersion modeling

- Establishing procedures for measuring and recording emissions and/or process rates
- A public involvement process

Regardless of which alternative is ultimately selected, the biomass plant would need to meet all NSPS and NESHAP requirements. This listing is not all-inclusive; Fort Carson and any contractors would comply with all applicable Colorado air pollution control regulations.

2.5 ALTERNATIVE 3

Short-term minor adverse and long-term moderate beneficial effects on air quality would be expected. The short-term minor adverse effects would be from air emissions during construction and installation of the PV systems, and long-term beneficial effects from indirect reductions in the use of fossil-fuel based electricity (Table 2-7).

Table 2-7. Potential Indirect Emissions Reductions from PV Arrays

Site Location	Description/Name	Acres	Annual Power [megawatt-hour (MWhr)]	Indirect Emissions Reductions (tpy)		
				NO_x	SO_2	CO_2
Cantonment	Gate 2 North	3	4,350	5.9	5.4	4,146
Cantonment	Gate 2 South	7.6	11,020	14.9	13.8	10,502
Cantonment	Chiles	12.7	18,415	24.9	23.0	17,550
SWMU	SWMU 1-10-170	86.9	126,005	170.3	157.6	120,087
SWMU	SWMU 5 (Site 1)	14.3	20,735	28.0	25.9	19,761
SWMU	SWMU 5 (Site 2)	41.9	60,755	82.1	76.0	57,901
Training Area	Bravo North (Site 1)	71.5	103,675	140.1	129.7	98,805
Training Area	Butts Road	89.4	129,630	175.2	162.2	123,541
Training Area	Magrath Avenue	19.5	28,275	38.2	35.4	26,947
Training Area	Wildhorse	361.1	523,595	707.7	655.1	499,002
Training Area	Titis/Signal Hill	31.9	46,255	62.5	57.9	44,082
Training Area	Ray Nixon	146.8	212,860	287.7	266.3	202,862
Training Area	Tent City	97.1	140,795	190.3	176.1	134,182
	Total	**983.7**	**1,426,365.0**	**1,927.9**	**1,784.5**	**1,359,369**

Source: EPA, 2011.

Permitting and Regulatory Review. Alternative 3 would not include any new stationary sources of air emissions. No air permits to construct or operate would be required. The construction projects would be accomplished in full compliance with Colorado regulatory requirements, through the use of compliant practices or products. These requirements appear in 5 CCR 1001-1, AQCC Regulations. They include the following:

- Odor Emission (*5 CCR 1001-4*)
- Open Burning, Prescribed Fire, and Permitting (*5 CCR 1001-11*)
- Control of Emission of Ozone Depleting Compounds (*5 CCR 1001-19*)

This listing is not all-inclusive; Fort Carson and any contractors would comply with all applicable Colorado air pollution control regulations.

GHGs. Alternative 3 would constitute a net decrease in Scope 2 GHG emissions up to 1.36 million tpy of CO_2. These would be indirect GHG resulting from the reduction of generation of electricity off-site but purchased by the Installation. There would be no direct ongoing GHG emissions from operation of the PV arrays.

2.6 ALTERNATIVE 4

Short-term minor adverse effects on air quality would be expected. The short-term effects would be from air emissions during construction and installation of the expanded non-portable water system and the pump station. Long-term effects would be negligible as there would be no ongoing sources of operational emissions.

Permitting and Regulatory Review. Alternative 4 would not include any new stationary sources of air emissions. Air permits, however, may be required for land disturbance areas (5 CCR 1001-5). The construction projects would be accomplished in full compliance with Colorado regulatory requirements, through the use of compliant practices or products.

Climate and GHGs. There would be no direct ongoing GHG emissions from operation of the expanded non-potable water system.

2.7 ALTERNATIVE 5

Short-term minor adverse and long-term moderate beneficial effects on air quality would be expected. The short-term effects would be from air emissions during construction and installation of the wind turbines, and long-term effects from reductions of indirect emissions due to the decrease use of fossil-fuel based electricity. Potential indirect emissions reductions of NO_x, SO_2, and CO_2 from Alternative 5 are outlined in Table 2-8.

Table 2-8. Potential Indirect Emissions Reductions from Wind Turbines

	Size of Units	Number of Units	Annual Power (MWhr)	Indirect Emissions Reductions (tpy)		
				NO_x	SO_2	CO_2
Lower Bound	1.5	3	39,420	53.3	49.3	37,568
Upper Bound	3	5	131,400	177.6	164.4	125,228

Source: EPA, 2011.

Permitting and Regulatory Review. Alternative 5 would not include any new stationary sources of air emissions. Air permits, however, may be required for land disturbance areas (5 CCR 1001-5). The construction projects would be accomplished in full compliance with Colorado regulatory requirements, through the use of compliant practices or products.

GHGs. Alternative 5 would constitute a net decrease in Scope 2 GHG emissions ranging from 37,568 to 125,228 tpy CO_2e. These would be indirect GHGs resulting from the reduction of generation of electricity off-site but purchased by the Installation. There would be no direct ongoing GHG emissions from operation of the wind turbines.

2.8 ALTERNATIVE 6

Short-term minor adverse and long-term moderate beneficial effects on air quality would be expected. The short-term effects would be from air emissions during construction and installation of the future geothermal and solar projects, and long-term effects from reductions of indirect emissions due to the decreased use of fossil fuel based electricity from these projects. Since the exact scope of these projects is in the preplanning stages, the reductions of indirect emissions due to the decreased use of fossil-fuel based electricity cannot be estimated; however, they would be similar in magnitude to those outlined under Alternative 3.

Permitting and Regulatory Review. Alternative 6 would not include any new stationary sources of air emissions. Air permits, however, may be required for land disturbance areas (5 CCR 1001-5). The construction projects would be accomplished in full compliance with Colorado regulatory requirements, through the use of compliant practices or products.

GHGs. Alternative 6 would constitute a net decrease in Scope 2 GHG emissions similar in magnitude to those outlined under Alternative 3. These would be indirect GHG emissions resulting from the reduction of generation of electricity off site but purchased by the Installation. There would be no direct ongoing GHG emissions from operation of the future geothermal or solar projects.

2.9 ALTERNATIVE 7

Short-term minor adverse and long-term beneficial effects on air quality would be anticipated from Alternative 7. The short-term effects would be from air emissions during construction and installation of infrastructure upgrades, and long-term effects from reductions of indirect emissions due to the decrease use of electricity from behavioral and energy conservation measures enacted.

Permitting and Regulatory Review. Alternative 7 would not include any new stationary sources of air emissions. Air permits, however, may be required for land disturbance areas (5 CCR 1001-5). Any construction projects would be accomplished in full compliance with Colorado regulatory requirements, through the use of compliant practices or products identical to those outlined under Alternative 1 in Section 2.3.

GHGs. Alternative 7 would constitute a net decrease in Scope 2 GHG emissions. These would be indirect GHG emissions resulting from improved efficiencies in equipment and the reduction of electricity use from conservation and behavioral measures enacted by the Installation.

3.0 CUMULATIVE EFFECTS

The Proposed Action would have short-term minor and long-term moderate adverse cumulative effects on air quality. By directly inventorying all emissions in a nonattainment region and monitoring concentrations of criteria pollutants in attainment regions, the state of Colorado takes into account the effects of all past and present emissions in their state. This is done by putting a regulatory structure in place designed to prevent air quality deterioration for areas that are in attainment with the NAAQS and to reduce common or criteria pollutants emitted in nonattainment areas to levels that will achieve compliance with the NAAQS (EPA, 2010a). This structure of rules and regulations are contained in the SIP. SIPs are the regulations and other materials for meeting clean air standards and associated CAA requirements. SIPs include:

- State regulations that EPA has approved;
- State-issued, EPA-approved orders requiring pollution control at individual companies; and

- Planning documents, such as area-specific compilations of emissions estimates and computer simulations (modeling analyses), demonstrating that the regulatory limits assure that the air will meet air quality standards (EPA, 2010).

The SIP process applies either specifically or indirectly to all activities in the region. Regardless of which alternative is ultimately selected, regional growth and contemporaneous actions would continue, including CAB and Grow the Army actions at Fort Carson. These activities would introduce new stationary and mobile sources of air emissions at Fort Carson. These actions would have some level of impact to air quality that has been evaluated in separate NEPA documents. However, neither these or any other large-scale projects or proposals have been identified that, when combined with the Proposed Action, would threaten the attainment status of the region, would have substantial GHG emissions, or would lead to a violation of any Federal, state, or local air regulation. Estimated emissions from the 40MW WTE plant or the 13MW biomass plant would be appreciable. Therefore, the Proposed Action would have moderate adverse cumulative effects on air quality. Although there would be an increase in emissions associated with the 40MW WTE plant or the 13MW biomass plant, implementing either would constitute an overall net decrease in both criteria pollutants and GHGs due to reduction in the use of off-Post fossil-fuel-based electricity. These indirect reductions in emissions would be appreciably greater than operational emissions from the proposed WTE plant. Therefore, in the context of regional air quality or global warming the cumulative effects would be beneficial.

4.0 PROPOSED MITIGATION

No mitigation measures for air quality would be required. The direct, indirect, and cumulative effects associated with air quality for all alternatives would be minor to moderate. No activities outside compliance with existing regulations, permits, and plans would be required to reduce the level of effect to less than significant.

5.0 LIST OF SECTION ACRONYMS

Acronym	**Definition**
AQCC	Air Quality Control Commission
AQCR	Air-Quality Control Region
As	arsenic
BACT	Best Available Control Technology
BMPs	Best management practices
CAA	Clean Air Act
CAB	Combat Aviation Brigade
CCR	Code of Colorado Regulations
Cd	cadmium
CDDs	chlorinated dibenzo-p-dioxin and tetrachlorodibenzo-p-dioxin
CDFs	chlorinated dibenzofurans and dibenzofurans
CDPHE	Colorado Department of Public Health and Environment
CFR	Code of Federal Regulations
CH_4	Methane
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalents
Cr	chromium
DSI	duct sorbent injection
e.g.	exemplī grātiā (for example)
eGRID	Emissions & Generation Resource Integrated Database
EO	Executive Order
EPA	United States Environmental Protection Agency
ESP	electrostatic precipitator
FF	fabric filter
GCR	General Conformity Rule
GHG	greenhouse gas
HAP	Hazardous Air Pollutant
HCl	hydrochloric acid
Hg	mercury
LAER	Lowest Achievable Emissions Rate
MACT	Maximum Achievable Control Technology
MMBTU	Million Metric British Thermal Units
MSW	municipal solid waste
MW	megawattt
MWhr	megawatt-hour
N_20	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NESHAP	National Emission Standards for Hazardous Air Pollutants
Ni	Nickel
NNSR	Nonattainment New Source Review

NO_2	nitrogen dioxide
NO_x	oxides of nitrogen
NREL	National Renewable Energy Laboratory
NSPS	New Source Performance Standards
NSR	New Source Review
O_3	ozone
Pb	lead
PM	particulate matter
PM_{10}	particulate matter less than 10 microns in diameter
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
Ppb	parts per billion
ppm	parts per million
PSD	Prevention of Significant Deterioration
PTE	potential to emit
PV	Photovoltaic
RONA	Record of Non-applicability
SD	spray dryer
SNCR	selective non-catalytic reduction
SIP	State Implementation Plan
SNCR	selective noncatalytic reduction
SO_2	sulfur dioxide
SWMU	Solid waste management unit
tpy	tons per year
$\mu g/m^3$	micrograms per cubic meter
VOC	volatile organic compounds
WARM	Waste Reduction Model
WTE	waste to energy

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7.0 GLOSSARY

Air-Quality Control Region - A contiguous area where air quality is relatively uniform. AQCRs may consist of two or more cities, counties or other governmental entities, and each region is required to adopt consistent pollution control measures across the political jurisdictions involved.

Attainment Areas - A zone within which the level of a pollutant is considered to meet the National Ambient Air Quality Standards.

Criteria Pollutants - The Clean Air Act requires EPA to set standards for six common air pollutants. These commonly found air pollutants (also known as "criteria pollutants") are found all over the United States. They are particle pollution (often referred to as particulate matter), ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides, and lead.

National Ambient Air Quality Standards (NAAQS) - Standards established by the EPA that apply to outdoor air throughout the country. Primary standards are designed to protect human health, with an adequate margin of safety, including sensitive populations such as children, the elderly, and individuals suffering from respiratory disease.

National Emissions Standards for Hazardous Air Pollutants - Emissions standards set by the EPA for an air pollutant not covered by NAAQS that may cause an increase in fatalities or in serious, irreversible, or incapacitating illness.

New Source Performance Standards - Pollution control standards issued by the EPA. The term is used in the Clean Air Act to refer to air pollution emission standards, and in the Clean Water Act referring to standards for discharges of industrial wastewater to surface waters.

Nonattainment Areas - A locality where air pollution levels persistently exceed national standards or that contributes to ambient air quality in a nearby area that fails to meet standards.

Particulate Matter - Small solid particles and liquid droplets in the air.

PM_{10} - Particulate matter less than 10 microns in diameter.

$PM_{2.5}$ - Particulate matter less than 2.5 microns in diameter.

State Implementation Plan - The state plan for complying with the Federal Clean Air Act. A SIP consists of narrative, rules, technical documentation, and agreements that an individual state will use to clean up area not meeting the National Ambient Air Quality Standards.

8.0 LIST OF PREPARERS

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MS Civil/Environmental Engineering, Tufts University, 1997
20 Years Experience

ATTACHMENT A - AIR QUALITY SUPPORTING CALCULATIONS

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Table A-1. Construction Equipment Use				
Equipment type	**Number of units**	**Days on site**	**Hours per day**	**Operating hours**
Excavators Composite	5	230	4	4600
Rollers Composite	5	230	8	9200
Rubber Tired Dozers Composite	5	230	8	9200
Plate Compactors Composite	10	230	4	9200
Trenchers Composite	10	230	8	18400
Air Compressors	10	230	4	9200
Cement & Mortar Mixers	10	230	6	13800
Cranes	5	230	7	8050
Generator Sets	5	230	4	4600
Tractors/Loaders/Backhoes	5	230	7	8050
Pavers Composite	5	230	8	9200
Paving Equipment	10	230	8	18400

Table A-2. Construction Equipment Emission Factors (pounds/hour)						
Equipment	**CO**	**NO_x**	**VOC**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**
Excavators Composite	0.5828	1.3249	0.1695	0.0013	0.0727	0.0727
Rollers Composite	0.4341	0.8607	0.1328	0.0008	0.0601	0.0601
Rubber Tired Dozers Composite	1.5961	3.2672	0.3644	0.0025	0.1409	0.1409
Plate Compactors Composite	0.0263	0.0328	0.0052	0.0001	0.0021	0.0021
Trenchers Composite	0.5080	0.8237	0.1851	0.0007	0.0688	0.0688
Air Compressors	0.3782	0.7980	0.1232	0.0007	0.0563	0.0563
Cement and Mortar Mixers	0.0447	0.0658	0.0113	0.0001	0.0044	0.0044
Cranes	0.6011	1.6100	0.1778	0.0014	0.0715	0.0715
Generator Sets	0.3461	0.6980	0.1075	0.0007	0.0430	0.0430
Tractors/Loaders/Backhoes	0.4063	0.7746	0.1204	0.0008	0.0599	0.0599
Pavers Composite	0.5874	1.0796	0.1963	0.0009	0.0769	0.0769
Paving Equipment	0.0532	0.1061	0.0166	0.0002	0.0063	0.0063

Table A-3. Construction Equipment Emissions (tpy)						
Equipment	**CO**	**NO_x**	**VOC**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**
Excavators Composite	1.3405	3.0473	0.3899	0.0030	0.1673	0.1673
Rollers Composite	1.9968	3.9591	0.6109	0.0035	0.2764	0.2764
Rubber Tired Dozers Composite	7.3419	15.0291	1.6763	0.0113	0.6481	0.6481
Plate Compactors Composite	0.1212	0.1511	0.0237	0.0003	0.0096	0.0096
Trenchers Composite	4.6737	7.5782	1.7027	0.0064	0.6334	0.6334
Air Compressors	1.7396	3.6708	0.5668	0.0033	0.2591	0.2591
Cement and Mortar Mixers	0.3087	0.4537	0.0778	0.0007	0.0306	0.0306
Cranes	2.4194	6.4804	0.7158	0.0055	0.2879	0.2879
Generator Sets	0.7960	1.6054	0.2472	0.0016	0.0989	0.0989
Tractors/Loaders/Backhoes	1.6355	3.1176	0.4846	0.0031	0.2410	0.2410
Pavers Composite	2.7022	4.9661	0.9030	0.0041	0.3537	0.3537
Paving Equipment	0.4897	0.9760	0.1526	0.0015	0.0580	0.0580
Total	**25.57**	**51.03**	**7.55**	**0.0444**	**3.06**	**3.06**

Table A-5. Delivery of Equipment and Supplies						
Delivery of Concrete						
Volume of Concrete (cubic yards)	9259					
Number of Concrete Trucks	***926***					
Delivery of Equipment and Supplies						
Number of Deliveries Per Site Per Day	4					
Days of Construction	230					
Total Number of Deliveries	2760					
Grand Total Number of Trucks	**3686**					
Number of Trips	2					
Miles Per Trip	30					
Total Miles	221,156					
Pollutant	**CO**	**NO_x**	**VOC**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**
Emission Factor (lbs/mile)	0.0219	0.0237	0.0030	0.0000	0.0009	0.0007
Total Emissions (lbs)	4854.18	5244.17	661.85	5.67	189.32	163.51
Total Emissions (tpy)	**2.43**	**2.62**	**0.33**	**0.0028**	**0.09**	**0.08**
Source: CARB, 2007.						

Table A-6. Surface Disturbance						
TSP Emissions	80	lb/acre				
PM_{10}/ Total Suspended Particles	0.45					
$PM_{2.5}/PM_{10}$	0.15					
Period of Disturbance	30	days				
Capture Fraction	0.5					
Building/Facility	**Area (acres)**	**TSP (lbs)**	**PM_{10} (lbs)**	**PM_{10} (tons)**	**$PM_{2.5}$ (lbs)**	**$PM_{2.5}$ (tons)**
Demolition	26.5	63,480	28,566	14.28	2,142	1.07

Sources: USEPA, 1995; USEPA, 2005.

Table A-7. Worker Commutes						
Number of Workers	50					
Number of Trips	2					
Miles Per Trip	30					
Days of Construction	115					
Total Miles	345000					
Pollutant	**CO**	**NO_x**	**VOC**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**
Emission Factor (lbs/mile)	0.0105	0.0011	0.0011	0.0000	0.0001	0.0001
Total Emissions (lbs)	14556.84	1521.98	1489.29	14.83	117.38	73.04
Total Emissions (tpy)	**7.28**	**0.76**	**0.74**	**0.0074**	**0.06**	**0.04**

Source: CARB, 2007.

Table A-8. Total Construction Emissions (tons per year)						
Activity/Source	**CO**	**NO_x**	**VOC**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**
Construction Equipment	25.57	51.03	7.55	0.0444	3.06	3.06
Delivery of Equipment and Supplies	2.43	2.62	0.33	0.0028	0.09	0.08
Surface Disturbance	0.00	0.00	0.00	0.0000	14.28	1.07
Worker Commutes	7.28	0.76	0.74	0.0074	0.06	0.04
Total Construction Emissions	**35.27**	**54.42**	**8.63**	**0.0547**	**17.50**	**4.25**

Table A-9. Estimated Emissions for Waste-To-Energy Plant						
Emission Factors for Mass Burn Waterwall Combustors						
	Uncontrolled	**ESP**	**DSI/ESP**	**SD/ESP**	**DSI/FF**	**SD/FF**
Pollutant	**lb Emissions/tons Waste**					
PM	2.51E+01	2.10E-01	5.90E-02	7.03E-02	1.79E-01	6.20E-02
As	4.37E-03	2.17E-05	4.37E-03	1.37E-05	1.03E-05	4.23E-06
Cd	1.09E-02	6.46E-04	8.87E-05	7.51E-05	2.34E-05	2.71E-05
Cr	8.97E-03	1.13E-04	3.09E-05	2.59E-04	2.00E-04	3.00E-05
Hg	5.60E-03	5.60E-03	3.96E-03	3.26E-03	2.20E-03	2.20E-03
Ni	7.85E-03	1.12E-04	3.22E-05	2.70E-04	1.43E-04	5.16E-05
Pb	2.13E-01	3.00E-03	2.90E-03	9.15E-04	2.97E-04	2.61E-04
SO2	3.46E+00	3.46E+00	9.51E-01	6.53E-01	1.43E+00	5.54E-01
HCl	6.40E+00	6.40E+00	2.78E-01	4.58E-01	6.36E-01	2.11E-01
CDD/CDF	1.67E-06	1.67E-06	1.17E-06	6.21E-07	1.60E-07	6.61E-08
NOx	3.56E+00	3.56E+00	3.56E+00	3.56E+00	3.56E+00	3.56E+00
CO	4.63E-01	4.63E-01	4.63E-01	4.63E-01	4.63E-01	4.63E-01
CO_2	1.90E+03	1.90E+03	1.90E+03	1.90E+03	1.90E+03	1.90E+03
Tons of Waste	336,351	tons/year				
	Uncontrolled	**ESP**	**DSI/ESP**	**SD/ESP**	**DSI/FF**	**SD/FF**
Pollutant	**tons/year**					
PM	4,221.2	35.3	9.9	11.8	30.1	10.4
As	0.7349	0.0036	0.7349	0.0023	0.0017	0.0007
Cd	1.8331	0.1086	0.0149	0.0126	0.0039	0.0046
Cr	1.5085	0.0190	0.0052	0.0436	0.0336	0.0050
Hg	0.9418	0.9418	0.6660	0.5483	0.3700	0.3700
Ni	1.3202	0.0188	0.0054	0.0454	0.0240	0.0087
Pb	35.8214	0.5045	0.4877	0.1539	0.0499	0.0439
SO2	581.9	581.9	159.9	109.8	240.5	93.2
HCl	1,076.3	1,076.3	46.8	77.0	107.0	35.5
CDD/CDF	2.81E-04	2.81E-04	1.97E-04	1.04E-04	2.69E-05	1.11E-05
NOx	598.7	598.7	598.7	598.7	598.7	598.7
NOx w/SNCR	389.2	389.2	389.2	389.2	389.2	389.2
CO	77.9	77.9	77.9	77.9	77.9	77.9
CO_2	319,533.5	319,533.5	319,533.5	319,533.5	319,533.5	319,533.5

Table A-10. Potential Indirect Emissions Reductions from WTE and Biomass Plants					
Plant Size		**40**	**13**	**2.5**	**MW**
Power Generated		350400	113880	21900	MWhr
Pollutant	**Emissions rate (lb/MWhr)**	**Emissions (tons/year)**			
Nitrogen oxides (NO_x)	2.7033	473.6	153.9	29.6	
Sulfur dioxide (SO_2)	2.5022	438.4	142.5	27.4	
Carbon Dioxide (CO_2)	1,906.1	333,941.7	108,531.1	20,871.4	

Table A-11. Estimated Emissions for Biomass Plant								
Plant Size	15	MW						
Source Operation	PM	PM_{10}	$PM_{2.5}$	NO_x	SO_2	CO	VOC	HAPs
Woody Biomass Grate Boiler	60	50	45	115	25	175	15	<10/25
Woody Biomass Handling and Processing	<1	<1	<1	-	-	-	-	-
Fly Ash Handling	<1	<1	<1	-	-	-	-	-
Boiler Support Material Handling	<1	<1	<1	-	-	-	-	-
Portable Wood Chipper Combustion Emissions	<1	<1	<1	<1	<1	<1	<1	<1
Additional Emergency Equipment (generators, etc.)	<1	<1	<1	<1	<1	<1	<1	<1
Total PTE	60	50	45	115	25	175	15	0
Plant Size	13	MW						
Source Operation	PM	PM_{10}	$PM_{2.5}$	NO_x	SO_2	CO	VOC	HAPs
Woody Biomass Grate Boiler	52	43	39	100	22	152	13	<10/25
Woody Biomass Handling and Processing	<1	<1	<1	-	-	-	-	-
Fly Ash Handling	<1	<1	<1	-	-	-	-	-
Boiler Support Material Handling	<1	<1	<1	-	-	-	-	-
Portable Wood Chipper Combustion Emissions	<1	<1	<1	<1	<1	<1	<1	<1
Additional Emergency Equipment (generators, etc.)	<1	<1	<1	<1	<1	<1	<1	<1
Total PTE	52	43	39	100	22	152	13	<1
Plant Size	2.5	MW						
Source Operation	PM	PM_{10}	$PM_{2.5}$	NO_x	SO_2	CO	VOC	HAPs
Woody Biomass Grate Boiler	10	8	8	19	4	29	3	<10/25
Woody Biomass Handling and Processing	<1	<1	<1	-	-	-	-	-
Fly Ash Handling	<1	<1	<1	-	-	-	-	-
Boiler Support Material Handling	<1	<1	<1	-	-	-	-	-
Portable Wood Chipper Combustion Emissions	<1	<1	<1	<1	<1	<1	<1	<1

Table A-11. Estimated Emissions for Biomass Plant								
Additional Emergency Equipment (generators, etc.)	<1	<1	<1	<1	<1	<1	<1	<1
Total PTE	10	8	8	19	4	29	3	<1

Table A-11. Potential Indirect Emissions Reductions from Wind Turbines					
		Emission Factors (lbs/MWhr)	2.7033	2.5022	1,906.1
			Emissions (tpy)		
Size of Units	**Number of Units**	**MWhr**	**NO_x**	**SO_2**	**CO_2**
1.5	3	39,420	53.3	49.3	37,568
3	5	131,400	177.6	164.4	125,228

Table A-12. Potential Indirect Emissions Reductions from PV Arrays						
			Emission Factors (lbs/MWhr)	2.7033	2.5022	1,906.1
				Emissions (tpy)		
Site Location	**Description/Name**	**Acres/MW**	**MWhr**	**NO_x**	**SO_2**	**CO_2**
Cantonment	Gate 2 North	3	4,350	5.9	5.4	4,146
Cantonment	Gate 2 South	7.6	11,020	14.9	13.8	10,502
Cantonment	Chiles	12.7	18,415	24.9	23.0	17,550
SWMU	SWMU 1-10-170	86.9	126,005	170.3	157.6	120,087
SWMU	SWMU 5 (Site 1)	14.3	20,735	28.0	25.9	19,761
SWMU	SWMU 5 (Site 2)	41.9	60,755	82.1	76.0	57,901
Training Area	Bravo North (Site 1)	71.5	103,675	140.1	129.7	98,805
Training Area	Butts Road	89.4	129,630	175.2	162.2	123,541
Training Area	Magrath Avenue	19.5	28,275	38.2	35.4	26,947
Training Area	Wildhorse	361.1	523,595	707.7	655.1	499,002
Training Area	Titis/Signal Hill	31.9	46,255	62.5	57.9	44,082
Training Area	Ray Nixon	146.8	212,860	287.7	266.3	202,862
Training Area	Tent City	97.1	140,795	190.3	176.1	134,182
	Total	**983.7**	**1,426,365.0**	**1,927.9**	**1,784.5**	**1,359,369**

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ATTACHMENT B - RECORD OF NONAPPLICABLITY (RONA)

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RECORD OF NON-APPLICABILITY
In Accordance with the Clean Air Act - General Conformity Rule For
The Fort Carson Net Zero Waste, Water, and Energy Implementation

18 July 2012

The Army's Proposed Action is to implement Net Zero waste, water, and energy goals by 2020 at Fort Carson while meeting energy mandates for renewable energy production and GHG emissions reduction. In doing so, the Army will increase Fort Carson's energy and water security and sustain ongoing and future military missions. Fort Carson proposes to implement the following energy initiatives as part of the Net Zero energy program:

- Building and grid metering and establishment of microgrids
- Building renovations, expansions, and technology upgrades to increase efficiency of power usage
- Installation policy changes regarding transportation (e.g., increased telecommuting, Soldier incentives)
- Acquisition of systems with lower energy requirements
- Cogeneration and heat energy recovery
- Construction and use of energy storage facilities
- Renewable/alternative energy infrastructure development (including construction, electrical tie-in, and facility operations and maintenance) such as:
    1. Construction and operation of a waste-to-energy (WTE) plant
    2. Biomass plant (heat or combined heat and power)
    3. Construction and operation of ground source heat pumps
    4. Construction and operation of wind turbines
    5. Photovoltaic systems (solar cell)
- Assessment of baseline energy efficiency of Installation infrastructure and vehicle fleets
- Reducing consumption for both tactical and non-tactical (Garrison) operations
- Transportation and fleet upgrades and innovations (electric vehicles and battery storage upgrades)
- Use of more efficient fuels

To determine whether the GCR applies, all direct and indirect sources of emissions were estimated and combined for the Net Zero projects within the Colorado Springs CO maintenance area. Direct emissions are emissions that would be caused or initiated by a Federal action and occur at the same time and place as the action. Indirect emissions are defined as reasonably foreseeable emissions that would be caused by the action, but could occur later in time or be farther removed in distance from the action itself. More specifically, project-related construction and operational emissions were estimated for:

- Alternative 2b: Construct and Operate an up to 13MW Biomass Plant in Bravo North Site 2
- Alternative 3: Construction and Operation of Photovoltaic Systems at Gate 2 North and South, Chiles, SWMU 5 (Sites 1 and 2), Magrath Avenue, and Titis/Signal Hill
- Alternative 4: Expansion of the Existing Non-Potable Water System
- Alternative 5: Construction and Operation of Wind Turbines
- Alternative 6: Implement Future Renewable Energy Development within Net Zero Footprint Identified by the Army

Upper bound assumptions were made to estimate emissions during the year of maximum construction. Construction activities including the use of construction equipment, worker vehicles (e.g., bulldozers, backhoes), use of VOC paints, and paving off gasses and fugitive particles from surface disturbances were included in the analysis. The total construction emissions of CO during the maximum year of construction would be less than the applicability thresholds (Table 1). If Alternative 2b (Construct and Operate an 13MW Biomass Plant in Bravo North Site 2) were selected, operational emissions of CO in any given year would be more than the applicability thresholds. However, if this alternative were ultimately selected a formal conformity demonstration would not be required. This Alternative includes modified stationary sources that would require a permit under the Prevention of Significant Deterioration (PSD) program (40 CFR 93-153(d)(1)), therefore it would be exempt from the GCRs. All other alternatives would have either no operational emissions or they are located outside the CO maintenance area. Therefore, for all alternatives, the general conformity requirements do not apply, and no formal conformity determination is required.

Table 1. Total Annual Emissions Subject to the GCR

Activity	Estimated Annual CO Emissions Within the CO Maintenance Area (tpy)	Applicability Threshold (tpy)	Exceeds Applicability Threshold?
Construction[a]	35	100	No
Operational			
Alternative 2b: Construct and Operate an up to 13MW Biomass Plant in Bravo North Sites	152	100	**Yes**
All other alternatives	None		No

Note: [a] Year of maximum construction emissions

Notably, an ongoing net decrease in CO emissions is expected after the construction phase due to the reduction in off-site fossil fuel combustion to generate electricity for the Installation. However, since the exact location of these emissions is unknown, they are not considered reasonably foreseeable under the GCRs and have been excluded from this analysis.

Supported documentation and emission estimates:

(X) Are Attached
( ) Appear in the NEPA Documentation
( ) Other (Not Necessary)

Roderick Chisholm
Signature

fr DAVID L. GROSSO
COL, SF, GARRISON COMMANDER
Title

25 Sep 12
Date

APPENDIX D
SPECIAL STATUS WILDLIFE OBSERVED ON FORT CARSON

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Special Status Wildlife Species Observed on Fort Carson

Common Name	Scientific Name	Species Type	Status[1]	Authority[2]
Southern redbelly dace	*Phoxinus erythrogaster*	Fish	SE	CDOW, CNHP, CSP
Arkansas darter[3]	*Etheostoma cragini*	Fish	ST	CDOW, CNHP, CSP, USFWS
Greenback cutthroat trout[3]	*Oncorhynchus clarki stomias*	Fish	ST	CDOW, USFWS
Flathead Chub	*Platygobio gracilis*	Fish	SC	CDOW
Northern leopard frog	*Rana pipiens*	Amphibian	SC	CDOW, CNHP, CSP
Painted turtle	*Chrysemys picta*	Reptile	SC	CNHP
Short-horned lizard	*Phrynosoma douglassi*	Reptile	SC	CNHP, CSP
Triploid checkered whiptail	*Aspidosceli neotessalatus*	Reptile	SC	CDOW, CNHP, CSP, SAR
Black-tailed prairie dog	*Cynomys ludovicianus*	Mammal	SC	CDOW, CNHP, CSP
American white pelican	*Pelecanus erythrorhynchos*	Bird	SC	CNHP
Snowy egret	*Egretta thula*	Bird	SC	CNHP
White-faced ibis	*Plegadis chihi*	Bird	SC	CNHP
Mississippi kite	*Ictinia misisippiensis*	Bird	SC	PIF
Bald eagle	*Haliaeetus leucocephalus*	Bird	ST	CDOW, CNHP, CSP, PIF, USFWS
Northern harrier	*Circus cyaneus*	Bird	SC	PIF, USFWS
Northern goshawk	*Accipiter gentilis*	Bird	SC	CNHP
Swainson's hawk	*Buteo swainsoni*	Bird	SC	PIF, USFWS
Ferruginous hawk	*Buteo regalis*	Bird	SC	CDOW, CNHP, CSP, PIF, USFWS
Rough-legged hawk	*Buteo lagopus*	Bird	SC	PIF
Golden eagle	*Aquila chrysaetos*	Bird	SC	USFWS
Peregrine falcon	*Falco peregrinus*	Bird	SC	CDOW, CNHP, CSP, PIF, USFWS
Prairie falcon	*Falco mexicanus*	Bird	SC	CNHP, PIF, USFWS
Scaled quail	*Callipepla squamate*	Bird	SC	PIF
Mountain plover	*Charadrius montanus*	Bird	SC	CDOW, CNHP, CSP, PIF, USFWS
Solitary sandpiper	*Tringa solitaria*	Bird	SC	USFWS
Black-necked stilt	*Himantopus mexicanus*	Bird	SC	CNHP

Special Status Wildlife Species Observed on Fort Carson

Common Name	Scientific Name	Species Type	Status[1]	Authority[2]
Long-billed curlew	*Numenius americanus*	Bird	SC	CDOW, CNHP, CSP, PIF, USFWS
Willet	*Catoptrophorus semipalmatus*	Bird	SC	CNHP
Wilson's phalarope	*Phalaropus tricolor*	Bird	SC	CNHP
Forester's tern	*Sterna forsteri*	Bird	SC	CNHP
Band-tailed pigeon	*Patagioenas fasciata*	Bird	SC	CNHP
Yellow-billed cuckoo	*Coccyzus americanus*	Bird	SC	USFWS
Northern pygmy-owl	*Glaucidium gnoma*	Bird	SC	CNHP, PIF
Burrowing owl	*Athene cunicularia*	Bird	ST	CDOW, CNHP, CSP, PIF, USFWS
Mexican spotted owl[3]	*Strix occidentalis*	Bird	ST	CDOW, PIF, USFWS
Short-eared owl	*Asio flammeus*	Bird	SC	CNHP
Common poorwill	*Phalaenoptilus nuttallii*	Bird	SC	PIF
Black swift	*Cypseloides niger*	Bird	SC	CNHP
White-throated swift	*Aeronautes saxatalis*	Bird	SC	PIF
Black-chinned hummingbird	*Archilochus alexandri*	Bird	SC	PIF
Caliope hummingbird	*Stelluta calliope*	Bird	SC	PIF
Rufous hummingbird	*Selasphorus rufus*	Bird	SC	PIF
Lewis' woodpecker	*Melanerpes lewis*	Bird	SC	CNHP, PIF, USFWS
Red-headed woodpecker	*Melanerpes erythrocephalus*	Bird	SC	USFWS
Yellow-bellied sapsucker	*Sphyrapicus varius*	Bird	SC	PIF
Williamon's sapsucker	*Sphyrapicus thyroides*	Bird	SC	USFWS
Olive-sided flycatcher	*Contopus cooperii*	Bird	SC	PIF
Willow flycatcher	*Empidonax trailii*	Bird	SC	CHNP
Dusky flycatcher	*Emidonax oberholseri*	Bird	SC	PIF
Gray flycatcher	*Empidonax wrightii*	Bird	SC	PIF
Cassin's kingbird	*Tyrannus vociferans*	Bird	SC	PIF
Western kingbird	*Tyrannus verticalis*	Bird	SC	PIF
Northern shrike	*Lanius excubitor*	Bird	SC	PIF
Loggerhead shrike	*Lanius ludovicianus*	Bird	SC	USFWS

Special Status Wildlife Species Observed on Fort Carson

Common Name	Scientific Name	Species Type	Status[1]	Authority[2]
Western scrub jay	*Aphelocoma californica*	Bird	SC	PIF
Pinyon jay	*Gymnorhinus cyanocephalus*	Bird	SC	USFWS
Clark's nutcracker	*Nucifraga columbiana*	Bird	SC	PIF
Juniper titmouse	*Baeolophus ridgwayi*	Bird	SC	PIF
Carolina wren	*Thyrothorus ludovicianus*	Bird	SC	PIF
Western bluebird	*Sialia mexicana*	Bird	SC	PIF
Mountain bluebird	*Sialia currucoides*	Bird	SC	PIF
Veery	*Catharus fuscescens*	Bird	SC	CNHP
Brown thrasher	*Toxostoma rufum*	Bird	SC	PIF
Curve-billed thrasher	*Toxostoma curvirostre*	Bird	SC	CNHP
White-eyed vireo	*Vireo griseus*	Bird	SC	PIF
Blue-headed vireo	*Vireo solitarius*	Bird	SC	PIF
Blue-winged warbler	*Vermivora pinus*	Bird	SC	PIF
Golden-winged warbler	*Vermivora virginiae*	Bird	SC	PIF, USFWS
Virginia's warbler	*Vermivora virginiae*	Bird	SC	PIF, USFWS
Black-throated gray warbler	*Dendroica nigrescens*	Bird	SC	PIF, USFWS
Black-throated green warbler	*Dendroica virens*	Bird	SC	PIF
Worm-eating warbler	*Helmitheros vermivorus*	Bird	SC	PIF
Hooded warbler	*Wilsonia citrina*	Bird	SC	PIF
Grace's warbler	*Dendroica graciae*	Bird	SC	CNHP, USFWS
Lazuli bunting	*Passerina amoena*	Bird	SC	PIF
Indigo bunting	*Passerina cyanea*	Bird	SC	PIF
Dickcissel	*Spiza americana*	Bird	SC	PIF
Green-tailed towhee	*Pipilo chlorurus*	Bird	SC	PIF
Canyon towhee	*Pipilo fuscus*	Bird	SC	PIF
Cassin's sparrow	*Aimophila cassinii*	Bird	SC	CNHP, CSP, PIF, USFWS
American tree sparrow	*Spizella arborea*	Bird	SC	PIF
Rufous-crowned sparrow	*Aimophila ruficeps*	Bird	SC	CNHP
Brewer's sparrow	*Spizella breweri*	Bird	SC	PIF, USFWS

Special Status Wildlife Species Observed on Fort Carson

Common Name	Scientific Name	Species Type	Status[1]	Authority[2]
Black-throated sparrow	*Amphispiza bilineata*	Bird	SC	PIF
Lark bunting	*Calamospiza melanocorys*	Bird	SC	PIF, USFWS
Grasshopper sparrow	*Ammodramus savannarum*	Bird	SC	PIF, USFWS
Fox sparrow	*Passerella illaca*	Bird	SC	PIF
Lincoln's sparrow	*Melospiza lincolnii*	Bird	SC	PIF
White-throated sparrow	*Zonotrichia albicollis*	Bird	SC	PIF
Harris' sparrow	*Zonotrichia querula*	Bird	SC	PIF
McCown's longspur	*Calcarius mccownii*	Bird	SC	CNHP
Lapland longspur	*Calcarius lapponicus*	Bird	SC	PIF
Chestnut-collared longspur	*Calcarius ornatus*	Bird	SC	CNHP, USFWS
Bobolink	*Dolichonyx oryzivorus*	Bird	SC	CNHP
Brown-capped rosy finch	*Leucocsticte australis*	Bird	SC	CNHP
Cassin's finch	*Carpodacus cassinii*	Bird	SC	PIF

[1]SE = Colorado State Endangered, ST = Colorado State Threatened, SC = Species of Special Concern
[2]CDOW = Colorado Division of Wildlife; CNHP = Colorado Natural Heritage Program; CSP = Central Shortgrass Prairie Ecoregional Assessment and Partnership Initiative (now called the Shortgrass Prairie Partnership); PIF = Partners in Flight; USFWS = US Fish and Wildlife Service; SAR=Species of Concern
[3]This species is also recognized as Federally-protected
Source: February 2009 Final Environmental Impact Statement for Implementation of Fort Carson Grow the Army Stationing Decisions. Prepared by Fort Carson and U.S. Army Environmental Command with assistance by Potomac-Hudson Engineering, Inc. Available on the Web at:
http://www.carson.army.mil/pcms/documents/2009_EIS.pdf