U.S. General Services Administration

Public Buildings Service

Rocky Mountain Region (Region 8)

Denver Federal Center

Energy Conservation Measures

Draft

Environmental Assessment

March 2024

Denver Federal Center
Energy Conservation Measures
Draft Environmental Assessment
Lakewood, Colorado

U.S. General Services Administration | Public Buildings Service
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EXECUTIVE SUMMARY

The U.S. General Services Administration (GSA) Rocky Mountain Region (Region 8) has prepared this Environmental Assessment (EA) to assess and document potential impacts resulting from the implementation of energy conservation measures (ECMs) at the Denver Federal Center (DFC) (project), located in the City of Lakewood, Colorado. This EA examines the impacts from the proposed project, including the construction and operation of the ECMs.

This EA has been prepared pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended.

Purpose of and Need for the Project

The purpose of the proposed project is to decarbonize and electrify the DFC, to the extent practicable, using clean onsite renewable energy generation and electrification solutions. To achieve this, GSA would install a geothermal heat pump system(s) and a solar photovoltaic (PV) system to supply year-round heating and cooling and electrical power. These systems, along with other ECMs, would replace approximately 90 percent of fossil fuel consumption on campus and allow for self-generated solar PV to electrify approximately half of the campus. The proposed project is needed to cut DFC grid-purchased energy use by approximately 65 percent and water usage by approximately 29 percent.

The project would also allow GSA to reduce its carbon footprint and become less dependent on nonrenewable energy sources. Government operations began at the DFC in the 1940s, and the campus has historically relied on energy generated from carbon-heavy methods. The ECMs would modernize energy infrastructure on the DFC, reduce lifecycle operating costs, and mitigate risk associated with future fossil-fuel price volatility.

Alternatives Development

Table ES-1 provides a summary and comparison of the alternatives analyzed in this draft EA.

Public Involvement

Internal and External Scoping

GSA held a virtual scoping meeting on November 15, 2023, at 6 p.m. Mountain Standard Time (MST). The meeting included a 20-minute presentation followed by an opportunity for questions and answers. No attendees asked questions, and the meeting adjourned at 6:30 p.m. A recording of the presentation was placed on the DFC website at: https://www.gsa.gov/dfc-environmental-assessment. The public comment period was open from November 2 to December 4, 2023. GSA accepted public scoping comments until 11:59 p.m. MST on December 4, 2023. One substantive comment from the Colorado Department of Transportation (CDOT) was received, requesting information on any potential impacts to state-owned highways.

Draft EA Review

After considering the issues identified during internal and external scoping, GSA prepared this draft EA. The public is encouraged to provide comments on this draft EA during the public comment period anticipated to occur from March 6, 2024 through April 5, 2024. As part of the public involvement process for the draft EA, GSA intends to host one virtual and one in-person public meeting, anticipated on March 12, 2024, and March 14, 2024, respectively. The meetings and availability of the EA will be advertised in the Denver Post. Hard copies of the draft EA will be available at the Jefferson County Library – Belmar and Lakewood locations.

TABLE ES-1. SUMMARY OF ALTERNATIVES.

Alternative A – Centralized	Alternative B – Decentralized	Alternative C – No Action
Incorporate sustainable, climate-resilient, and operationally efficient design. Seek to meet or exceed energy and sustainability goals established by federal guidelines and policies, along with industry-standard building codes and best practices.	Incorporate goals and objectives similar to Alternative A.	No change from existing conditions.
Construct a single geothermal bore field, co-located with the ground-mounted solar PV array in the southeast field of the DFC, which would consist of approximately 2,880 boreholes.	Construct dispersed geothermal bore fields across the DFC to decrease the piping distance to serviced buildings. Approximately 2,805 total boreholes would be required. The solar PV array would be constructed in the southeast field of the DFC, as proposed under Alternative A.	No change from existing conditions.
Geothermal heating and cooling system would service buildings 25, 41, 45, 48, 56, 67, 95, and 810.	Geothermal heating and cooling system would service the same buildings as under Alternative A.	No change from existing conditions.
Pipeline network supporting the geothermal bore field would consist of two main branches, one traveling from the bore field to and along Main Avenue to service buildings 95 and 810, and another leaving Main Avenue to follow 5th Street, servicing the remaining buildings. The pipeline network would cross McIntyre Gulch in two locations and the Agricultural Ditch in one location. These crossings would occur via existing bridges or underground to avoid direct impacts to either waterway.	Rather than one pipeline network, as proposed under Alternative A, Alternative B would construct multiple bore fields to service multiple buildings. Horizontal piping connecting each bore field to the building it services would be isolated from other bore fields/pipelines.	No change from existing conditions.
Requires new permanent structures to support the geothermal heating and cooling system, including one pump house and three valve houses, all located within the southeast field of the DFC.	Requires new, permanent structures to support the geothermal heating and cooling system, including nine total valve houses – one per geothermal bore field, except for the two bore fields proposed to service building 25, which would utilize one valve house.	No change from existing conditions.
Requires the use of approximately 27 acres of land within the southeast field of the DFC.	Requires approximately 27 acres of land within the southeast field of the DFC, as well as approximately 23 acres of land throughout the DFC (50 acres in total for geothermal and solar PV systems).	No change from existing conditions.

Affected Environment and Environmental Consequences

Impacts from the alternatives on the affected environment (i.e., resources) are described in chapter 3 of this EA. Table ES-2 provides a summary of potential impacts from the project. In general, adverse impacts would primarily occur during construction, would be minimized by mitigation measures, and would be short-term in duration. A summary of proposed mitigation measures if provided in section 3.18 of the draft EA. Alternative C (No Action) would continue the existing water consumption, use of fossil fuels for heat and energy with the associated levels of greenhouse gas (GHG) emission, and energy dependence on the public grid. Alternative C would also not provide any of the benefits of the proposed project, as noted in table ES-2.

TABLE ES-2. SUMMARY OF POTENTIAL IMPACTS.

Resource	Alternative A Impacts	Alternative B Impacts	Alternative C Impacts
Geology and Soils	Impacts on soils (all previously disturbed) would be approximately 27 acres, in addition to the amount required for the installation of the pipeline network associated with the geothermal heating and cooling system. Construction activities may expose the project area soils to wind, erosion, sedimentation, and compaction, resulting in direct, minor, adverse impacts onsite over the short-term. Installation of the geothermal bore field would result in direct, site-specific, minor to moderate, adverse impacts on geology over the short- and long-term due to the need to drill through bedrock and the presence of permanent geothermal well infrastructure.	Impacts on soils (all previously disturbed) would be approximately 50 acres, in addition to the amount required for the installation of the pipeline network associated with the geothermal heating and cooling system. Impacts to soils resulting from construction-related erosion, sedimentation, and compaction would be the same as those anticipated under Alternative A, although greater, due to the larger area of proposed ground disturbance. Impacts to geology under Alternative B would be the same as those anticipated under Alternative A, although impacts would be dispersed across the campus instead of isolated to the southeast field.	None
Wildlife and Habitat	Impacts to onsite wildlife and habitat would be direct, negligible to minor, and adverse, and would occur over the short- and long-term. Species onsite would be accustomed to frequent human activity and could relocate to nearby areas of suitable habitat. Concerns exist about the potential for solar PV arrays to adversely affect bird populations, as an array may create a reflective glare that could be mistaken as a body of water.	Impacts on wildlife under Alternative B would be the same as those anticipated under Alternative A. Impacts on habitat would be more widespread across the DFC under Alternative B, although high-quality habitat is not present in any of the locations where bore fields are proposed.	None
Vegetation and Invasive Species	Impacts on vegetation (previously disturbed) would be approximately 27 acres, in addition to the amount required for the installation of the pipeline network associated with the geothermal heating and cooling system. Direct, negligible, adverse impacts to onsite vegetation could occur over the short- and long-term from construction activities; however, the site has been previously cleared and supports limited, previously disturbed vegetation.	Impacts on vegetation (previously disturbed) would be approximately 50 acres, in addition to the amount required for the installation of the pipeline network associated with the geothermal heating and cooling system. Impacts on vegetation would be the same as those anticipated under Alternative A, although greater, due to the larger area of proposed ground disturbance.	None; invasive and non-native plant species in the southeast field would remain.
Water Resources	Construction activities could result in temporary increases in runoff and an increased risk of leaks or spills of contaminants, resulting in direct, negligible to minor, adverse impacts to localized water quality within adjacent surface waters and wetlands, as well as groundwater over the short-term. Pipeline	Impacts to water resources under Alternative B would be the same as those anticipated under Alternative A, although adverse impacts related to construction runoff would be greater, due to the larger area of proposed ground disturbance.	None; water usage would not be reduced.

Resource	Alternative A Impacts	Alternative B Impacts	Alternative C Impacts
	crossings would avoid direct impacts to surface waters, wetlands, and floodplains. Drilling of boreholes could also expose groundwater to contamination. Operation risks associated with geothermal systems and the management of those risks is discussed in section 3.4 of the draft EA.		
Cultural Resources	The southeast field is either not visible or is obscured from view from both cultural resources identified onsite. Views of both resources would not be altered, and no vibration impacts would occur.	Potential visual impacts on cultural resources would be similar under Alternative B as under Alternative A. Under Alternative B, one valve house proposed near one of two National Register of Historic Places-listed buildings would visually intrude on the area.	None
Air Quality and GHG	Direct, negligible to minor, adverse impacts over the short-term to local air quality. Negligible, adverse impacts on GHGs, due to construction emissions, over the long-term. Indirect, minor, beneficial effects on air quality and GHG emissions over the long-term due to cleaner, renewable energy production.	Impacts on air quality and GHG emissions under Alternative B would be similar to those anticipated under Alternative A, although volatile organic compound emissions would be higher under Alternative B, as existing parking lots would be disturbed and would require repaving.	Adverse impact on state and federal emission reduction goals with continued use of fossil fuel generated electricity.
Land Use and Aesthetics	Direct, site-specific, negligible to minor, adverse impacts would occur over the short- and long-term, as what is currently an open field would be converted to a solar PV array and geothermal bore field. As the site has been previously disturbed and does not contain noteworthy visual resources, impacts would be minor.	Impacts on land use and aesthetics under Alternative B would be similar to those described under Alternative A, although more widespread across the DFC campus. As a result, impacts to land use and aesthetics under Alternative B would be moderate. During construction, existing parking lots and areas of open space across campus would be temporarily taken out of use. In addition, temporary visual disturbances associated with the presence of construction equipment and dust would impact a larger number of campus users.	None
Environmental Justice (EJ)	No minority, low-income, tribal, or disabled populations occur within the DFC campus, although it is possible that disabled individuals may work at or visit the DFC. There would be no interruptions to public transportation or assistance services under Alternative A, although there may be a need for temporary pedestrian detours and occasional lack of access to handicapped parking. Overall, Alternative A would not result in disproportionally high and adverse effects on EJ populations.	Impacts to disabled individuals under Alternative B would be similar to those discussed under Alternative A. Under Alternative B, there may be additional limited access to handicapped parking during the installation of bore fields beneath existing parking lots. Overall, Alternative B would not result in disproportionally high and adverse effects on EJ populations.	None

Resource	Alternative A Impacts	Alternative B Impacts	Alternative C Impacts
Environmental Contamination and Waste Management	Alternative A has the potential to encounter contamination in the southeast field of the DFC. With implementation of mitigation measures, adverse impacts associated with construction are anticipated to be direct, short-term, site-specific, and minor. Operation of the proposed ECMs would result in negligible adverse impacts over the short- and long-term.	Alternative B also has the potential to encounter contamination in the southeast field and in other locations where dispersed bore fields are proposed. With implementation of mitigation measures, adverse impacts are anticipated to be similar to those identified under Alternative A, although with slightly more potential to impact contaminated areas under Alternative B due to the dispersed layout of the geothermal bore fields.	None
Transportation	Traffic delays may occur during planned detours and as a result of increased personnel and equipment entering and exiting the DFC for the duration of construction. Most traffic impacts would occur within the DFC campus and not on the surrounding roadway network, and would be direct, minor, adverse impact over the short-term. Following construction, existing conditions would return.	Short-term construction access-related impacts under Alternative B would be similar to those described under Alternative A; however, under Alternative B, some disruption to parking would occur as many proposed bore fields would be constructed under existing parking lots. Following construction, roadways and parking lots would be returned to existing conditions.	None
Noise and Vibration	During construction of Alternative A, direct, minor, adverse noise impacts would be expected over the short-term due to intermittent noise level increases. Under Alternative A, construction noise would be primarily limited to the southeast field of the DFC. Following construction, noise levels would return to existing conditions. Vibration impacts are not anticipated under Alternative A.	Noise impacts under Alternative B would be more widespread as construction would occur in multiple locations across campus, rather than limited to the southeast field. As a result, short-term adverse impacts would be minor to moderate. Vibration impacts are not anticipated under Alternative B.	None
Utilities	Short-term adverse impacts to onsite utilities would be direct and negligible to minor due to the possibility for temporary disruptions on campus. No disruption to public utilities would be anticipated.	Adverse impacts under Alternative B would be the same as those described under Alternative B.	None
Safety and Security	During construction, the increase in construction personnel within the secured campus, as well as the increased potential for construction related injuries and accidents, may result in minor onsite safety and security concerns over the short-term.	Impacts on safety and security under Alternative B would be similar to those anticipated under Alternative A, although impacts would be dispersed across campus instead of isolated in the southeast field.	None
Socioeconomics	Construction of Alternative A would have direct, minor, beneficial impacts on job availability and unemployment in the short-term, as construction activities would temporarily support employment in	Impacts on socioeconomics under Alternative B would be the same as those discussed under Alternative A.	None

Resource	Alternative A Impacts	Alternative B Impacts	Alternative C Impacts
	the construction industry. Population, housing, schools, and other public and private services would not be impacted.		
Cumulative Effects	Negligible, adverse cumulative effects to geology and soil are anticipated as Alternative A would permanently change the geology and soils underlying the DFC. Similarly, a negligible to minor, adverse cumulative effect is anticipated to vegetation, land use and aesthetics, and wastes onsite due to permanent changes to the lands within the DFC and potential for additional waste generation (including eventual disposal of solar panels containing batteries and metals). A minor beneficial cumulative effect is anticipated to air quality, climate change, and GHGs.	Alternative B would have similar cumulative effects as Alternative A.	The DFC would continue to use fossil fuel generated electricity and heating, which would continue to contribute cumulatively to air quality emissions, GHGs, and the worsening of climate change effects.

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APPENDICES

ACRONYMS

µg	microgram
AADT	average annual daily traffic
APE	area of potential effects
AST	aboveground storage tank
ASTM	American Society for Testing and Materials
BAS	building automation systems
BGEPA	Bald and Golden Eagle Protection Act
BMP	best management practices
CAA	Clean Air Act
CCR	Code of Colorado Regulations
CDOT	Colorado Department of Transportation
CDPHE	Colorado Department of Public Health and Environment
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CH_4	methane
CIMC	Cleanup in My Community
CO	carbon monoxide
CO_2	carbon dioxide
CO_{2e}	carbon dioxide equivalent
COSHPO	Colorado State Historic Preservation Office
CWA	Clean Water Act
dB	decibel
dBA	adjusted (for human hearing) decibel
DCPA	Defense Civil Preparedness Agency
DFC	Denver Federal Center
EA	Environmental Assessment
ECMs	energy conservation measures
EJ	environmental justice
EO	executive order
EPA	[U.S.] Environmental Protection Agency
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FPS	Federal Protection Service
GHG	greenhouse gas
GSA	[U.S.] General Services Administration
GSHP	ground source heat pump
GWP	global warming potential
HDPE	high-density polyethylene
HVAC	heating, ventilation, and air conditioning
IA	investigation area
Pb	lead
PBS	Public Buildings Service
kgal	kilo gallons
LBP	lead-based paint
LEC	low-embodied carbon
m^3	cubic meter
MBTA	Migratory Bird Treaty Act
MLRA	Major Land Resource Area
MMBtu	million British thermal units
mph	miles per hour
MW	megawatt
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NDER	National Deep Energy Retrofit
NEPA	National Environmental Policy Act
NHD	National Hydrography Dataset
NHPA	National Historic Preservation Act
NO_2	nitrogen dioxide
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
O_3	ozone
OCD	Office of Civil Defense Emergency Operations Center
OSHA	Occupational Safety and Health Administration
Pb	lead
PBS	Public Buildings Service
PCOC	potential contaminants of concern
PM_{10}	particulate matter (10 microns in size)
$PM_{2.5}$	particulate matter (2.5 microns in size)
ppb	parts per billion
ppm	parts per million
PPV	peak particle velocity
PV	photovoltaic
RCRA	Resource Conservation and Recovery Act
RTD	Regional Transportation District
SC-GHG	social cost of greenhouse gases
SO_2	sulfur dioxide
SWPPP	Storm Water Pollution Prevention Plan
TDS	total dissolved solids
U.S.	United States
USACE	United States Army Corps of Engineers
U.S.C.	United States Code
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UST	underground storage tank
VAV	variable air volume
V/C	volume-to-capacity
VFD	variable-frequency drive
VOC	volatile organic compound
WHO	World Health Organization

1.0 INTRODUCTION

The U.S. General Services Administration (GSA) Rocky Mountain Region (Region 8) prepared this Environmental Assessment (EA) to assess and document potential impacts from the implementation of energy conservation measures (ECMs) at the Denver Federal Center (DFC) (project), located in the City of Lakewood, Colorado (figure 1). The proposed project would support the objectives of Executive Order (EO) 14057, *Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability*, GSA's *Strategic Plan for Fiscal Years 2022-2026*, and the agency's *National Deep Energy Retrofit* (NDER) *Program*, which seek to reduce energy and water use through integrative ECMs. If implemented, construction could begin in the fall of 2024 and last approximately two years.

The National Environmental Policy Act of 1969 (NEPA), as amended, requires federal agencies to prepare an EA to determine if an action has the potential to significantly affect the quality of the human environment. GSA is integrating the consultation processes required under section 106 of the National Historic Preservation Act (NHPA), section 7 of the Endangered Species Act (ESA), and other applicable laws and regulations with the NEPA process. This EA presents the potential adverse and beneficial effects on natural, cultural, and other resources that may result from the proposed project.

1.1 Purpose of and Need for the Project

The purpose of the proposed project is to decarbonize and electrify the DFC, to the extent practicable, using onsite renewable energy generation and electrification solutions. To achieve this, GSA would install a geothermal heat pump system(s) and a solar photovoltaic (PV) system to supply year-round heating and cooling and electrical power. These systems, along with other ECMs, would replace approximately 90 percent of fossil fuel consumption on campus and allow for self-generated solar PV to electrify approximately half of the campus. The proposed project is needed to cut DFC grid-purchased energy use by approximately 65 percent and water usage by approximately 29 percent.

The project would allow GSA to reduce its carbon footprint and become less dependent on nonrenewable energy sources. Government operations began at the DFC in the 1940s, and the campus has historically relied on energy generated from carbon-heavy methods. The ECMs would modernize energy infrastructure, reduce lifecycle operating costs, and mitigate risk associated with future fossil-fuel price volatility.

1.2 Project Background

GSA conducted a 50% Investment Grade Audit (IGA) for a comprehensive package of improvements included in the proposed project. The IGA recommends the installation of a geothermal heating and cooling system, as well as a ground-mounted solar PV system, described in more detail in sections 2.2.1 and 2.2.2, respectively. Specifically, up to 68.8 million British thermal units (MMBtu) per hour of geothermal energy and up to 14.3 megawatts (MW) of ground-mounted solar PV systems have been recommended to supply year-round heating and cooling and electrical power (Ameresco 2024a).

This project would address other key energy and sustainability priorities, such as compliance with the Council on Environmental Quality's (CEQ's) *Guiding Principles for Sustainable Federal Buildings*. In total, the IGA identifies approximately 115 energy efficiency and renewable energy opportunities recommended for implementation, including geothermal heating and cooling with dedicated heat-recovery chillers, solar PV array, battery energy storage systems, new building automation systems (BAS) and controls strategies, exhaust air heat recovery, and transformer replacements. These proposed ECMs provide sustainable facility improvements and recurring reductions in utility costs. Most measures would occur within existing building envelopes or campus infrastructure and would have little to no potential for impacts to the environment (e.g., updates to wiring, electric boxes, or heat piping inside of buildings).

FIGURE 1. PROJECT AREA

1.3 Project Area

The project area consists of the DFC campus (figure 1), which is comprised of 570 acres located along U.S. Route 6 in Lakewood, Colorado, approximately eight miles west of downtown Denver. It is open to the public and is one of the largest single-entity owned, contiguous parcels of land in Lakewood. The federal government acquired the campus in 1941 for the purpose of small arms ammunition production. Following the ammunition plant's closing after World War II, the government converted buildings to office, research, and administrative use (GSA 2008a). Today, the DFC campus houses 7,700 federal tenants from 30 different agencies in 41 federal buildings, totaling approximately four million square feet of office, laboratory, and warehouse space (GSA 2023a).

1.4 Issues and Impact Topics

Through internal and external scoping, GSA has identified a range of issues and impact topics to evaluate in this draft EA. Issues are concerns, conflicts, obstacles, or benefits that the current situation has caused or that a specific action would cause if implemented. Impact topics are resources or values analyzed for potential environmental impacts under each alternative. GSA will retain issues and impact topics for analysis if there is potential for effects on specific resources and if these impacts will help the agency make a reasoned decision between the alternatives. Issues and impact topics are dismissed from detailed analysis if the preceding considerations do not apply.

1.4.1 Issues and Impact Topics Retained for Detailed Analysis

Table 1 describes the resources or values potentially affected by the alternatives and that require further consideration.

TABLE 1. ISSUES AND IMPACT TOPICS RETAINED.

Impact Topic	Reasons for Retaining Impact Topic
Geology and Soils	Proposed construction and ground-disturbing activities could result in geology and soils impacts because of the need to drill boreholes for the geothermal system and install footings for the solar PV array. The proposed project could require the removal of soil from boreholes or foundation excavations. The EA considers the potential volume of soils that may need removed and what potential disposal requirements.
Wildlife and Habitat	Proposed construction and ground-disturbing activities could result in impacts to wildlife habitat and temporary disturbance to species that occur within the project area. Solar PV panels have been of concern related to migrating birds and bats, including concerns over glare and potential disruption to flight patterns (Hathcock 2018).
Vegetation and Invasive Species	Most of the DFC campus is hardscaped (i.e., buildings, roads, parking lots) with some areas of landscaped vegetation. The DFC southeastern corner is an open field that, based on a 2023 Wetland and Aquatic Resources Delineation Report, contains several invasive and non-native plant species (e.g., teasel, mullein) (GSA 2023b). Depending on the selected alternative, areas of landscaped vegetation may be disturbed. The southeast field would be impacted. Impacts of the project on vegetation (landscaped and open areas) and means for handling invasive and non-native plant species is discussed.
Water Resources	Proposed construction and ground-disturbing activities could result in impacts to adjacent wetlands, surface waters, and corresponding water quality. Under both action alternatives, the pipeline network associated with the geothermal system would be required to cross surface waters, either by utilizing existing bridge crossings or by underground installation. Additionally, improper installation of boreholes for the geothermal heating and cooling system has the potential to affect groundwater. GSA found solvents in groundwater at the DFC at concentrations above either regulatory or risk-based screening level criteria (GSA 2008a). EO 11988, *Floodplain Management*, requires an examination of floodplain impacts and potential risks involved in placing facilities in or near floodplains. Limited areas (e.g., McIntyre Gulch and Alameda Parkway) within or near the DFC are located within the 100- or 500-year floodplains, as defined by the Federal Emergency Management Agency (FEMA).

Impact Topic	Reasons for Retaining Impact Topic
Cultural Resources	The DFC has been evaluated for its eligibility as a historic district or as an individual resource and determined ineligible for listing in the National Register of Historic Places (NRHP) because of the extensive changes that have occurred to the campus and buildings since they were first constructed (GSA 2008a). However, two NRHP-listed buildings exist onsite: the Office of Civil Defense Emergency Operations Center (OCD) and building 710. The geothermal and solar PV systems would not connect to either historic building; however, vibration is a concern during borehole drilling due to the age of the historic buildings, and visual impacts could occur after construction. The potential for surviving undisturbed prehistoric archaeological resources onsite is low, as the DFC has undergone extensive landscape and development transformation since 1941 (GSA 2008a).
Air Quality and Greenhouse Gas (GHG)	Proposed construction may cause increased vehicle emissions and fugitive dust from ground-disturbing activities, construction equipment, and vehicles during implementation. The proposed project, through use of renewable energy, has potential to reduce emissions generated by the DFC.
Land Use and Aesthetics	Construction activities would result in changes in existing land use on the DFC campus (i.e., conversion of parking lots and/or other open space to solar arrays). The addition of above ground solar arrays within the DFC campus could affect aesthetics.
Environmental Justice	EO 12898, *General Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*," directs federal agencies to identify and address disproportionately high and adverse human health or environmental effects of their actions on minority and low-income populations. The U.S. Census Bureau's data and the Environmental Protection Agency's (EPA's) Environmental Justice Screening and Mapping Tool will be used to assess the potential for disproportionate impacts on environmental justice (EJ) communities. This EA will also consider EO 14096, *Revitalizing Our Nation's Commitment to Environmental Justice for All*, to ensure EJ needs and concerns are appropriately considered.
Environmental Contamination and Waste Management	Closed-loop geothermal and solar PV infrastructure do not typically contaminate subsurface resources; however, some solar PV panels can contain metals like lead and cadmium, which are harmful to human health and the environment at elevated levels upon disposal (EPA 2023a). Structures at the DFC may contain asbestos and lead-containing paints that could be encountered by construction workers while installing new utility connections for heating, ventilation, and air conditioning (HVAC) and electrical lines at buildings being served by the proposed ECMs. The Colorado Department of Public Health and Environment (CDPHE), per their authority under section 2007 of the Resource Conservation and Recovery Act (RCRA), issued the DFC two (active) Compliance Orders on Consent (Orders on Consent): No. 96-04-11-01, which was issued to prevent further off-site migration of contaminated groundwater and required remediation of an offsite groundwater plume associated with a previously leaking underground storage tank (UST) (GSA 2008b); and No. 97-07-18-01, which is a sitewide order that requires GSA to identify and investigate the nature and extent of sitewide environmental contamination from current and past releases of hazardous substances, and remediate those releases (GSA 2008b; State of Colorado 1996 and 1997). Construction and land-disturbing activities could encounter areas where contamination is present. Land-disturbing activities would need to comply with DFC standard operating procedures that ensure compliance with Orders on Consent and ensure public and worker safety. Discussions on the potential for activities to occur within potentially contaminated areas are addressed in the EA.
Transportation	The project could result in temporary alterations to traffic (i.e., vehicular, transit, and pedestrian) patterns, primarily within the DFC. Construction (e.g., material deliveries, commuting workers, drilling rig access) could affect the surrounding roadway network.
Noise and Vibration	Proposed construction would produce intermittent noise from mechanized equipment use, vehicle use, and the presence of construction personnel. Drilling operations could generate ground vibration with potential for effects on nearby buildings and the two historic structures.
Utilities	The proposed project would require modifications to existing utility infrastructure as well as the installation of new utility features. There may be temporary interruptions of service to

Impact Topic	Reasons for Retaining Impact Topic
	buildings within the DFC that are to be served by the proposed system. Design and construction of the system would be completed in a manner that does not interrupt any public utility services to areas outside of the DFC campus. Design of the proposed project requires consideration of the locations of existing electric, potable water, sanitary sewer, telecommunication, natural gas, and steam utility lines, including how any proposed piping networks could impact existing service and transmission lines.
Safety and Security	The DFC is a secured facility. Security is an important concern to federal tenants and the surrounding community. An influx of temporary construction personnel may present safety and security concerns and the nature of construction activities could impact nearby emergency services.
Socioeconomics	Proposed construction may temporarily increase the availability of jobs, especially in the drilling industry. GSA expects no impacts to neighborhoods, transit, tax base, or other socioeconomic issues. The proposed project would change required maintenance activities due to implementation of a geothermal system(s) and a solar PV array.

1.4.2 Issues and Impact Topics Considered but Dismissed from Detailed Analysis

Table 2 describes resources considered but dismissed from detailed analysis.

TABLE 2. IMPACT TOPICS CONSIDERED BUT DISMISSED FROM DETAILED ANALYSIS.

Impact Topic	Reasons for Dismissing Impact Topic
Community Facilities and Services	No impacts to existing community facilities and services would occur from the proposed project. The DFC campus would remain open to the public during construction. The project would not impact facilities outside of the DFC; therefore, community facilities and services were dismissed from further analysis.
Threatened and Endangered Species	U.S. Fish and Wildlife Service (USFWS) correspondence, dated November 14, 2023, concurred that the project would have no effect on any federally listed candidate, proposed, threatened, or endangered species. The USFWS stated that formal consultation is thus not necessary (USFWS 2023a); therefore, threatened and endangered species were dismissed from further analysis.

1.5 Relevant Laws and Regulations

1.5.1 National Environmental Policy Act and NEPA Process

Signed into law on January 1, 1970, NEPA requires federal agencies to assess the environmental effects of their proposed actions prior to making decisions (U.S. Environmental Protection Agency [EPA] 2023b). The GSA Public Buildings Service (PBS) NEPA Desk Guide (1999) states, “The principal purpose of an EA is to help you determine whether to prepare an EIS for your action. [GSA] uses EAs as a method to streamline NEPA compliance for actions that are not major federal actions significantly affecting the quality of the human environment.” Federal agencies must also prepare an EA if the significance of the impacts that may result from the proposed action is unknown. GSA’s EAs and other NEPA documents are prepared in accordance with the CEQ regulations for implementing NEPA (40 Code of Federal Regulations [CFR] 1500-1508), GSA Administrative Order 1095.1F – Environmental Considerations in Decision Making, and the GSA PBS NEPA Desk Guide (1999).

Federal agencies must provide meaningful opportunities for public participation. When an agency begins scoping or publishes a NEPA document for public review and comment, opportunities for the public and interested stakeholders to become involved in the NEPA process occur (EPA 2023c). Please refer to chapter 4.0 for detailed information concerning internal and external scoping and public review of the draft EA during the NEPA process.

1.5.2 Section 106 of the National Historic Preservation Act

The NHPA (54 United States Code [U.S.C.] 300101 et seq.) directs each federal agency, and those tribal, state, and local governments that assume federal agency responsibilities, to protect historic properties and to avoid, minimize, or mitigate harm that may result from agency actions. Title 36 CFR 800 details the section 106 process, which involves identifying and assessing the effects a federal agency's actions may have on historic properties. Early consideration of historic or cultural resources in project planning and full consultation with interested parties are key to effective compliance with section 106. The Colorado State Historic Preservation Office (COSHPO), Tribal Historic Preservation Officers, and Certified Local Governments are the primary consulting parties in the process.

The NRHP is a list of districts, sites, buildings, structures, and objects that have been determined by the National Park Service to be significant in American history, architecture, archaeology, engineering, or culture at the local, state, or national level. A property must be at least 50 years old to qualify for listing in the NRHP (36 CFR 60.4), but there are exceptions.

The section 106 process includes four steps (1) initiate consultation with the primary consulting parties, (2) identify and evaluate any properties for their potential eligibility in the NRHP, (3) assess effects of the project on sites listed in or eligible for listing in the NRHP, and (4) resolve any adverse effects via design changes or mitigation (GSA 2023c).

GSA is using this draft EA to satisfy the requirements of section 106 of the NHPA. This draft EA describes the section 106 consultation activities in more detail in sections 3.5 and 4.3.

1.5.3 Section 7 of the Endangered Species Act

The ESA provides a means for conserving threatened and endangered species and the ecosystems supporting them. The ESA directs all federal agencies to participate in conserving these species and to use their authorities to further the purposes of the ESA. Specifically, section 7(a)(1) of the ESA charges federal agencies to aid in the conservation of threatened and endangered species, and section 7(a)(2) requires the agencies to ensure that their activities are not likely to jeopardize the continued existence of listed species or adversely modify designated critical habitats. Section 7 of the ESA (16 U.S.C. 1531 et seq.) outlines the procedures for federal interagency cooperation on these efforts. As noted in table 2, the USFWS concurred that the project would have no effect on species protected under the ESA.

1.5.4 Other Relevant Laws and Regulations

Table 3 provides a list of other potentially relevant laws and regulations that GSA must comply with as part of the project planning and NEPA process.

TABLE 3. RELEVANT LAWS AND REGULATIONS.

Statutes
Archaeological Resources Protection Act of 1979 (16 U.S.C. § 470aa-mm)
Clean Air Act of 1970 as amended (42 U.S.C. § 7401, et seq.)
Clean Water Act of 1977 as amended (33 U.S.C. § 1251, et seq.)
Comprehensive Environmental Response, Compensation, & Liability Act of 1980 (42 U.S.C. § 9601, et seq.)
ESA of 1973 (16 U.S.C. § 1531-1544)
Energy Act of 2020 (Public Law No: 116-260)
Energy Independence and Security Act (42 U.S.C. § 17001, et seq.)
National Energy Conservation Policy Act (42 U.S.C. § 8231, et seq.)
NHPA of 1966 (54 U.S.C. § 300101 et seq.) (Public Law No: 89-665)
Resource Conservation and Recovery Act of 1976 (42 U.S.C. § 6901, et seq.)
Regulations
32 CFR 229 – Protection of Archaeological Resources: Uniform Regulations

33 CFR 320-330 – U.S. Army Corps of Engineers Regulations
36 CFR 800 – Protection of Historic Properties
40 CFR 300-399 – Hazardous Substance Regulations
40 CFR 6, 51, and 93 – Conformity of General Federal Actions to State or Federal Implementation Plans
CEQ Regulations (40 CFR 1500-1508)
Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation (48 Federal Register 44716, Thursday, September 29, 1983)
Executive Orders
EO 11593 – Protection and Enhancement of the Cultural Environment
EO 11988 – Floodplain Management
EO 11990 – Protection of Wetlands
EO 12088 – Federal Compliance and Pollution Control
EO 12898 – Environmental Justice
EO 13007 – Indian Sacred Sites
EO 13175 – Indian Trust Resources
EO 13186 – Responsibilities of Federal Agencies to Protect Migratory Birds
EO 13287 – Preserve America
EO 13327 – Federal Real Property Asset Management
EO 13589 – Promoting Efficient Spending
EO 13690 – Establishing a Federal Flood Risk Management Standard (reinstated under EO 14030)
EO 13990 – Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis
EO 14008 – Tackling the Climate Crisis at Home and Abroad
EO 14030 – Climate-Related Financial Risk
EO 14057 – Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability
EO 14096 – Revitalizing Our Nation's Commitment to Environmental Justice for All
Code of Colorado Regulations
Rules and regulations for permitting development and appropriation of geothermal wells (2 Code of Colorado Regulations [CCR] 402-10)
Air Quality Control Commission Regulations (5 CCR 1001-1 to 32)
Water Quality Control Commission Regulations (5 CCR 1002-11 to 101)
Hazardous Materials and Waste Management Division Rules and Regulations (6 CCR 1007-1 to 7)

2.0 ALTERNATIVES DEVELOPMENT

2.1 Alternatives Development Process

This draft EA evaluates three alternatives, which include two action alternatives and the No Action Alternative. Internal and external scoping activities have refined the alternatives. The alternatives are described in greater detail in section 2.3.

The proposed project would incorporate sustainable and operationally efficient designs. GSA would seek to meet or exceed energy and sustainability goals established by federal guidelines and policies, along with industry standard building codes and best practices. Sustainability elements and considerations may include, but are not limited to, the following:

- Implementation of the *Facilities Standards for the Public Buildings Service* (P100) and associated 2022 Addendum in facilities design (GSA PBS 2021):
    - includes mandatory standards for energy performance and sustainable design, historic preservation, accessibility, and other codes and standards;
    - considers reducing the environmental impact of materials used; and
    - diverts at least 50 percent of nonhazardous construction and demolition waste from a landfill.

- Adherence to the *Energy Act of 2020,* which places emphasis on ECMs as outlined below:
  - renewed emphasis for energy and water savings;
  - focus on electric solutions and less natural gas and fuel oil systems; and
  - renewable energy strategies.
- Compliance with the objectives of EO 14057, *Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability*, including:
  - 100 percent carbon pollution-free electricity on a net annual basis by 2030, including 50 percent 24/7 carbon pollution-free electricity;
  - net-zero emissions from federal procurement, including a Buy Clean policy to promote use of construction materials with lower embodied emissions; and
  - reduced GHG emissions.
- Observance of the 2020 *Guiding Principles for Sustainable Federal Buildings*, which addresses six sustainable principles (EPA 2023d):
  - employ integrated design principles;
  - optimize energy performance;
  - protect and conserve water;
  - enhance the indoor environmental quality;
  - reduce the environmental impact of materials; and
  - assess and consider building resilience.

2.2 Elements Common to the Action Alternatives

2.2.1 Geothermal Heating and Cooling System

The geothermal heating and cooling system(s) would involve the use of closed-loop ground source heat pumps (GSHPs), which use the temperature of the earth rather than the fluctuating temperature of the outside air to facilitate heating and cooling. GSHPs circulate a water and propylene glycol solution through pipes buried in the ground. Propylene glycol is a direct food substance generally recognized as safe and is readily biodegradable (21 CFR 184.1666; NIH 2023). The surrounding temperature of the shallow ground, which stays relatively constant year-round, cools the solution and serviced buildings in the summer and heats them in the winter. “Closed-loop” (figure 2) refers to the system of pipes, known as the heat exchanger, in which the solution circulates to absorb or relinquish heat within the ground (NREL 2023).

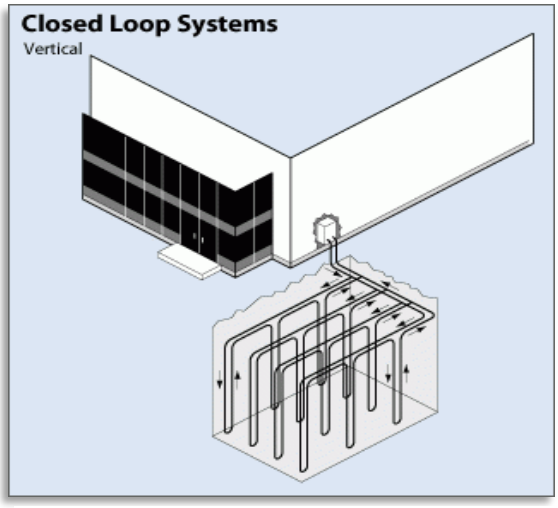

FIGURE 2. CLOSED-LOOP GEOTHERMAL SYSTEM (source: www.energy.gov/energysaver/geothermal-heat-

The borings for the closed-loop GSHPs would be installed by a state-certified and licensed driller in accordance with Colorado Department of Natural Resources Division of Water Resources, State Engineer’s Office geothermal well regulations (2 CCR-402-10), as well as International Ground Source Heat Pump Association and National Ground Water Association guidelines. Typical closed-loop GSHP systems consist of six-inch diameter vertical or horizontal boreholes. Manifolds would connect the pipelines to the heat pumps. A heat exchanger would then transfer the heat between the refrigerant in the heat pump and the solution in the pipes (DOE 2023a).

High-density polyethylene (HDPE) piping would be used for the geothermal wells (boreholes). Piping would be hermetically sealed (via heat fusion) per American Society for Testing and Materials (ASTM) standards (ASTM D2610, ASTM D2683) and manufacturer's specifications. Boreholes would be sealed from the top to bottom (entire depth) using a thermally enhanced cementitious grout that would facilitate heat transfer and would seal the borehole to prevent leakage of surface contaminants into aquifers and/or cross-contamination between aquifers (Ameresco 2024b). In areas where a geological formation prevents the grouting material from forming a solid seal, a granular cementitious material would be used to ensure a complete seal. The pipes would be pressure tested before and after installation and filled with potable water from the DFC's existing domestic water system and mixed with propylene glycol. Once properly installed, the geothermal wells do not extract, or come into contact with, groundwater. Aside from the domestic water used to initially fill the pipes, the system is non-consumptive of groundwater resources (OWRC 2012).

The pipeline network connecting the geothermal heating and cooling system to serviced buildings would be constructed from 24-inch schedule 40 polyvinyl chloride pipe or HDPE pipe and would be installed using open cut trenching. The system would be designed to cross surface waters underground or using existing bridges and would not come into direct contact with surface waters. Pipelines would be heat fusion sealed to avoid contact with or possible contamination of water resources.

Where possible, low-embodied carbon (LEC) materials would be used during construction of the proposed ECMs. For example, HDPE pipes are made from a type of plastic and have a lower carbon footprint than traditional steel pipes and would be utilized to the extent practicable (Chohan 2023).

2.2.2 Ground-Mounted Solar Photovoltaic System

Solar energy is a reliable form of renewable energy. The panels on a solar PV array convert sunlight into electrical energy and can be roof-mounted or ground-mounted (photo 1). The proposed project would install a 14.3 MW alternating current (~11.3 MW direct current) ground-mounted solar array of PV panels in the southeast quadrant of the DFC bound by West Alameda Avenue (south) and Kipling Street (east) (referred to throughout this EA as the southeast field). The solar PV array would likely consist of 585-watt bifacial solar modules installed on a fixed tilt mounting system. The tilt of the mounting system would be 25 degrees facing due south. The system would require up to 27 acres of land. Where possible, LEC steel and geopolymer concrete would be used, as available, for solar PV racking and construction of PV foundations and equipment pads.

PHOTO 1. EXAMPLE GROUND-MOUNTED SOLAR ARRAY
(Source: www.energy.gov/articles/getting-most-out-solar-panels)

2.2.3 Other ECMs Proposed

Table 4 provides a summary of additional ECMs proposed as part of this project. These other proposed ECMs and their associated benefits would generally occur within existing building envelopes or campus infrastructure. Other measures such as air treatment to improve HVAC efficiency, battery energy storage systems and microgrids (paired with the solar PV), and use of LEC materials (i.e., steel, concrete, asphalt, glass, and carbon steel for water piping) are being considered.

TABLE 4. OVERVIEW OF PROPOSED ECMS BY TECHNOLOGY CATEGORY.

Technology Category	Proposed Solution	Benefits
BAS Optimization	Implementation of advanced sequencing and optimization of existing controls to allow for load shedding for grid demand response.	• Energy savings • Reduced runtime for HVAC equipment • Improved occupant comfort • Added monitoring and functionality
Quad Pane and Secondary Windows	Replacement of existing windows and use of supplemental windowpanes using LEC glass.	• Reduced outside air infiltration • Improved occupant comfort • Major infrastructure upgrade
HVAC Improvements	Reduction in lab space air changes to comply with current codes, replace leaking variable air volume (VAV) box couplings, and replace standard v-belts with notched drive fan motor belts.	• Energy savings • Allow boiler plant to be turned off in summer, where otherwise VAV boxes would leak
Motors and Variable-frequency Drives (VFDs)	Installation of premium efficiency motors and VFDs for selected constant speed HVAC systems. Most large HVAC systems already have VFDs. Replacement of standard v-belts with notched drive fan motor belts.	• Energy savings • VFDs reduce wear on HVAC systems • VFDs allow for demand response strategies
Domestic Hot Water Heating-Electrification	New electric heat pump domestic water heaters to replace gas fired.	• Electrification of domestic hot water production
High Efficiency Transformers	Installation of new high efficiency transformers.	• Energy savings • Reduced associated heat loss

2.3 Alternatives Considered

2.3.1 Alternative A – Centralized Geothermal System with Ground-Mounted Solar Array

Under Alternative A, a single geothermal bore field would be co-located with the ground-mounted solar PV array (figure 3). The conceptual layout of this alternative includes a ground-mounted solar PV array located above the geothermal bore field, which would consist of approximately 2,880 boreholes. Under this alternative, the co-located solar PV array and bore field would require approximately 27 acres of land. The proposed site has been previously cleared and would not require removal of any large trees or shrubs, as shown in photo 2.

PHOTO 2. EXISTING DFC SOUTHEAST FIELD (FACING WEST)

Alternative A would require a pump house (see figure 3), due to the distance of the geothermal field from the serviced buildings, and three valve houses. Each valve house would serve a third of the proposed geothermal wells. This proposed design would allow any leak to be narrowed down to a portion of the larger bore field.

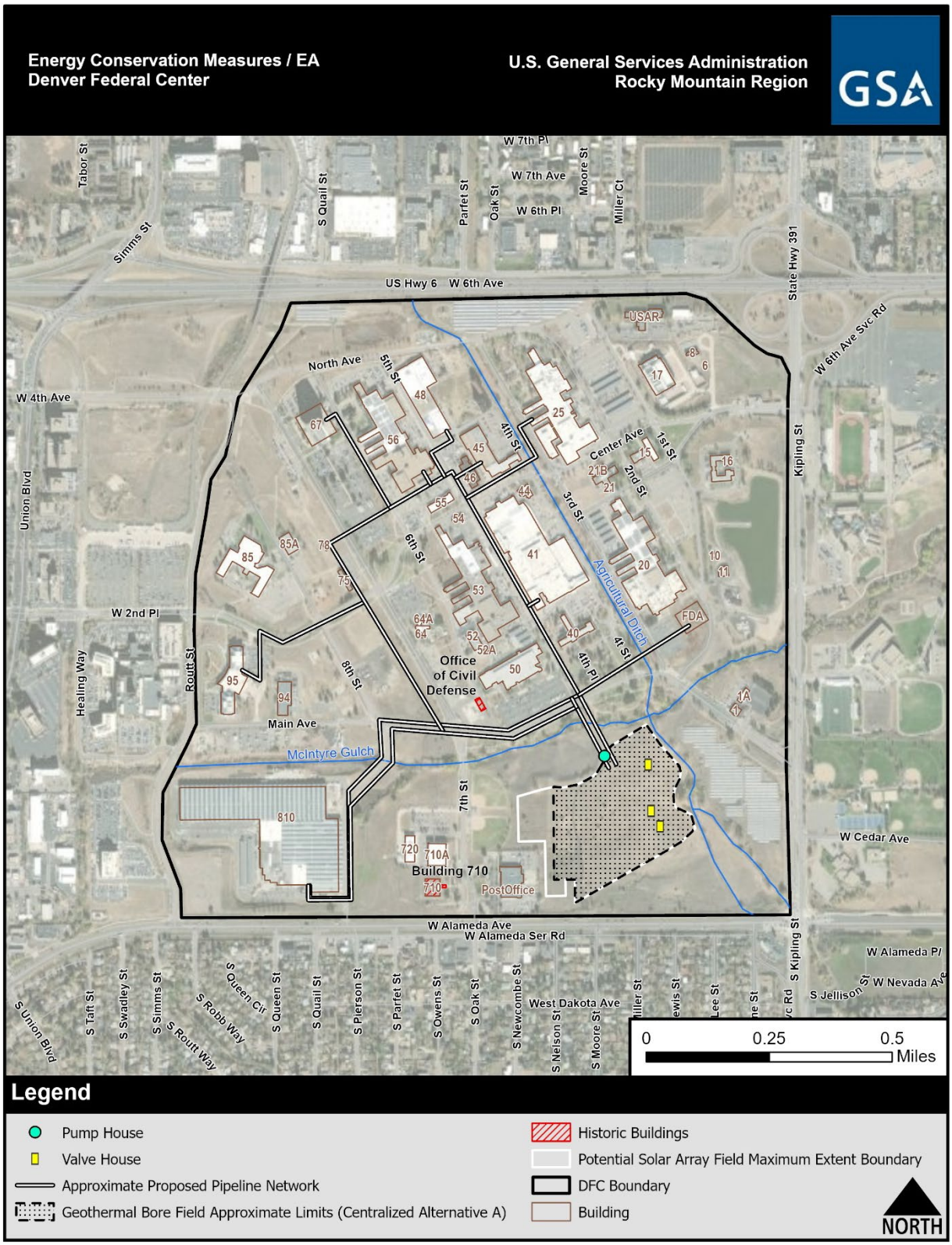

FIGURE 3. ALTERNATIVE A – CENTRALIZED ALTERNATIVE

A screening process used existing aerial photography and mapping to layout the geothermal pipeline network in a way that minimized environmental impacts and decreased the piping distance to serviced buildings (25, 41, 45, 48, 56, 67, 95, and 810). Reduced piping distance would reduce pressure (head) losses. The pipeline network would consist of two main branches, one traveling from the bore field to and along Main Avenue to service buildings 95 and 810, and another leaving Main Avenue to follow 5th Street, servicing the remaining buildings. Service lines to buildings 25, 45, and 48, would cross through the parking areas east of 5th Street. Service lines to building 56 would pass through the parking lot west of 5th Street and south of building 56, with service to building 67 achieved via a continuation of the line along 6th Street.

Construction required for the development of the geothermal bore field, the solar PV array, and the supporting pipeline network and utilities would necessitate grading and ground disturbance. Disturbance to existing parking lots and roads would occur during construction and during repaving.

2.3.2 Alternative B – Decentralized Geothermal System with Ground-Mounted Solar Array

Alternative B would disperse multiple geothermal bore fields across the DFC to decrease the piping distance to serviced buildings, thus reducing pressure (head) losses. Like Alternative A, Alternative B would install the solar PV array in the southeast field of the DFC, on 27 acres of previously cleared land. Unlike Alternative A, Alternative B would require an additional 23 acres of land on which smaller bore fields would be installed (see figure 4). Approximately 2,805 total boreholes would be used to service the adjacent buildings. A pump house would not be required under Alternative B, as bore fields would be located within close proximity to the serviced buildings. One valve house would be constructed within each proposed bore field, except for the two bore fields proposed to service building 25, which would utilize one valve house. Nine valve houses would be required (see figure 4). Each valve house would allow for shut down of individual bore fields should a leak be detected.

The Alternative B screening process also located the proposed geothermal bore fields in areas that minimized environmental impacts. The proposed bore field locations for specific buildings are:

- Building 25: 78-borehole field to the southeast and 338-borehole field off the building's northeast corner; both would be under an existing parking lot. A pipeline would connect the two fields along the parking lot's western edge and then feed directly into the building via one service pipeline.
- Building 41: installation of two similarly sized fields of 330 boreholes each, one under an existing parking lot along Main Avenue's north side and one located within the southeast field. A pipeline would follow 5th Street to service the building.
- Buildings 45 and 48: a field of 169 boreholes in the cleared area just off the southeast corner of building 48 with a pipeline directly into the building.
- Building 56: an L-shaped field under the parking area just to the south to include approximately 235 boreholes and a service pipeline directly into the building.
- Building 67: 560 boreholes field under the parking lot to the south and a direct service pipeline.
- Building 95: a field off the southeast corner of the building (135 boreholes) and another off the northeast corner (300 boreholes) with pipelines directly to the building. A portion of one of the bore fields would be installed under an existing parking lot. The majority of both bore fields would be installed beneath landscaped, manicured open areas between buildings.
- Building 810: a field of approximately 330 boreholes to the southwest under a cleared area at the corner of Routt Street and Alameda Avenue with a pipeline directly to the building.

Construction of the dispersed geothermal bore fields, the solar PV array, and the supporting pipeline network and utilities would necessitate grading and ground disturbance under Alternative B. Disturbance to existing parking lots and roads would occur during construction and during repaving.

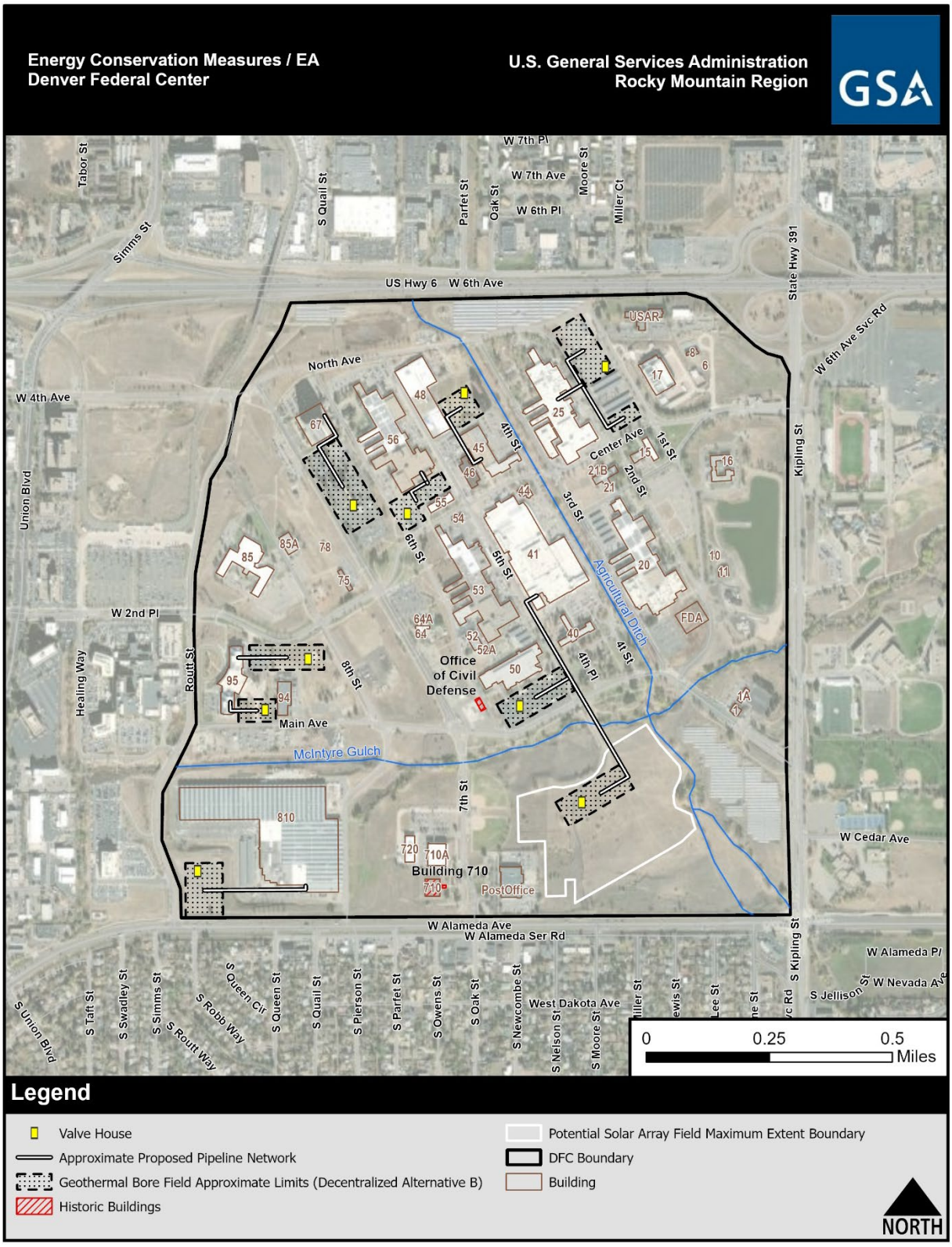

FIGURE 4. ALTERNATIVE B – DECENTRALIZED ALTERNATIVE

2.3.3 Alternative C – No Action

NEPA requires federal agencies to consider a No Action Alternative to provide a baseline for comparing the environmental impacts of the action alternatives. Under Alternative C, No Action Alternative, GSA would not implement the proposed ECMs at the DFC and would continue to utilize fossil-fuel-fired equipment to provide the electric and heating and cooling needs of the associated facilities. Alternative C would not meet the objectives of EO 14057, GSA's Strategic Plan, and the agency's NDER Program, which seek to reduce energy and water use.

2.4 Alternatives Dismissed from Further Consideration

2.4.1 Lots 9 and 10

GSA considered two land areas referred to as infill land areas #9 and #10 for construction of the solar PV array as an alternative to siting the array within the southeast field (see figure 5). Infill refers to undeveloped or underutilized land within the DFC. Land area #9 is approximately nine acres situated between 7th and 8th Streets, north of Main Avenue and south of Center Avenue. Land area #10 is approximately six acres situated between 7th and 8th Streets, north of Center Avenue and south of W 4th Avenue. This alternative proposed either centralized (beneath land areas #9 and #10) or decentralized (dispersed) geothermal bore fields. A centralized alternative would require approximately twenty-three acres of land. A decentralized alternative would require approximately thirty-three acres of land to account for the solar PV array installed on land areas #9 and #10, as well as construction of the dispersed bore fields. GSA dismissed this alternative from detailed consideration because of an elevated risk of environmental hazards due to previously unidentified land uses visible on historic aerial photos, when compared to the southeast field that, on historic aerial photos, shows little use over time (Netronline n.d.). Additionally, this alternative would remove infill land from future use and would result in greater visual impact, as the solar PV array would be located along major vehicular and pedestrian pathways.

2.4.2 Rooftop Solar PV Panels

GSA additionally considered installing solar PV panels on rooftops, including roofs of existing buildings. GSA dismissed this option due to concerns with impacts on building tenants during construction, the need for costly structural analyses, and the age of several buildings which could affect the ability to install new technology on older construction.

A second option for utilizing rooftops for solar PV panels would involve the construction of carports with rooftop solar panels, within existing parking lots. GSA dismissed this as an alternative due to costs and consideration of the benefits provided by construction of a solar PV array in the southeast field. Rooftop solar panels present unique challenges, including the need for additional snow removal efforts (to remove snow from the surface of the panels and from the spaces between the carports), the potential for vehicle strikes to the carports, and other general maintenance concerns. Should funding become available for the construction of PV solar-equipped carports at the DFC, this option could be reconsidered as part of a future effort. For this effort, construction of one larger PV array in the southeast field eliminates some of the snow removal concerns, provides a more secure site for the array with less possibility of accidental damage, and is more cost effective.

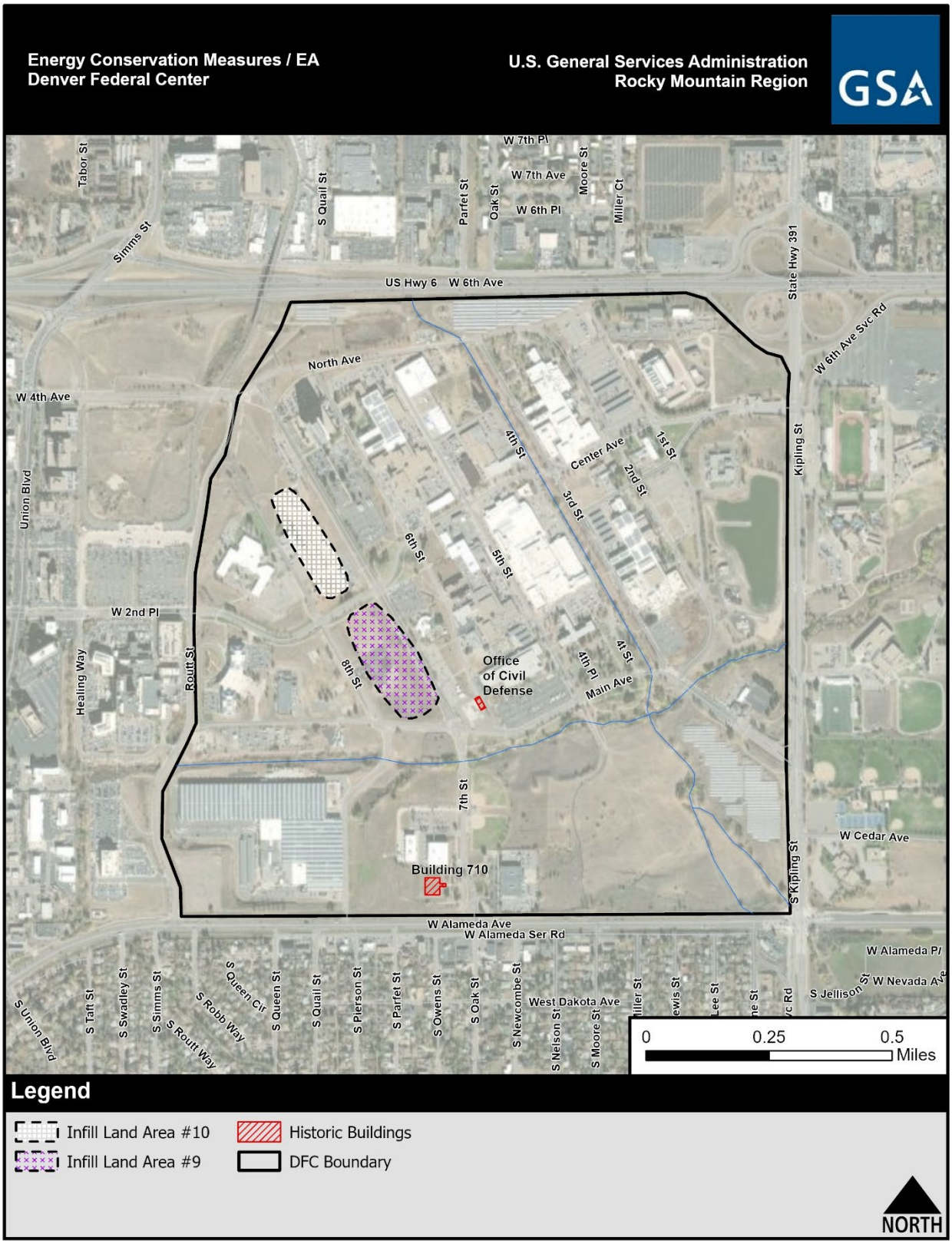

FIGURE 5. INFILL AREAS #9 AND #10 (SOLAR PV OPTION – DISMISSED)

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter describes the existing conditions of the human environment, and the impacts of Alternatives A, B, and C. The project area is limited to the boundaries of the DFC campus, except where specified. The analysis is described in terms of direct, indirect, and cumulative environmental impacts. Direct impacts are caused by the action and occur at the same time and place. Indirect impacts are caused by the action and occur later in time or are farther removed in distance but are still reasonably foreseeable. Cumulative impacts result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative impacts (section 3.15) can result from individually minor, but collectively significant, actions taking place over time (40 CFR 1508.7–1508.8).

Potential impacts are described in terms of intensity, geographic context, and duration, as applicable. Definitions for impact thresholds for the resources analyzed in this chapter are provided in table 5. Mitigation and minimization measures are summarized in section 3.18.

TABLE 5. IMPACT THRESHOLDS.

Impact Description	Definition
Intensity	**Negligible**: The impact is not measurable or discernable from current conditions **Minor**: The impact is slight but detectable **Moderate**: The impact is readily apparent, and there would be a noticeable change **Major**: The impact is severe, significant, and highly noticeable
Geographic Context	**Site-specific**: Impacts are limited to the DFC campus **Localized**: Impacts extend beyond the DFC to the general vicinity of the campus **Regional**: Impacts affect a larger area such as Jefferson County
Duration	**Short-term**: Impacts would occur only during construction (temporary) **Long-term**: Impacts would occur after construction

3.1 Geology and Soils

Resources analyzed in this section include the geology and soils underlying the DFC.

3.1.1 Affected Environment

3.1.1.1 Geology

The DFC sits within the Great Plains physiographic province, which is characterized by flat to rolling prairie with scattered hills and bluffs, bordered by the Rocky Mountains front range (USGS 1995). The region is in the Central High Plains (southern part) major land resource area, which is characterized by undulating to rolling shale plain, with steep slopes bordering the larger tributaries of the South Platte and Arkansas Rivers (USDA NRCS 2022). The DFC overlies the Denver Basin, which is comprised of Cretaceous and tertiary sandstone, conglomerate, and shale of the Fox Hills sandstone, Laramie formation, Arapahoe formation, Denver formation, and Dawson arkose. Below these formations is a layer of nearly impermeable Cretaceous shale, approximately 6,000 feet thick (U.S. Geological Survey [USGS] 1995). The surficial geologic materials found beneath the DFC include alluvial deposits known as the Piney Creek, Broadway, and Lower Verdos Terrace. These alluvial deposits are composed of unconsolidated, stratified, poorly to well-sorted gravel, sand, and silt materials eroded from the Rocky Mountain Front Range. The Denver and Arapahoe formations underlie the alluvial material and consist of consolidated, interbedded sandstone, siltstone, claystone, shale, and conglomerate. The depth to bedrock at the DFC varies across the campus from zero to several tens of feet (GSA 2008a). The USGS 2018 Seismic Hazard Map shows this region at moderate risk of seismic hazard (hazard level two to three out of seven) (USGS 2018). While no active faults occur beneath the DFC, the Golden Fault is located approximately four miles west (Colorado Geological Survey 2023).

3.1.1.2 Soils

The United States Department of Agriculture Natural Resources Conservation Service identifies six soil map units within the DFC boundaries. None of which are considered hydric, or prime or other important farmland. The most common soil complex, underlying approximately 93 percent of the property, is the Denver-Urban land complex. Denver and similar soils comprise approximately 65 percent of these areas, and Urban land (streets, parking lots, sidewalks, buildings, and other impervious structures) accounts for approximately 20 percent. The remaining 15 percent includes minor components such as Englewood, Ulm, and Nunn soil (USDA NRCS 2023). Soils underlying the DFC are generally well-drained with a high runoff class and only a slight erosion hazard.

3.1.2 Environmental Consequences

3.1.2.1 Methods and Assumptions

Impacts on geology and soils were quantitatively analyzed by calculating the amount of excavated or disturbed soil in the project area. Approximate quantities of excavated material associated with installation of the solar PV array and geothermal bore fields were calculated by multiplying the total number of boreholes by the estimated volume of one borehole (six inches in diameter and 500 feet in length), and assuming that approximately 35 percent of excavated material would be reused onsite as fill or cover material (all excavated material would not likely be reused onsite as the borehole piping will fill any drilled holes). Additional excavated material associated with the installation of the pipeline network required to connect buildings to the geothermal system was calculated by multiplying pipeline length by trench depth (approximately six feet) and trench width (approximately four feet), and assuming that approximately 50 percent of excavated material would be reused as backfill in the trench (all of the excavated material would not be reused as the pipes would take up some of the area in the trench). The analysis qualitatively focused on the potential for erosion, sedimentation, and compaction.

3.1.2.2 Alternative A – Centralized Geothermal System with Ground-Mounted Solar Array (Centralized Alternative)

Alternative A ground disturbance would be approximately 27 acres for the co-located solar PV array and geothermal bore field, and some additional disturbance for installation of the geothermal pipeline network. Approximately 14,800 cubic yards of material would be excavated, with 6,800 cubic yards occurring in the southeast field and 8,000 cubic yards associated with pipeline installation. Soils would be reused onsite to the extent practicable and allowable or properly disposed of as required by applicable permits and regulations. Proposed work areas are unlikely to contain native topsoil due to development of the DFC over time. Geothermal boreholes are not anticipated to exceed six inches in diameter and would be installed according to a design based on geotechnical information. If during the boring operation, shallow groundwater, which could contain contaminants, is encountered, the contractor would isolate the encountered shallow groundwater to avoid mixing with any drinking water aquifers in accordance with the regulations outlined in section 2.2.1. Depth to bedrock beneath the DFC campus ranges from zero to tens of feet. Drilling operations would encounter bedrock as boreholes would be drilled at depths of approximately 500 feet, based on the results of geothermal well testing. Boreholes would be grouted, top to bottom, as discussed in section 2.2.1. Grouting of the boreholes would mitigate any long-term seismic, groundwater infiltration, or settlement issues. Additionally, the proposed solar PV array and geothermal heating and cooling system would be designed to meet seismic safety standards. Direct, moderate, adverse geologic impacts would occur onsite over the short-term under Alternative A. Grouting of the boreholes would mitigate this short-term impact. Minor, adverse geological impacts would result over the long-term as the site geology would be permanently altered by the installed geothermal wells; however, proper installation and grouting of the wells would result in minor overall impacts to onsite geology.

Construction may expose project area soils to wind, erosion, sedimentation, and compaction, resulting in a direct, minor, adverse impact to onsite soils during the short-term. The contractor would implement mitigation measures during construction such as applying water to exposed soils and revegetating exposed areas following construction. In addition, the contractor would prepare a detailed stormwater pollution prevention plan (SWPPP) prior to construction in accordance with National Pollutant Discharge Elimination System (NPDES) permit requirements. A NPDES Construction General Permit is required for any construction activity disturbing one acre or more of land. The NPDES program for federally owned facilities in Colorado is administered by the EPA. The development of this SWPPP, with review and approval by EPA, would ensure that appropriate measures are employed to contain sediments. Following construction, revegetation of disturbed areas, using native seed mixes and plants, would minimize erosion and promote infiltration of stormwater.

Construction or installation of other ECMs (see table 4) would primarily occur within existing building envelopes, and would not require ground disturbance (e.g., installation of quad pane and secondary windows, implementation of BAS optimization, etc.).

During operation of the proposed ECMs, additional ground-disturbing activities would not be required; therefore, operation would not cause adverse effects to geology and soils.

3.1.2.3 Alternative B – Decentralized Geothermal System with Ground-Mounted Solar Array (Decentralized Alternative)

Alternative B ground disturbance would be approximately 27 acres for the solar PV array, approximately 23 acres for the dispersed geothermal bore fields, and an additional amount for the installation of the geothermal pipeline network. Approximately 10,400 cubic yards of material would be excavated, with 6,600 cubic yards associated with installation of the geothermal bore fields, and 3,800 cubic yards associated with pipeline installation. Short- and long-term impacts to geology would be the same as those discussed under Alternative A. Impacts to soils would be similar but greater than those described under Alternative A due to the larger area of proposed ground disturbance.

Impacts associated with other ECMs included in the proposed project under both action alternatives would be similar to those discussed under Alternative A. Mitigation measures under Alternative B would likewise be the same as those proposed under Alternative A.

3.1.2.4 Alternative C – No Action

Under the No Action Alternative, no ground disturbance would occur; therefore, no impacts would be anticipated to existing geology and soils.

3.2 Wildlife and Habitat

Resources analyzed in this section include wildlife, habitat, special-status species listed as threatened or endangered at the state level, and migratory birds. This section discusses resources that may occur within and adjacent to the proposed project boundaries. Migratory birds are protected under the Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703-711); bald and golden eagles are additionally protected under the Bald and Golden Eagle Protection Act (BGEPA) (16 U.S.C. 668-668d). EO 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds* (66 Federal Register 3853) directs federal agencies to identify where unintentional take is likely to have a measurable negative effect on migratory bird populations and to avoid or minimize adverse impacts through enhanced collaboration with the USFWS. EO 13186 was issued in part to ensure that environmental analyses of federal actions assess the impacts of these actions on migratory birds. It also states that emphasis should be placed on species of concern, priority habitats, and key risk factors, and it prohibits the take of any migratory bird without authorization from the USFWS.

3.2.1 Affected Environment

Very little quality wildlife habitat is located at the DFC due to the built-up environment; therefore, the overall diversity of wildlife is expected to be low. The presence of some large areas of open habitat and remnant native vegetation has the potential to provide some habitat for highly adaptable species that are common to disturbed or urban areas and are tolerant of human activity (e.g., cars, noise), such as birds and small mammals. The DFC campus is surrounded by a chain link fence and is only accessible by security gates, which restricts access to many large species of wildlife (GSA 2010). Representative mammalian species of the area include the coyote (*Canis latrans*), black-tailed prairie dog (*Cynomys ludovicianus*), eastern cottontail (*Sylviagus floridanus*), mule deer (*Odocoileus hemionus*), striped skunk (*Mephitis mephitis*), red fox (*Vulpes vulpes*), and raccoon (*Procyon lotor*). More than 315 species of birds have been identified within Jefferson County, many of which could occur within the DFC. Raptor species that may occur include the red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk (*Buteo swainsoni*), American kestrel (*Falco sparverius*), northern harrier (*Circus cyaneus*), Cooper's hawk (*Accipiter cooperi*), sharp-shinned hawk (*Accipter striatus*), great horned owl (*Bubo virginianus*), barn owl (*Tyto* alba), and the eastern screech owl (*Otus asio*). Additionally, there are 17 species of reptiles and amphibians potentially occurring at the DFC, including the wandering garter snake (*Thamnophis elegans*), western plains garter snake (*Thamnophis radix*), western rattlesnake (*Crotalus viridis*), bullsnake (*Pituophis melanoleucus*), northern leopard frog (*Rana pipiens*), and bullfrog (*Rana catesbeiana*) (GSA 2010).

3.2.1.1 Special Status Species

Table 6 summarizes threatened and endangered species listed at the state level.

TABLE 6. STATE SPECIAL STATUS SPECIES WITH POTENTIAL TO OCCUR WITHIN THE DFC.

Species	State Status	Habitat	Expected to occur in the DFC?
Mammals			
River otter (*Lontra canadensis*)	Threatened	Freshwater environments (rivers, creeks, and lakes) and prefers clean, clear water that provide suitable prey species.	No. The preferred surface water features are not present within the DFC.
Birds			
Burrowing owl (*Athene cunicularia*)	Threatened	Open grasslands, prairies, and desert habitats. These owls do not dig their own burrows; instead, they often utilize abandoned burrows dug by other animals.	No. While this species utilizes grasslands and prairie dog burrows, this species is not known to occur at the DFC.
Least tern (*Sterna antillarum*)	Endangered	Associated with water. Nests on riverine sandbars or salt flats.	No. The preferred surface water features are not present within the DFC.
Fish			
Suckermouth minnow (*Phenacobius mirabilis*)	Endangered	Runs and riffles of creeks and rivers with substrates ranging from sand and gravel to large boulders. Spawns presumably over gravelly riffles.	No. The preferred surface water features are not present within the DFC.
Common shiner *(Luxilus cornutus)*	Threatened	Creeks and small to medium rivers with clear cool weedless water, moderate to swift current, gravel to rubble bottom, and alternating pools and riffles.	No. The surface water features preferred by this species are not present within the DFC.

Source: CPW 2023a, CPW 2023b, NatureServe 2023

3.2.1.2 Migratory Birds

Per the USFWS Information, Planning, and Consultation (IPaC) tool results, nine migratory birds of conservation concern may occur within the DFC. The bald eagle and golden eagle also may be found at the DFC but are not birds of conservation concern in this area; these species instead warrant special attention under the BGEPA. Table 7 lists the IPaC identified migratory birds of conservation concern.

TABLE 7. MIGRATORY BIRD SPECIES WITH POTENTIAL TO OCCUR WITHIN THE DFC.

Species	Breeding Season in Area	Breeding Habitat	Expected to occur in DFC?
Bald eagle (*Haliaeetus leucocephalus*)	December 1 – August 31	Areas close to coastal areas, bays, rivers, lakes, reservoirs, or other bodies of water. Nests in tall trees, on pinnacles, or on cliffs near water.	Possible. Although the DFC contains riparian communities that may provide potential foraging habitat, it lacks habitat that would be regularly used by the species.
Chestnut-collared longspur (*Calcarius ornatus*)	May 1 – Aug 10	Level to rolling mixed-grass and shortgrass uplands, moist lowlands. Nests on the ground.	No. The primarily urbanized habitat, containing landscaped or disturbed vegetation, within the project area is unlikely to support suitable breeding habitat for this species.
Chimney swift (*Chaetura pelagica*)	Mar 15 – Aug 25	Rural and urban environments. Nests primarily in chimneys, but also on interior walls of anthropogenic structures. Natural nest sites include the interior of hollow tree trunks and branches, cavities created by other animals/birds, and rock shelters.	Unlikely. This species utilizes anthropogenic habitats that could be found in the structures of the developed portions of the DFC; however, the DFC Wildlife Management Plan does not consider this a species likely to occur onsite.
Clark's grebe (*Aechmophorus clarkii*)	Jun 1 – Aug 31	Marshes, lakes, and bays. Nests among tall plants growing on edges of large areas of open water.	No. The surface water features preferred by this species are not present within the DFC.
Ferruginous hawk (*Buteo regalis*)	Mar 15 – Aug 15	Open country, primarily prairies, plains, and badlands; sagebrush, saltbush-greasewood shrubland, periphery of pinyon-juniper and other woodlands, desert. Nesting sites depend on available substrates and surrounding land use. If nesting on the ground, locations are generally located far from human activities and on elevated landforms in large grasslands. If nesting in trees, lone or peripheral trees are preferred over densely wooded areas.	Unlikely. Although the DFC contains riparian communities that may provide potential foraging habitat, adjacent roadways and the nearby presence of humans would deter breeding within the project area.
Golden eagle (*Aquila chrysaetos*)	December 1 – August 31	Open and semi-open country, especially in hilly or mountainous terrain. Nests are often located on rock ledges of cliffs, but sometimes in large trees, on steep hillsides, or on the ground.	Possible. This species is listed as one that may occur at the DFC in the DFC Wildlife Management Plan due to the presence of mixed grasslands.
Lesser yellowlegs (*Tringa flavipes*)	Breeds elsewhere		Unlikely. Breeds in Canada and spends winters in South America. This species is listed as one that

Species	Breeding Season in Area	Breeding Habitat	Expected to occur in DFC?
			may occur at the DFC in the DFC Wildlife Management Plan, meaning it may be encountered within the DFC on stopovers during migration; however, the primarily urbanized habitat consisting of landscaped or disturbed vegetated areas existing within the project area is unlikely to support suitable foraging or resting habitat during migration stopovers.
Lewis's woodpecker (*Melanerpes lewis*)	Apr 20 – Sep 30	Open forest and woodland with a brushy understory and ground cover. In the western U.S., closely associated with open ponderosa pine forest. Nests in natural cavities, abandoned northern flicker holes, or previously used cavities.	No. The vegetation in the project area is previously disturbed and includes few trees. This habitat is not expected to support suitable breeding habitat for this species.
Long-eared owl (A*sio otus*)	Mar 1 – Jul 15	Deciduous and evergreen forests, orchards, wooded parks, farm woodlots, river woods, and desert oases. Nests in trees, usually in nests previously abandoned by other birds or squirrels; sometimes in tree cavities; rarely on the ground.	No. The vegetation in the project area is previously disturbed and includes few trees. This habitat is not expected to support suitable breeding habitat for this species.
Pectoral sandpiper (*Calidris melanotos*)	Breeds elsewhere		No. Breeds in Canada and spends winters in South America. The primarily urbanized habitat, containing landscaped or disturbed vegetated areas, existing within the project area is unlikely to support suitable foraging or resting habitat during migration stopovers.
Red-headed woodpecker (*Melanerpes erythrocephalus*)	May 10 – Sep 10	Open woodland, especially with beech or oak, open situations with scattered trees, parks, cultivated areas and gardens. Nests in hole excavated in a live tree, dead stub, utility pole, or fencepost.	No. The vegetation in the project area is previously disturbed and includes few trees. This habitat is not expected to support suitable breeding habitat for this species.

Source: GSA 2010; NatureServe 2023; USFWS 2023b

3.2.2 Environmental Consequences

3.2.2.1 Methods and Assumptions

The likelihood of wildlife species to occur within the project area was assessed through a review of the Final Wildlife Management Plan EA (GSA 2010) and a comparison of species-specific habitat type to habitat types available within the DFC campus. Potential existing habitat was qualitatively evaluated based on aerial imagery and general knowledge of the proposed project area.

3.2.2.2 Alternative A – Centralized Geothermal System with Ground-Mounted Solar Array (Centralized Alternative)

Construction of Alternative A would have direct, negligible to minor, adverse impacts on local and site-specific wildlife and wildlife habitat over the short-term. Construction of the solar PV array, geothermal bore field, and associated structures would disturb wildlife inhabiting the southeast field; however, the field supports limited, previously disturbed vegetation and isolated trees and shrubs that do not represent high-quality habitat for wildlife. Coyote dens and bird nests have been identified along the Agricultural Ditch (see section 3.4) and McIntyre Gulch in the past (GSA 2008b). If present, these species may be disturbed by construction activities; however, the DFC is located within a highly developed urban area that experiences frequent human activity. As a result, impacts to wildlife would be minor, as most species that inhabit the project area may be tolerant of humans and vehicle traffic or are able to relocate to nearby areas of suitable habitat. Construction of the geothermal pipeline network would occur alongside of (parallel to) and/or beneath (perpendicular crossings) existing roads and beneath parking lots that do not serve as quality wildlife habitat.

Construction or installation of other ECMs (table 4) could have direct, negligible to minor, adverse impacts on local and site-specific wildlife over the short-term due to a temporary increase in noise and activity.

The operation of proposed ECMs under Alternative A would have direct, negligible to minor, adverse impacts on local wildlife over the long-term. Concerns exist about the potential for solar PV arrays to adversely affect migratory bird populations. While a single panel may not pose a significant threat, a collection of panels may create a reflective glare that could be mistaken as a body of water by birds in flight and their insect prey, a phenomenon referred to as the “lake effect.” Injury or direct mortality may result if birds attempt to land on the solar PV array (Hathcock 2018). During final design, the engineers will consider ways to reduce possible impacts to birds. The operation of the geothermal heating and cooling system would not be expected to affect wildlife. The change in noise associated with operation would be negligible in relation to the current, urban nature of the area. Likewise, the operation of other ECMs proposed (quad pane and secondary windows, BAS optimization, use of LEC materials, etc.) would not be expected to impact wildlife and habitat.

3.2.2.3 Alternative B – Decentralized Geothermal System with Ground-Mounted Solar Array (Decentralized Alternative)

Impacts to wildlife from the construction of the solar PV array and the geothermal heating and cooling system under Alternative B would be the same as those discussed under Alternative A.

Construction of the proposed geothermal bore fields under Alternative B would have direct, negligible to minor, adverse impacts to onsite wildlife habitat over the short-term. One bore field serving building 41, as well as those bore fields serving buildings 25, 56, 67, and a portion of one of the two bore fields to serve building 95, would be constructed under existing parking lots, which do not provide habitat to wildlife. The proposed geothermal bore field serving buildings 45 and 48 and the bore field serving building 810 would be constructed under previously cleared areas utilized for parking and equipment storage, which likewise do not provide quality wildlife habitat and would therefore not impact wildlife species or their habitat. The portions of the two proposed bore fields near building 95 that would not be located beneath an existing parking lot would be constructed under maintained open spaces containing minimal vegetation such as trees, shrubs, and landscaped grasses. Wildlife may make occasional use of these vegetated areas, but they do not represent high-quality habitat due to surrounding development and frequent human activity, as well as limited diversity of vegetation. While construction would remove existing vegetation from these areas and may disturb wildlife that is present, no meaningful loss of habitat would be expected. Construction of the geothermal pipeline network would occur alongside of (parallel to) or beneath (perpendicular crossings) existing roads and

parking lots that do not serve as quality wildlife habitat and would therefore not have any significant impacts.

Impacts associated with other ECMs included in the proposed project under both action alternatives would be the same under Alternative B as under Alternative A. Likewise, operation of proposed ECMs under Alternative B would be the same as those discussed under Alternative A.

3.2.2.4 Alternative C – No Action

Under the No Action Alternative, the proposed ECMs would not be implemented at the DFC and no construction would occur; therefore, there would be no impacts to wildlife and habitat.

3.3 Vegetation and Invasive Species

Resources analyzed in this section include vegetation within and adjacent to the project area.

3.3.1 Affected Environment

Vegetation within the DFC includes riparian and wetland communities as well as urban landscapes, disturbed areas, and grasslands. Developed portions of the campus are surrounded by landscaped vegetation. Undeveloped open space areas are categorized as either open mixed grasslands or open disturbed areas. Open mixed grasslands consist of naturally occurring, but largely non-native vegetation. Open disturbed areas have little or no vegetation because of human-related disturbances (GSA 2008b). The riparian community found along the detention ponds on the northern side of the DFC, Downing Reservoir, the Agricultural Ditch, and McIntyre Gulch retain valuable native vegetation properties. This community is composed of deciduous trees and shrubs, along with various willow species (GSA 2008a). According to a wetland and aquatic resources delineation conducted in 2022 and 2023, non-native vegetation within the southeast field of the DFC (in which the solar PV array is proposed under both action alternatives) includes cut-leaf teasel (*Dipsacus laciniatus*), common mullein (*Verbascum thapsus*), and other non-native plants (GSA 2023b).

3.3.2 Environmental Consequences

3.3.2.1 Methods and Assumptions

To assess impacts on vegetation, potentially impacted areas of existing vegetation were qualitatively evaluated. The potential for invasive and nonnative plant dispersal was also considered.

3.3.2.2 Alternative A – Centralized Geothermal System with Ground-Mounted Solar Array (Centralized Alternative)

Construction of Alternative A would have direct, negligible, adverse impacts to onsite vegetation over the short- and long-term. Construction of the solar PV array, geothermal bore field, and associated structures would remove existing vegetation; however, this area has been disturbed in the past. This area supports limited, previously disturbed vegetation and isolated trees and shrubs that do not represent historic, native vegetative communities. Remaining undisturbed areas are open grasslands, which consist of naturally occurring, but largely non-native vegetation. While construction would remove existing vegetation from this area, no substantial loss of habitat or impact to overall native vegetation would be expected. Disturbed areas would be revegetated following construction.

Construction equipment would be washed before and after coming to the site to the extent practicable to limit the transport of invasive species. Non-native invasive species present in the project area would be removed from the site before earthmoving activities began. Construction of the geothermal pipeline network would occur alongside of (parallel to) and/or beneath (perpendicular crossings) existing roads and beneath parking lots that do not contain vegetation.

Construction or installation of other ECMs could have direct, negligible, adverse impacts to onsite vegetation over the short-term; however, it is likely that most of these ECMs would be installed within existing building envelopes or on existing impervious surfaces already lacking vegetation.

No additional impacts to vegetation are anticipated during operation of ECMs under Alternative A. No additional ground disturbance would be required, and routine maintenance of solar PV panels, ground-source heat pump systems, or other proposed ECMs would not be expected to affect vegetation.

3.3.2.3 Alternative B – Decentralized Geothermal System with Ground-Mounted Solar Array (Decentralized Alternative)

Impacts to vegetation from construction occurring in the southeast field under Alternative B and associated impact minimization measures would be the same as those discussed under Alternative A.

Construction of the geothermal heating and cooling system under Alternative B would have similar short- and long-term impacts as those discussed under Alternative A; however, impacts would be greater as they would be dispersed across campus rather than isolated to the southeast field. Geothermal bore fields proposed to serve buildings 25, 56, and 67, as well as one of the two bore fields proposed for building 41, and a portion of one of the two bore fields to serve building 95 would be located beneath existing parking lots. Proposed bore fields for buildings 45, 48, and 810 would be located beneath previously cleared areas. Proposed bore fields at other locations would, at least partially, impact areas of open grassland, landscaped grasses, and some trees and shrubs. These sites consist of patches of previously disturbed vegetation and isolated trees and shrubs that do not represent historic, native vegetation communities. Grasslands are either maintained by human landscaping or are naturally occurring but contain largely non-native vegetation. Vegetated areas would be restored, to the extent possible, following construction with native seed mixes and plants. Construction of the pipeline network serving the bore fields would occur alongside of (parallel to) and/or beneath (perpendicular crossings) existing roads and beneath parking lots that do not contain vegetation would therefore not have any substantial impacts.

Impacts associated with other ECMs included in the proposed project under both action alternatives would be the same under Alternative B as under Alternative A. Likewise, operation of proposed ECMs under Alternative B would be the same as those discussed under Alternative A.

3.3.2.4 Alternative C – No Action

Under the No Action Alternative, the proposed ECMs would not be implemented. There would be no impacts to vegetation and non-native invasive species would remain in the project area.

3.4 Water Resources

Resources analyzed in this section include surface water bodies, including streams, wetlands, and floodplains, and groundwater resources located within the boundaries of the DFC campus.

3.4.1 Affected Environment

3.4.1.1 Watershed

The DFC is located within the Upper South Platte USGS 8-digit Hydrologic Unit Code (10190002) (USGS 2023). The South Platte River, which originates in Colorado and flows northeast through Denver, is the largest waterway in this watershed (USGS 2015).

3.4.1.2 Surface Waters

A wetland and aquatic resources delineation was conducted in November and December 2022 and March 2023 to identify and delineate the boundaries of wetland and open water features occurring within the boundaries of the DFC campus. Two natural waterways were identified: McIntyre Gulch and

its small unnamed tributary. The locations of wetlands identified during the delineation are shown on figure 6. The National Hydrography Dataset (NHD) presents approximate locations for some features. Where the NHD does not identify a surface water that was delineated during the 2022/2023 delineation, its approximate location has been labeled. Delineated boundaries for all surface waters identified during the delineation may be found in the *Wetland and Aquatic Resources Delineation Report* (delineation report) dated October 2023 (GSA 2023b).

McIntyre Gulch (identified on figure 6 and in the delineation report as OW-10) is a perennial, relatively permanent waterway that flows in an eastward direction. It enters the DFC campus from the southwest corner and continues east to its confluence with Lakewood Gulch. Overall, McIntyre Gulch is a highly entrenched stream that is actively incising in some sections. This condition is likely the result of urbanization in the watershed, which contributes to higher and flash flood flows, along with constructed infrastructure that constricts the floodplain and natural hydrogeomorphic processes. Within the DFC campus, McIntyre Gulch receives stormwater flow from adjacent federal buildings and associated parking. The stream becomes increasingly entrenched as it flows east, with severely eroded streambanks observed at the eastern extent of this segment, near Kipling Street. The aforementioned delineation report notes that bedrock streambed was observed in some sections, including a karst formation near the confluence of the tributary (GSA 2023b).

The unnamed tributary to McIntyre Gulch is identified on figure 6 and in the delineation report as OW-01. This intermittent, relatively permanent waterway receives stormwater from adjacent federal buildings and associated parking, as well as from Alameda Avenue on the southern edge of the DFC. The tributary enters McIntyre Gulch from the south.

In addition to McIntyre Gulch and its tributary, several artificial surface waters were identified during the wetland and aquatic resources delineation. The DFC stormwater management and conveyance systems consists of several constructed channels and wetlands constructed in uplands. The Downing Reservoir (OW-80), located on the east side of the DFC campus adjacent to Kipling Street, is an artificial open water feature that receives water from a constructed Agricultural Ditch (OW-50) that diverts water from Clear Creek in Golden and traverses to the southeast through the City of Lakewood. The DFC stormwater management system receives water from onsite parking lots and rooftops as well as stormwater originating in the commercially developed area west of the campus (GSA 2023b).

Section 303(d) of the federal Clean Water Act (CWA) (22 U.S.C. 1251-1387) requires states to establish lists of waterbodies that fail to meet their designated uses based on associated water quality standards, and to submit updated lists to the EPA every two years, along with an integrated report on water quality conditions that is required in section 305(b) of the CWA. The CDPHE is responsible for producing Colorado's section 303(d) list and Integrated Report. While McIntyre Gulch is not discussed in the 2024 Integrated Water Quality Monitoring and Assessment Report, Lakewood Gulch, to which McIntyre Gulch flows, is listed as in attainment of its designated uses (CDPHE 2023a).

The DFC southeast field is adjacent to McIntyre Gulch and the Agricultural Ditch. Under both action alternatives, the geothermal pipeline network would be required to cross McIntyre Gulch to connect one or multiple geothermal bore fields to the buildings to be serviced. Under Alternative A, the pipeline network would be required to cross the Agricultural Ditch in two locations. Stormwater runoff in this area appears to sheet flow eastward to the Agricultural Ditch and southward toward Alameda Avenue.

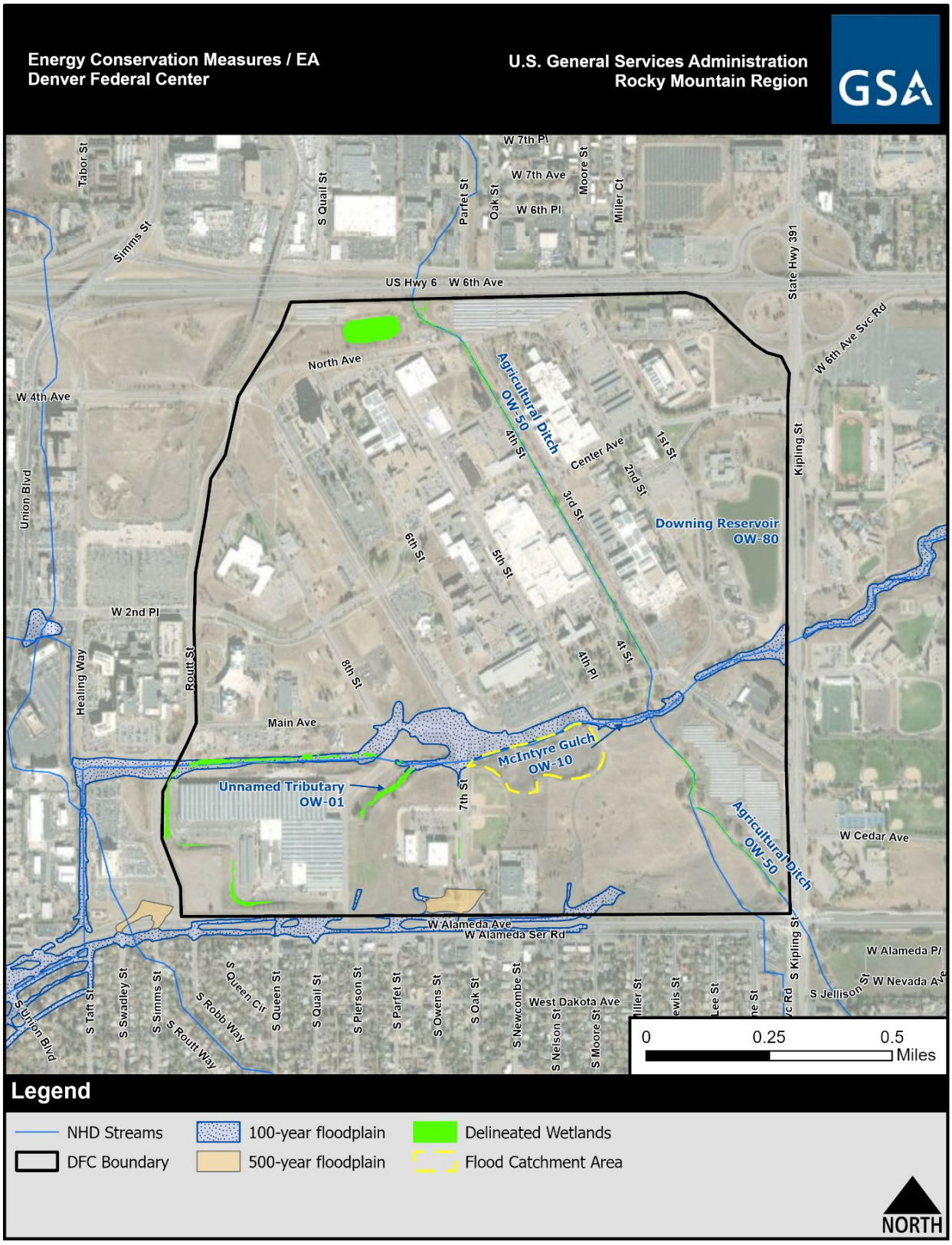

FIGURE 6. DELINEATED WETLANDS, NHD STREAMS, AND FLOODPLAINS WITHIN THE DFC BOUNDARIES

3.4.1.3 Wetlands

The wetland and aquatic resources delineation identified a total of 18 aquatic resources, including the previously described surface waters and associated wetlands (see figure 6). As stated, McIntyre Gulch and its small unnamed tributary are the only natural waterways identified. McIntyre Gulch and abutting wetlands with relatively permanent surface water connectivity were previously determined to be Waters of the U.S. under U.S. Army Corps of Engineers (USACE) jurisdiction. Downing Reservoir, the Agricultural Ditch, and the DFC stormwater management and conveyance system, including manmade channels and wetlands constructed in uplands, were previously determined to be non-jurisdictional features. Additional details may be found in the delineation report dated October 2023 (GSA 2023b). Coordination with USACE is ongoing as GSA pursues a Jurisdictional Determination for the resources identified in the report.

The USFWS National Wetlands Inventory (NWI) identifies multiple riverine wetlands, two freshwater ponds, one small area of forested/shrub riparian wetland, and one small area of herbaceous riparian wetland occurring within the boundaries of the DFC campus, with the latter two wetland areas abutting one of the two identified freshwater ponds (USFWS 2023c). The DFC southeast field is adjacent to, but not within, the riverine wetlands identified by the NWI, corresponding to the waterbodies identified as McIntyre Gulch and the Agricultural Ditch. Likewise, locations of proposed geothermal bore fields under both action alternatives occur in areas outside of wetlands identified by both the NWI and the wetland and aquatic resources delineation.

3.4.1.4 Groundwater

The DFC is located near the western edge of the Denver Basin aquifer system, which is a confined bedrock aquifer system that underlies an area of approximately 7,000 square miles and consists of four aquifers contained in five geologic formations. In the area of the DFC, three aquifers are present (listed in order from top to bottom): the Denver aquifer, the Arapahoe aquifer, and the Laramie aquifer. The Denver Basin is not well connected to other major aquifers in the area; however, the surficial aquifer along the South Platte River Valley overlies the Denver Basin along the valley of the South Platte River from Denver to just east of Greeley, Colorado. Shallow, discontinuous surficial aquifers overlie parts of the Denver Basin elsewhere, primarily along streams extending from the South Platte River. The DFC does not overlie the surficial aquifer and is located south and west of the nearest edges of the surficial aquifer system in this area (USGS 1995).

Regionally, the Denver Basin aquifer system provides water for municipalities, as well as industrial, domestic, and agricultural uses. Population growth and increased development have, over time, taxed the limited availability of groundwater within the Denver Basin (USGS 2011).

Groundwater in the vicinity of the DFC occurs at approximately 10 to 20 feet below ground surface (GSA 2008a). Monitoring has identified solvents in the groundwater in some locations at concentrations in excess of either regulatory or risk-based screening level criteria identified in CDPHE Orders on Consent for the site (see section 3.9) (GSA 2008b). Based on mapping in the 2022 monitoring reports, the groundwater contamination plumes are located just west of and north of Downing Reservoir along the eastern edge of the DFC (GSA 2023f). Groundwater is not used for onsite drinking water or irrigation, although groundwater to the west of the site is utilized for irrigation. The DFC sources water from Denver Water through a single 16-inch line connection near Kipling Street and 6th Avenue (GSA 2008b).

3.4.1.5 Floodplains

Most of the DFC campus is located outside of the 100- or 500-year floodplain; however, the McIntyre Gulch 100-year floodplain traverses the site, where the stream separates the site of the proposed solar PV array from the buildings on the opposite side of Main Avenue (see figure 6). Additionally, small areas of the McIntyre Gulch 100- and 500-year floodplain enter the campus at its southern extent (FEMA 2014; FEMA 2022). The locations of the solar PV array and geothermal bore fields proposed under both action alternatives are located outside of the 100- or 500-year floodplain; however, the geothermal pipeline network would be required to cross the 100-year floodplain to connect one or multiple bore fields to the buildings to be serviced.

3.4.2 Environmental Consequences

3.4.2.1 Methods and Assumptions

To assess impacts to water resources, the location and extent of ground disturbance were considered in proximity to surface waters and wetlands identified in the delineation report (GSA 2023b). Water usage, possible groundwater impacts, and potential disturbance within or alterations to the 100-year floodplain were also evaluated. No work is proposed within the 500-year floodplain.

3.4.2.2 Alternative A – Centralized Geothermal System with Ground-Mounted Solar Array (Centralized Alternative)

3.4.2.2.1 Surface Waters and Wetlands

No direct impacts on wetlands are anticipated. Should this change during the final design process, consultation with USACE would be required to verify updated wetland boundaries and to confirm jurisdiction (coordination with USACE is ongoing as GSA pursues a Jurisdictional Determination for resources identified in the delineation report). Construction of Alternative A could result in direct, minor, localized adverse effects to water quality over the short-term within adjacent surface waters and wetlands, primarily McIntyre Gulch and associated wetlands, as well as the Agricultural Ditch, due to a temporary increase in construction-related runoff. Additionally, an increase in activity and the presence of construction equipment would increase the risk of leaks or spills of oil, lubricants, and other contaminants, which could runoff to nearby surface waters and wetlands, adversely affecting water quality. Potential impacts would be minimized through the implementation of stormwater controls and best management practices (BMPs), designed to address increases in stormwater velocities and volumes during construction. Any necessary construction permits would be acquired, and adherence to permit conditions would be strictly enforced (an Erosion Control Plan is required as part of the DFC Excavation Permit and a SWPPP would be required under the project's NPDES permit).

The proposed pipeline network would cross McIntyre Gulch via existing bridges at 5th Street and at 8th Street (figure 3). By attaching the pipeline to the existing bridges, direct impacts to the stream would be avoided. Construction equipment and personnel would likewise access the site from existing roadways and bridges. At no time would construction equipment enter the boundaries of any wetland or surface water. Electrical lines from the solar PV array would utilize an existing manhole in the southeast field and an existing spare conduit to connect to the existing DFC grid at an existing switch near 5th and Main Avenue. Under Alternative A, the proposed pipeline network would be required to cross the Agricultural Ditch in two locations (see figure 3). It is anticipated that these crossings would occur under ground to avoid direct impacts to the waterway.

Construction or installation of other ECMs would primarily occur within existing building envelopes and would not require ground disturbance.

Water for construction would be acquired from the existing domestic water supply, likely utilizing the fire hydrant nearest to the project area.

During operation of the proposed ECMs, additional ground-disturbing activities would not be required. The proposed geothermal heating and cooling system would initially fill the loops with water supplied by the DFC's existing domestic water system; therefore, operations under Alternative A would not be expected to result in adverse effects to surface waters and wetlands. Use of the completed ECMs would decrease overall water usage onsite by approximately 29 percent but none of the water used on site is from the water resources discussed in this section. The reduction in water usage is due to the proposed geothermal system not requiring cooling towers, which are one of the single biggest existing consumers of water onsite (Ameresco 2024).

After construction, the co-located geothermal field and solar PV array site would be reseeded using native seed mixes and plants. Stormwater runoff would continue to sheet flow eastward to the Agricultural Ditch and southward toward Alameda Avenue. Because the site would remain pervious, no changes in stormwater runoff volumes would be anticipated.

3.4.2.2.2 Groundwater

Like surface waters, local groundwater resources may be adversely affected by short-term construction-related runoff, via infiltration from receiving surface waters. The potential for such impacts would be minimized by the methods described in the previous subsection. The proposed drilling of geothermal boreholes could, if not installed properly, result in a contamination pathway into groundwater. The proposed system would be installed using heat sealing of pipes and grouting of boreholes, and would comply with state regulations, as discussed in section 2.2.1. It is also possible that wells could be damaged during construction by the movement of heavy equipment on the ground surface. This would be mitigated by spacing boreholes a minimum of 19 feet apart and by the contractor ensuring, that as wells are constructed, there is limited possibility of equipment driving over constructed wells (Ameresco 2024a). During construction, the proposed boreholes may come in contact with groundwater. Short-term, site-specific, negligible impacts to groundwater are anticipated. Contaminated groundwater, if encountered (unlikely based on the section 3.4.1.4 discussion), would be managed in accordance with CDPHE Orders on Consent and applicable federal and state waste regulations (see section 3.9).

Construction or installation of other ECMs would primarily occur within existing building envelopes and would require little to no ground disturbance. Aside from short-term construction-related runoff, it would not be expected that groundwater would be affected.

As stated above, water for construction would be acquired from the existing domestic water supply, utilizing the fire hydrant nearest to the project area.

During operation of the proposed ECMs, additional ground-disturbing activities would not be required. The proposed geothermal heating and cooling system would not come into contact with groundwater, as the piping would be hermitically sealed, and pressure tested prior to use. Additionally, the piping would be grouted from the bottom of the borehole to the top. Contamination of groundwater would be possible only in the event of a poorly grouted borehole (i.e., leaks or cracks in the grout) or if the pipe itself were to fail. Additionally, an improperly constructed borehole could act as a connection point between different aquifers, or a zone of contamination and an aquifer if constructed near an area of contamination, which would allow mixing of aquifers and/or contamination of an aquifer. As discussed in section 2.2.1, the proposed construction procedures would ensure a solid seal of both the boreholes and associated pipelines. Detailed quality control and assurance procedures would be in place during construction, along with continuous inspection by qualified professionals, to ensure that the construction procedures and state regulations outlined in section 2.2.1 are strictly followed.

No known areas of groundwater contamination exist within the southeast field. The most recent groundwater monitoring report shows the nearest groundwater contamination plume occurring north

of this area (GSA 2023f). Wells may be vulnerable to the movement of heavy equipment at the ground surface if that were to occur during operations. Under Alternative A the bore field would be located beneath the solar PV array; therefore, it is unlikely during operations and maintenance activity that heavy equipment would be driving over the constructed boreholes. In the unlikely event of a pipe rupture and failure of the grout seal, the propylene glycol solution circulating through the loops is non-toxic, food safe, and readily biodegradable, and would not adversely affect groundwater.

Studies have shown that large closed-loop geothermal systems can affect the overall temperature of adjacent aquifers, which has the potential to promote pathogenic microorganisms (NCDHD 2024). As groundwater directly beneath and adjacent to the DFC is not used for the public water supply, the potential for an increase in overall bacteria counts would not impact local drinking water supplies (City of Lakewood 2024; Denver Water 2022). Regionally, the Denver Basin aquifer system does provide water for the municipal water supply; however, it is unlikely that the addition of the proposed geothermal system in this location, removed from any potable water wells, would result in aquifer temperature changes. Geothermal systems do not heat the water in the system but rather transfer heat from the underground features surrounding the wells into the system fluids. As there is no heating within the system, there is little potential for the system to cause a change in temperature.

As described in section 2.2.1, closed-loop geothermal heating and cooling systems are non-consumptive of groundwater; therefore, operations under Alternative A would not be expected to result in adverse effects to groundwater.

3.4.2.2.3 Floodplains

Impacts to the 100-year floodplain would not be expected under Alternative A. Although the geothermal pipeline network would be required to cross the 100-year floodplain of McIntyre Gulch to connect the bore field to the serviced buildings, ground disturbance within the floodplain would be avoided. The pipeline would be adjacent and attached to existing bridges over McIntyre Gulch; therefore, the pipeline would be located above the 100-year floodplain and would not be impacted by a 100-year flood. The addition of two 24-inch pipes on the existing bridges would not create conditions that would impede flood waters or result in changes to flooding patterns downstream.

3.4.2.3 Alternative B – Decentralized Geothermal System with Ground-Mounted Solar Array (Decentralized Alternative)

3.4.2.3.1 Surface Waters and Wetlands

Impacts to surface waters and wetlands under this alternative would be similar to those described under Alternative A, and impact minimization measures would be the same.

As under Alternative A, direct contact with surface waters and wetlands would be avoided through the use of existing roadways and bridges. Under Alternative B, the pipeline would cross McIntyre Gulch in one location, using the existing bridge near the intersection of 5th Street and Main Avenue, as buildings 25 and 810 would be serviced by their own bore fields, eliminating the need to cross the Agricultural Ditch and to cross McIntyre Gulch near 8th Street.

Impacts associated with other ECMs included in the proposed project under both action alternatives would be the same under Alternative B as under Alternative A.

3.4.2.3.2 Groundwater

Impacts to groundwater under this alternative, including potential for encountering contaminated groundwater, would be similar to those described under Alternative A.

During operations of the proposed ECMs under Alternative B, impacts would be similar to those anticipated under Alternative A. The dispersed layout of the geothermal bore fields under Alternative

B could make the fields slightly more susceptible to well damage caused by movement of heavy equipment at the ground surface. Some of the proposed bore fields under this option are beneath parking lots. Design would need to ensure that the pavement structure of the parking lot, including any subbase, was adequate to distribute heavy vehicle and equipment loads in such a way that would not damage the geothermal wells. For bore fields constructed in other areas (landscaped or grass areas next to buildings) signage or protection (fencing) may be required to ensure heavy equipment movement would not impact geothermal wells in those areas.

3.4.2.3.3 Floodplain

Impacts to the 100-year floodplain would not be expected under Alternative B, for the reasons given under Alternative A.

3.4.2.4 Alternative C – No Action

Under the No Action Alternative, none of the proposed construction activities would occur; therefore, there would be no change to water resource conditions within or adjacent to the DFC campus. The DFC would continue to utilize cooling towers to provide the cooling needs of onsite buildings, which are one of the single biggest existing consumers of water onsite (Ameresco 2024).

3.5 Cultural Resources

Section 106 of the NHPA of 1966, as amended, and its implementing regulations under 36 CFR 800, require federal agencies to consider effects of federal actions on historic properties. Historic properties are those cultural resources that are either listed in, or eligible for listing in, the NRHP.

During the section 106 review, federal agencies are required to consider effects on historic properties within the area of potential effects (APE). The APE is defined as “the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist” (36 CFR 800.16). For this project, the APE is defined as the DFC campus. Cultural and historic resources may include archaeological sites, buildings, structures, objects, districts, or areas of traditional religious and cultural importance.

3.5.1 Affected Environment

Two properties at the DFC are listed individually in the NRHP. These properties are described briefly below. The DFC has been evaluated for its eligibility as a historic district or as an individual resource on its own and was determined ineligible for listing in the NRHP because of the extensive changes that have occurred to the buildings since they were first constructed (GSA 2008a). More details on consultation with COSHPO related to this project are provided in section 3.5.2, and copies of correspondence may be found in appendix A.

The most recent archaeological studies of the DFC were conducted in 1978 and 1997, both of which concluded that the potential for surviving undisturbed prehistoric archaeological resources was low since the property had undergone extensive landscape and development transformation since 1941 (GSA 2008a); however, an archaeological monitor would be onsite during all initial ground disturbing activities under both action alternatives. Archaeological resources are not discussed further in this EA.

The Office of Civil Defense Emergency Operations Center (5JF.1048.13). This property is identified in figure 1 as “Office of Civil Defense” and referred to throughout correspondence documents with the COSHPO as the Office of Civil Defense Emergency Operations Center (OCD) or the Emergency Operations Center. The building was constructed in 1961 and listed in the NRHP in 1999 for its association with the Cold War. It was constructed as a temporary structure until a more permanent bunker (building 710) could be completed. The OCD is a Quonset-style bunker partially buried underground and was intended to provide protection in the event of a nuclear attack. The building was designed as a temporary structure and was not intended for permanent occupancy or

use. In consultation with the COSHPO and in accordance with section 110 of the NHPA, GSA stabilized and mothballed the property in 2016. Permanent, interpretive signage is installed alongside the building to educate employees and visitors about the historic significance of the building.

Building 710 (5JF.1048.14). Building 710 (see figure 1) is an underground bunker designed to withstand a nuclear attack. It was constructed by the USACE in 1969 and served as the base for federal operations expected to be performed by the Defense Civil Preparedness Agency (DCPA). The structure consists of concrete and steel and is largely concealed below an earthen berm. Building 710 was listed in the NRHP in 2000 for its association with the Cold War, the way in which its design and construction reflect this era, as well as its continuous national preparedness and response function. It is currently occupied by FEMA, the successor agency to DCPA.

3.5.2 Environmental Consequences

3.5.2.1 Methods and Assumptions

In a letter dated November 2, 2023, GSA informed the COSHPO of the proposed undertaking, and invited them to participate in section 106 consultation (see appendix A). The following section includes a summary of the coordination with the COSHPO and additional information on potential visual impacts. Visual impacts were assessed based on recent (February 2024) photos taken on the DFC campus combined with information on topological relief in the area and the alternative layouts.

3.5.2.2 Alternative A – Centralized Geothermal System with Ground-Mounted Solar Array (Centralized Alternative)

In the November 2, 2023 letter, GSA stated that both action alternatives would avoid adverse effects to the OCD and building 710 by keeping clear the boundaries of each property from ground and construction disturbance, the placement of solar PV panels, staging equipment, and vibration that could potentially occur from neighboring activities. Alternative A would not include any work in the proximity of either building. The proposed geothermal heating and cooling system would not be connected to either building. Building 710 would continue to utilize existing systems, and the OCD is not currently occupied and does not require a utility connection. No vibration impacts to the historic structures would occur (see section 3.11).

In a letter dated November 20, 2023, the COSHPO stated, “We concur that neither alternative will directly impact the two National Register-listed properties. Potential visual effects to the properties may occur, but the ultimate impact cannot be known until the size and placement of the proposed infrastructure is further examined and shaped.” During construction, the visual landscape would be temporarily altered by vegetation clearing and the presence of construction equipment; however, the southeast field in which the proposed solar PV array and geothermal bore field would be installed has been previously disturbed by past construction and demolition activities and remediation projects and does not currently contain any structures. The visual landscape currently consists of open space vegetated with grasses, a few small trees, and shrubs. Following construction, the solar PV array, pump house, and valve houses would be visible.

From Building 710, a view of the southeast field is shielded by the Post Office, an existing fence, and other structures (photo 3). The OCD is an underground structure with an obstructed view of the field. A portion of the southeast field may be visible to visitors of the OCD when viewed from certain angles (photo 4). Due to a drop in topography of approximately ten feet from Main Avenue to the field, only the westernmost portion of the southeast field would be visible to a person standing by the OCD and looking in that direction; however, trees located between the OCD and the field would obscure the view when foliage is present. As stated, the addition of the solar PV array and associated structures would not deviate from the current visual landscape in this area. The views of (looking at) the OCD or building 710 would not change under Alternative A as no new infrastructure would be constructed near either building.

PHOTO 3. VIEW TOWARDS THE SOUTHEAST FIELD FROM BUILDING 710.

PHOTO 4. VIEW TOWARDS THE SOUTHEAST FIELD FROM THE OCD.

3.5.2.3 Alternative B – Decentralized Geothermal System with Ground-Mounted Solar Array (Decentralized Alternative)

Alternative B impacts to cultural resources would be similar to those discussed under Alternative A; however, under Alternative B, one of the two proposed geothermal bore fields at building 41 would be located adjacent to the OCD, rather than at a distance in the southeast field of the DFC (as proposed under Alternative A). The OCD, including the associated interpretive signage, would be protected by construction fencing during any activity occurring within proximity. Alternative B would not include any work in the proximity of building 710, and, as stated above, the building is shielded from view of any proposed aboveground equipment in the southeast field (the PV array) by other existing buildings and structures. Alternative B would include one valve house nearby the OCD that would visually intrude on the area around the historic building. However, as the DFC is a highly developed facility that contains other solar PV arrays and utility buildings, the addition of the valve house would not be out of place within the current visual landscape. No vibration impacts would occur (see section 3.11).

3.5.2.4 Alternative C – No Action

Under the No Action Alternative, the proposed ECMs would not be implemented and no changes to historic properties or the visual landscape would occur.

3.6 Air Quality and Greenhouse Gas

This section analyzes air quality in the project area in terms of compliance with national regulatory standards and discusses climate change and effects from GHGs.

3.6.1 Affected Environment

3.6.1.1 Air Quality

Air quality is the measure of the atmospheric concentration of defined pollutants in a specific area. An air pollutant is any substance in the air that can cause harm to humans or the environment. Pollutants may be natural or human-made and may take the form of solid particles, liquid droplets, or gases. The Clean Air Act (CAA) (42 U.S.C. 7401 et seq.), as amended, provides the framework for federal, state, and local rules and regulations to protect air quality. The CAA gives the EPA the responsibility to establish the primary and secondary National Ambient Air Quality Standards (NAAQS) (40 CFR 50). NAAQS (table 8) set acceptable concentration levels for seven criteria pollutants: PM_{10} (particulate matter less than or equal to 10 micrometers in aerodynamic size), $PM_{2.5}$ (particulate matter less than 2.5 micrometers in aerodynamic size), sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), and lead (Pb). NAAQS are split into two types: primary and secondary. Primary NAAQSs are used as the basis for determining whether a region is complying with CAA requirements.

TABLE 8. NATIONAL AMBIENT AIR QUALITY STANDARDS.

Pollutant	Primary(P) / Secondary (S)	Averaging Time	Level	Form
CO	P	8 hours	9 ppm	Not to be exceeded more than once/year
		1 hour	35 ppm	
Pb	P & S	3-month average	0.15 µg/m^3	Not to be exceeded
NO_2	P	1 hour	100 ppb	98th percentile of 1-hour daily max*
	P & S	1 year	53 ppb	Annual Mean
O_3	P & S	8 hours	0.070 ppm	Annual fourth-highest daily max 8-hour concentration*
PM $PM_{2.5}$	P	1 year	12.0 µg/m^3	Annual mean*
	S	1 year	15.0 µg/m^3	Annual mean*
	P & S	24 hours	35 µg/m^3	98th percentile*
PM PM_{10}	P & S	24 hours	150 µg/m^3	Not to be exceeded once/years*
SO_2	P	1 hour	75 ppb	99th percentile of 1-hour daily max concentrations*
	S	3 hours	0.5 ppm	Not to be exceeded more than once/year

Source: EPA 2023e * averaged over three years

The CDPHE Air Quality Control Commission oversees Colorado's air quality program according to the Colorado Air Pollution Prevention and Control Act, section 25-7-191 et seq. (CDPHE 2023b). The CDPHE develops emission control regulations to ensure the NAAQS are attained and maintained (CDPHE 2023c). Jefferson County, where the project area is located, is in a non-attainment area for 8-hour O_3 and a maintenance area for CO and PM_{10} (EPA 2023g). The General Conformity Rule (40 CFR §51, Subpart W, and 40 CFR §93) was established under the CAA and ensures that federal actions do not interfere with a state's plan to attain and maintain the NAAQS. The General Conformity Rule states that, if a project would result in a total net increase in direct and indirect emissions of nonattainment or maintenance pollutants that are less than the applicable *de minimis* (i.e., negligible) thresholds established in 40 CFR 93.153(b), detailed conformity analyses are not required pursuant to 40 CFR 93.153(c)(4). Item 4 exempts actions which implement a decision to conduct or carry out a conforming program. While not specifically mentioned in the legislation, GSA's NDER program is intended to modernize federal buildings to cut GHG emissions and reduce site energy consumption through deep energy retrofits; therefore, it is a conforming program that meets the definition of 40 CFR 93.153(c)(4). The General Conformity Rule does apply to the proposed project.

3.6.1.2 Greenhouse Gases

GHGs trap heat in the atmosphere by absorbing outgoing infrared radiation. GHG emissions released into the atmosphere from human-induced fossil fuel combustion are widely believed to be contributing to global climate changes. GHGs, which include carbon dioxide (CO_2), methane (CH_4), nitrous oxide

(N_2O), water vapor, and several trace gases, trap radiant heat reflected from the Earth in the atmosphere, causing the Earth's average surface temperature to rise (EPA 2023f).

The EPA has assigned GHGs a global warming potential (GWP), which is the ability of a gas or aerosol to trap heat in the atmosphere (EPA 2023f). To simplify GHG analyses, total GHG emissions from a source are often expressed as a CO_2 equivalent (CO_{2e}), which is calculated by multiplying the emissions of each GHG by its GWP and adding the results together to produce a single, combined emission rate representing all GHGs. While CH_4 and N_2O have much higher GWPs, CO_2 is emitted in such large quantities that it is the predominant contributor to global CO_{2e} emissions from both natural processes and human activities.

The National Emissions Inventory, updated every three years by the EPA, can be used to identify baseline GHG emissions. It contains estimates of annual air emissions by county within the U.S. The most recent publicly available inventory data is for calendar year 2020 (EPA 2020). The baseline emissions for Jefferson County are 2,691,311.84 tons CO_{2e}.

3.6.2 Environmental Consequences

3.6.2.1 Methods and Assumptions

To evaluate air quality impacts and GHG emissions, the project alternatives were reviewed to determine the potential to cause an increase in direct or indirect emissions from fixed and mobile sources such as stationary fuel combustion, construction equipment, and employee vehicles; or a change in indirect offsite GHG emissions associated with electricity generation.

A major adverse impact to air quality or GHG emissions would occur if the project alternatives would result in emissions of criteria pollutants that would exceed relevant air quality or health standards including the NAAQS; violate any federal or state permits; or conflict with local or regional air quality management plans to attain or maintain compliance with the federal and state air quality regulations.

The CEQ's interim guidance on NEPA and climate change also directs agencies to provide estimates of the social cost of GHGs (SC-GHG) associated with agency actions. Estimates of SC-GHG provide an aggregated monetary measure (in U.S. dollars) of the net harm or benefit to society associated with an incremental metric ton of emissions output or reductions in a given year. In this way, SC-GHG estimates can help the public and federal agencies understand or contextualize the potential impacts of GHG emissions and reduction efforts. GSA used the high and low discount rates provided in the *Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances* (EPA 2023h) to estimate annual SC-GHG values for this EA. Discount rates provide a range for valuing future climate damages; higher discount rates lead to a lower SC GHG value for impacts occurring further in the future. The values provided below were calculated by multiplying the estimated carbon equivalent reduction for the project of 28,461 tons per year (Ameresco 2024a) (which would also equal the DFC's current emissions output) in metric tons per year (25,819 metric tons per year), by the estimated social cost in dollar per metric ton of carbon dioxide (EPA 2023h). The EPA report provides SG-GHG values by decade; therefore, the analysis started with the decade prior to implementation and ends with the last full decade after implementation.

3.6.2.2 Alternative A – Centralized Geothermal System with Ground-Mounted Solar Array (Centralized Alternative)

Construction of the solar PV array and the geothermal heating and cooling system under Alternative A could result in direct, minor, adverse impacts on local air quality over the short-term due to the release of fugitive dust generated by site grading and preparation within the southeast field, as well as hauling equipment and materials across campus and locally, and other construction activities. Criteria pollutant emissions would result from the use of diesel- and gas-powered construction equipment,

primarily the drill rigs that would install the geothermal wells, as well as construction workers commuting to and from the site. Additionally, temporary alterations to traffic patterns may cause congestion within the project area and cause a negligible increase in criteria pollutant emissions. Individuals living or working near the site would be most affected.

Fugitive dust emissions during construction of the proposed ECMs would comprise a large portion of air emissions, through off- and on-road vehicle movement as well as site-grading activities. PM_{10} emissions could vary depending on the nature and magnitude of construction activity and local weather conditions. $PM_{2.5}$ emissions are contingent on soil moisture, silt content of soil, wind speed, and the amount of equipment operating (Yan et al. 2023).

Construction of the solar PV array and the geothermal heating and cooling system under Alternative A would generate GHG emissions that would represent a negligible incremental contribution to global GHG emissions and climate change. Short-term GHG emissions associated with construction of Alternative A would primarily result from the use of fuel from construction equipment, worker vehicles, and delivery and refuse trucks. Such activities would cause long-term negligible impacts, as GHG emissions remain in the atmosphere for long periods of time.

Construction of Alternative A would be expected to produce a negligible amount of Volatile Organic Compound (VOC) emissions due to minimal repaving required to complete asphalt patching where the pipeline network would cross roadways and parking lots. Minimization and mitigation measures are presented in section 3.18.

Construction or installation of other ECMs would primarily occur within existing building envelopes and would not require ground disturbance.

During operation of the proposed ECMs, Alternative A would result in a minor, beneficial impact on air quality emissions over the long-term, as heating and energy use would be more efficient and from a renewable source. The reduction of grid-purchased electricity may also lower air quality emissions resulting from upstream electricity production. Increased use of LEC materials would further reduce onsite emissions. Operation of a geothermal heating and cooling system would result in little to no emissions as heating and cooling occurs as a result of the constant temperature of the shallow Earth in which the system is constructed. Geothermal heat pumps have the potential to reduce energy usage and air emissions up to 44 percent compared to air-source heat pumps and 72 percent compared to standard air-conditioning equipment (DOE 2023b). There is no planned increase in employees that would result in increased personally owned vehicle commuting emissions. Based on the project's purpose and need to use clean onsite renewable energy generation, Alternative A would support Colorado's State Implementation Plan goals to reduce CO, PM_{10}, and O_3, and other emissions.

Under Alternative A, construction and operation of the proposed project would support U.S. and State of Colorado climate change and GHG reduction goals. Over the long-term, Alternative A would have indirect, minor, beneficial effects on climate change as facilities would be more energy efficient and would produce lower GHG emissions from energy usage and energy loss. Implementation of Alternative A would result in a carbon equivalent reduction of more than 28,461 tons per year (Ameresco 2024a).

Table 9 provides estimates of annual SC-GHG values, calculated using the method described in section 3.6.1. Calculations starting in 2027 show the reduction in GHG emissions, and hence reduced SC-GHG values, from the proposed ECMs as that is the first full year of anticipated operations of the proposed ECMs. Positive dollar amounts indicate a cost to society (negative) while negative dollar amounts (in parentheses) indicate a societal benefit. The table shows that approximately five to six years after the first full year of operation, emissions reductions from the proposed ECMs would begin to provide social benefits as measured by the SC-GHG values. By the end of the first full decade after

implementation, the project is estimated to provide $54 million to nearly $144 million in social benefits just in reduced GHG emissions.

TABLE 9. SOCIAL COST OF GHG EMISSIONS UNDER PROPOSED ACTION[1]

Emission Year	Discount rate[2] 2.50%	Emissions per year[3]	SC-GHG	Cumulative SC-GHG by Decade	Discount rate[2] 1.50%	SC-GHG	Cumulative SC-GHG by Decade
2020	**$120**	25,819	$3,098,280		**$340**	$8,778,460	
2021	$122	25,819	$3,149,918		$344	$8,881,736	
2022	$124	25,819	$3,201,556		$348	$8,985,012	
2023	$126	25,819	$3,253,194		$350	$9,036,650	
2024	$128	25,819	$3,304,832		$355	$9,165,745	
2025	$130	25,819	$3,356,470		$360	$9,294,840	
2026	$132	25,819	$3,408,108		$365	$9,423,935	
2027	$134	(25,819)	($3,459,746)		$370	($9,553,030)	
2028	$136	(25,819)	($3,511,384)		$374	($9,656,306)	
2029	$138	(25,819)	($3,563,022)		$378	($9,759,582)	
2030	**$140**	(25,819)	($3,614,660)	$8,623,546	**$380**	($9,811,220)	$24,786,240
2031	$142	(25,819)	($3,666,298)		$385	($9,940,315)	
2032	$145	(25,819)	($3,743,755)	$1,213,493	$390	($10,069,410)	$4,776,515
2033	$148	(25,819)	($3,821,212)	($2,607,719)	$395	($10,198,505)	($5,421,990)
2034	$150	(25,819)	($3,872,850)		$400	($10,327,600)	
2035	$154	(25,819)	($3,976,126)		$405	($10,456,695)	
2036	$158	(25,819)	($4,079,402)		$410	($10,585,790)	
2037	$160	(25,819)	($4,131,040)		$415	($10,714,885)	
2038	$164	(25,819)	($4,234,316)		$420	($10,843,980)	
2039	$168	(25,819)	($4,337,592)		$425	($10,973,075)	
2040	**$170**	(25,819)	($4,389,230)	($54,400,633)	**$430**	($11,102,170)	($143,992,563)

[1] Numbers in ( ) indicate a reduction in emissions and/or a reduction (benefit) in SC-GHG values.
[2] Table ES.1 provides discount rate $ values for decadal years (EPA 2023h). Values in between were estimated.
[3] metric tons per year

3.6.2.3 Alternative B – Decentralized Geothermal System with Ground Mounted Solar Array (Decentralized Alternative)

Construction impacts under Alternative B would be similar to those described under Alternative A, including the SC-GHG analysis. Under Alternative B, there would be comparatively higher VOC emissions as large areas of several existing parking lots at buildings 25, 41, 56, 67, and 95 would be disturbed and would require repaving. The asphalt required for repaving the lots would emit VOCs.

Long-term, beneficial impacts resulting from the operation of proposed ECMs under Alternative B would be the same as those described under Alternative A.

3.6.2.4 Alternative C – No Action

Under the No Action Alternative, GSA would not implement the proposed ECMs at the DFC and would continue to utilize fossil-fuel-fired equipment to provide the electric and heating and cooling needs of the associated facilities. This would result in no short-term increases in air emissions from construction and vehicle movement but would result in long-term adverse impacts to air quality. The anticipated emission reductions discussed under Alternatives A and B would not occur; therefore, the SC-GHG would continue to accumulate as an adverse impact on society. By the end of 2040, the total SC-GHG adverse impact from Alternative C would be an estimated $77 million to over $207 million.

3.7 Land Use and Aesthetics

This section analyzes how the proposed project may affect land uses, existing and future, within the DFC campus and the aesthetics of the campus.

3.7.1 Affected Environment

The DFC campus is described in section 1.3 and depicted in figure 1. Bordering roadways are discussed in section 3.10, and section 3.13 overviews secure access to the site.

Land uses surrounding the campus are primarily single-family residential with a mix of commercial and light industrial uses (GSA 2008b). The Lakewood zoning ordinance classifies the DFC as a mixed use–general–urban district (City of Lakewood 2023a); however, local zoning does not apply to the DFC as it is a federal facility. Additionally, the Lakewood Comprehensive Plan classifies the DFC as office land, which is designated for activities associated with the administration and management of businesses, professional, or enterprise services (City of Lakewood 2015).

The DFC central core consists of relatively dense development. Since the 1940s, development on the campus has primarily occurred on the periphery of this central core. A handful of buildings and associated surface parking areas are located outside the central core, irregularly placed within open grassy landscapes. Most of these buildings were constructed after 1950, and many of them are taller than the buildings within the central core. A U.S. Army Reserve facility, controlled by GSA, is located within the fenced perimeter of the campus, at the site's northeastern corner (GSA 2008b). In addition, there are a few government facilities that are not controlled by GSA, including a U.S. Post Office, which is not within the fenced perimeter of the campus but is on DFC property at the southern edge of the site, near the intersection of Alameda Avenue and 7th Street.

Most of the DFC is previously disturbed land consisting of buildings, parking lots, roadways, and related infrastructure interspersed with open areas and landscaped areas. Downing Reservoir is located on the eastern edge of the campus. The southeast field of the DFC in which the solar PV array is proposed under both action alternatives consists of an open, grassy space that is bordered by McIntyre Gulch to the north and an Agricultural Ditch to the east (see section 3.4) (GSA 2008b). Two ballfields are situated along the western edge of this open field just north of the U.S. Post Office. The eastern edge of the field contains an existing solar PV array that is separated from the field by the Agricultural Ditch. Additional solar PV arrays exist just to the west of this field on building 810. There are other locations and buildings throughout the DFC with existing solar panels as well.

3.7.2 Environmental Consequences

3.7.2.1 Methods and Assumptions

Impacts on land use and aesthetics that may occur from the project were qualitatively analyzed based on current and potential future land uses.

3.7.2.2 Alternative A – Centralized Geothermal System with Ground-Mounted Solar Array (Centralized Alternative)

Under Alternative A, 27 acres of land would be disturbed for the installation of the co-located solar PV array and geothermal bore field (and associated facilities) in what is currently an open field, resulting in direct, minor, adverse impacts to onsite land use and aesthetics over the short- and long-term. The southeast field has been previously disturbed by past construction and demolition activities and remediation projects and does not currently contain any structures. The visual landscape consists of open space vegetated with grasses, a few small trees, and shrubs (see photo 2). Vegetation clearing and other construction activities would temporarily alter the visual landscape in this portion of the campus; however, disturbed areas outside of what is required for the solar PV array, pump house, and

valve houses would be revegetated following construction. Installation of the solar PV array, pump house, and valve houses would permanently alter the visual landscape of the southeast field; however, as the DFC consists of a built-up environment (including existing solar PV arrays located nearby), situated in an urban area, such development would not deviate greatly from the existing environment, resulting in minor impacts. Additional disturbance would result from the installation of the geothermal pipeline network. The pipeline network would follow existing roadways and bridges and would not contribute to long-term impacts to land use or aesthetics, although construction activities associated with its installation could contribute to short-term impacts to aesthetics.

Construction or installation of other ECMs could have direct, negligible, adverse impacts to onsite aesthetics over the short-term; however, it is likely that most of these ECMs would be installed within existing building envelopes or on existing impervious surfaces lacking vegetation or significant visual features.

Direct, minor, adverse impacts to onsite land use and aesthetics would occur over the long-term because of operations of the proposed ECMs under Alternative A. The proposed site has been previously disturbed and does not currently contain structures or sensitive vegetation; therefore, impacts to aesthetics resulting from the presence of the solar PV array would be considered minor, as discussed above. Existing solar PV arrays are present elsewhere on campus, so the addition of a new solar PV array in this location would not deviate from the existing environment. During operations, the presence of the underground bore field would not impact aesthetics.

Future land uses in the southeast field would be limited if Alternative A is implemented. Under Alternative A, what is currently open space would be converted permanently (or for the entirety of the lifecycle of the proposed ECMs) and would therefore be unavailable for use in future development projects; however, the implementation of Alternative A would have the capacity to allow future developments within the DFC to be connected to clean energy (Ameresco 2024a).

3.7.2.3 Alternative B – Decentralized Geothermal System with Ground-Mounted Solar Array (Decentralized Alternative)

Under Alternative B, 27 acres of land would be disturbed for the solar PV array and approximately 23 acres of land would be disturbed for the dispersed geothermal bore fields. Impacts from the construction of the solar PV array and the geothermal pipeline network would be the same as Alternative A. Construction of the dispersed geothermal bore field would result in direct, moderate, adverse impacts to onsite land use and aesthetics over the short-term in multiple locations throughout campus, unlike Alternative A, under which impacts would be primarily isolated to the southeast field.

Proposed geothermal bore fields serving buildings 25, 56, and 67, as well as one of the two bore fields to serve building 41 and a portion of one of the two bore fields to serve building 95 would be constructed under existing parking lots. Pavement in these areas would be removed during bore field installation, which would result in short-term parking closures. Following project completion, parking lots would be repaved, returning them to their current use. The proposed locations of bore fields serving building 95 currently contain small areas of open space containing minimal, maintained vegetation. These open spaces would be temporarily altered for the duration of construction with activities such as vegetation clearing taking place. Following project completion, maintained open spaces that were disturbed during construction would be revegetated, returning these areas to their current use. Temporary visual disturbances associated with the presence of construction equipment and fugitive dust would affect a larger number of campus users and would be seen from more locations across campus than under Alternative A, due to the dispersed layout of Alternative B. Impacts associated with the construction of other ECMs would be the same under Alternative B as under Alternative A.

Impacts resulting from operation of the proposed ECMs under Alternative B would be similar to those described under Alternative A. Visual impacts would be dispersed across the campus under Alternative B, due to the presence of the proposed valve houses. Additionally, the proposed bore fields may limit future use of these areas, as maintenance of the bore fields and the need to protect them from the presence of heavy equipment at the ground surface may preclude future development projects from utilizing the sites that currently consist of open space. Also, as discussed in the IGA, Alternative B does not have the expansion capacity as that provided under Alternative A; therefore, future land use changes (new buildings) would have a limited ability to connect to the clean energy systems (Ameresco 2024a).

3.7.2.4 Alternative C – No Action

Under the No Action Alternative, none of the proposed construction activities would occur; therefore, there would be no change to land use or aesthetics within the DFC campus. Areas of existing open space would remain available for future development or projects. Future development projects would continue to rely on fossil fuel generated electricity, heating, and cooling.

3.8 Environmental Justice

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, issued in 1994, directs federal agencies to take the appropriate and necessary steps to identify and address disproportionately high and adverse effects of federal projects on the health or environment of minority and low-income populations to the greatest extent practicable. The EO is in response to Title VI of the Civil Rights Act of 1964 which states, “No person in the U.S. shall, on the grounds of race, color, or national origin be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance.”

Additionally, EO 14096, *Revitalizing Our Nation’s Commitment to Environmental Justice for All,* issued in 2023, directs federal agencies to consider whether impacts from a proposed project on human health or the environment (including social and economic aspects) would be disproportionately high and adverse for minority, low-income, tribal, and disabled populations, and would outweigh impacts on the general population or other comparison group.

An EJ assessment requires an analysis of whether minority, low-income, tribal, and/or disabled populations (i.e., populations of concern) would be disproportionally affected by a proposed federal action. GSA’s Environmental Justice Strategy (2016) guides the agency in addressing EJ by integrating the principles of EJ into GSA’s programs and activities (GSA 2016). The GSA guidance defines a minority population as one that has a meaningfully greater minority population and/or if the minority population of the affected area exceeds 50 percent (GSA PBS 1999) (note that the term “meaningfully” applies to the site-specific context of the project area, such as total population, socioeconomic conditions, and other factors).

3.8.1 Affected Environment

The DFC is located in Census tract 9800, block group 1 (9800-01). Census block group 9800-01 consists entirely of the DFC campus and is therefore non-residential (U.S. Census Bureau 2020). As such, Census block group 9800-01 does not have a meaningfully greater minority population than Jefferson County or the State of Colorado, nor do any low-income, tribal, or disabled populations occur within its boundaries. It is possible, however, that disabled individuals may visit or work at the DFC.

The two block groups to the south of the DFC were also considered in this analysis (117.08-01 and 117.08-03) due to the potential for noise impacts on this residential area (see section 3.11). Neither block group has any identified low-income, tribal, or disabled populations. The combined minority population within the two southern block groups is just over 29 percent of the population, which is

higher than Jefferson County (23 percent) but lower than the City of Lakewood as a whole (32 percent). Based on this data it does not appear that there is a meaningfully greater minority population in the area to the south of the DFC (U.S. Census Bureau 2020).

Data from EPA's Environmental Justice Screening and Mapping Tool (tool) were also gathered, which confirmed the above results of the Census block group analysis. The purpose of the tool is to help federal agencies identify disadvantaged communities that are marginalized, underserved, and overburdened by pollution, as directed by EO 14008, *Tackling the Climate Crisis at Home and Abroad*. The tool provides socioeconomic, environmental, and climate information at Census tract level, to inform decisions that may affect disadvantaged communities. The tool indicates that the study area block groups are within the 90th to 95th percentile for ozone when compared to the U.S. and 95th to 100th percentile for toxic releases to air. The block group to the southwest of the DFC is in the 80th to 90th percentile for USTs and the block group to the southeast of the DFC is in the 80th to 90th percentile for lead-containing paint (EPA 2024a). The DFC is currently under a CDPHE Order on Consent (No. 96-04-11-01) as a result of a leaking UST. Additionally, a sitewide Order on Consent (No. 97-07-18-01) states that land-disturbing activities need to comply with DFC standard operating procedures (see section 3.9).

3.8.2 Environmental Consequences

3.8.2.1 Methods and Assumptions

As stated above, no minority, low-income, disabled, or tribal populations occur within the DFC campus; however, disabled populations may work at or visit the DFC. As a result, the EJ analysis for this project focuses on impacts to disabled populations that may visit or work at the DFC. This analysis follows the guidance in the GSA PBS NEPA Desk Guide (GSA PBS 1999).

3.8.2.2 Alternative A – Centralized Geothermal System with Ground-Mounted Solar Array (Centralized Alternative)

Under Alternative A, there would be no interruptions to public transportation or assistance services utilized by disabled visitors to the DFC, although temporary road closures within the DFC campus may result in detours during installation of the pipeline network associated with the geothermal heating and cooling system. Temporary pedestrian rerouting during construction may also be required, primarily during installation of the pipeline. Any transit and pedestrian detours would consider the location of transit bus stop locations and the availability of handicapped access routes. Because pipe installation would occur within proximity of several bus stops, the construction contractor would be required to ensure adequate measures are implemented to maintain access to and safety around all bus stops. As a result, no disabled populations would be impacted to any degree greater than any other communities utilizing the DFC. Section 3.11 indicates direct, short-term, site-specific, minor impacts on noise levels during construction of Alternative A. Noise levels would return to near existing levels after construction. No disproportionate impacts to any minority populations would occur.

Construction or installation of other ECMs would primarily occur within existing building envelopes and would be done in a manner that ensures adequate access.

No long-term disproportionate impacts would be anticipated from the construction of any of the proposed ECMs under Alternative A, as all pedestrian and transit routes would be returned to existing conditions following construction. To the extent that the implementation of ECMs would contribute to improved air quality and decreased energy and water usage onsite, Alternative A could have a positive impact on EJ populations.

No impact to any disabled populations working at or visiting the DFC would be anticipated from operation of proposed ECMs under Alternative A, as operation of the facility from a pedestrian/transit

rider perspective would remain unchanged. As stated, EPA's Environmental Justice Screening and Mapping Tool suggests that within the three block groups analyzed, disadvantaged populations would be more likely to be exposed to air quality issues (ozone or toxic releases) and other contamination (like lead-containing paint). Operation of the proposed project would help address air quality issues because the project would reduce emissions and reduce use of fossil fuels (see section 3.6). Other contamination (like lead-containing paint) would also be either remediated, if encountered, or impacts controlled to negligible impacts through proper construction procedures (section 3.9).

3.8.2.3 Alternative B – Decentralized Geothermal System with Ground-Mounted Solar Array (Decentralized Alternative)

Short-term impacts related to construction under Alternative B would be similar to those described under Alternative A. Section 3.11 indicates direct, short-term, site-specific, minor to moderate impacts on noise levels during construction of Alternative B. The implementation of Alternative B may result in a greater number of detours due to the dispersed locations of the proposed geothermal bore fields. Many of the proposed bore fields abut existing roadways, which may result in longer or more frequent closures than those anticipated due to installation of the pipeline network alone. Impacts to bus stops at Center Avenue and 5th and 6th Streets and the northern stop on 6th Street could also be impacted due to proximity to proposed bore fields. Additionally, installation of bore fields beneath existing parking lots may temporarily disrupt access to handicapped parking. All impacts associated with construction of Alternative B would be short-term, as parking lots, roadways, and pedestrian routes would be returned to existing conditions following construction. No long-term disproportionate impacts to disabled populations would occur. To the extent that the implementation of ECMs would contribute to increased air quality and decreased energy and water usage onsite, Alternative B could have a positive impact on EJ, as discussed under Alternative A.

As with Alternative A, no impact to any disabled populations working at or visiting the DFC would be anticipated from operation of proposed ECMs under Alternative B, as operation of the facility from a pedestrian/transit rider perspective would remain unchanged. Noise and contamination concerns related to potential disadvantaged communities' exposure to air and contamination issues would be the same as discussed under Alternative A.

3.8.2.4 Alternative C – No Action

The implementation of the No Action Alternative would result in no changes to the DFC and would not have a disproportionate effect on EJ communities. Under the No Action Alternative, the DFC would continue to utilize fossil-fuel-fired equipment and generated electricity, and any potential positive impacts on EJ associated with the implementation of ECMs would not occur.

3.9 Environmental Contamination and Waste Management

In 1980, Congress enacted the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLA provides authority to the federal government to respond directly to releases and threatened releases of hazardous substances that have the potential to endanger public health or the environment. The purpose of CERCLA, often referred to as Superfund, is to clean up contaminated sites so that public health and welfare are not compromised. RCRA provides for "cradle to grave" regulations of hazardous wastes. Other federal laws applicable to hazardous waste and materials include the Community Environmental Response Facilitation Act of 1992; CWA; CAA; Safe Drinking Water Act; Occupational Safety and Health Administration (OSHA); Atomic Energy Act; Toxic Substances Control Act; and Federal Insecticide, Fungicide, and Rodenticide Act.

In addition to the acts and laws mentioned above, EO 12088, *Federal Compliance and Pollution Control*, mandates that necessary actions be taken to prevent and control environmental pollution when federal activities or federal facilities are involved.

Hazardous waste in Colorado is regulated primarily under the authority of RCRA and CDPHE regulations at 6 CCR 1007-3. Other Colorado laws regarding hazardous waste are specific to handling, storage, transportation, disposal, treatment, reduction, cleanup, and emergency planning.

3.9.1 Affected Environment

Historical activities at the DFC over more than half a century have resulted in the potential for contamination of soil, sediment, surface water, and groundwater within and around portions of the DFC (GSA 2008a). The DFC is currently under two active CDPHE Orders on Consent. No. 96-04-11-01 was issued to prevent further off-site migration of contaminated groundwater and required remediation of an offsite groundwater plume associated with a formerly leaking UST (GSA 2008b). No. 97-07-18-01 requires GSA to identify and investigate the nature and extent of sitewide environmental contamination from current and past releases of hazardous substances and remediate those releases (GSA 2008b; State of Colorado 1997). Under the sitewide Order on Consent, land-disturbing activities need to comply with DFC standard operating procedures, which require the following for any land-disturbing activities:

- Site Remediation Plan (GSA 2023e)
- Excavation Dig Permit (GSA 2018)

Although human health and ecological potential contaminants of concern (PCOCs) have been established sitewide and within proposed project boundaries as described above, the EPA's Cleanup in My Community (CIMC) website shows that previous DFC cleanup activities have controlled threats related to human exposure and groundwater migration (i.e., these issues, including the leaking UST, are "controlled" and do not show any recent violations) (EPA 2024b). In addition, the site's EPA Enforcement and Compliance History Online detailed facility report states that the site has not received a RCRA violation since 2014 (GSA 2024a).

In addition, due to the age of the buildings on the DFC, it is likely that buildings may contain lead-containing paints and asbestos-containing materials.

3.9.1.1 Soils, Sediment, and Surface Waters

DFC soils may contain asphalt compounds, like polyaromatic hydrocarbons, some metals, primarily lead and arsenic, asbestos and very rarely pesticides and herbicides. With the over 1,250,000 tons of soil excavated and disposed through remediation and construction projects at the DFC, less than one percent of these soils have been contaminated. The primary contaminant in soils has been asbestos associated with historic dumping of construction waste (GSA 2024d).

3.9.1.2 Groundwater Monitoring

Groundwater monitoring began at the DFC in 1995 and continues today. Solvents have been identified in groundwater onsite at concentrations exceeding either regulatory or risk-based screening level criteria. Order on Consent No. 96-04-11-01 requires that GSA investigate and remediate the suspected onsite source of the groundwater contamination plume and implement a groundwater containment system at the eastern boundary of the DFC to prevent further offsite migration of contaminated groundwater (GSA 2008b). Yearly groundwater monitoring is ongoing, and contaminant exceedances are still present in the groundwater plume; however, according to EPA's CIMC website, groundwater migration is controlled (EPA 2024b).

3.9.2 Environmental Consequences

3.9.2.1 Methods and Assumptions

Analysis of existing conditions detailed in the 2008 *Denver Federal Center Master Site Plan Study Final EIS* (GSA 2008a), personal communications with GSA personnel, and other publicly available

data sources were used to assess the hazardous materials and waste impacts associated with the action alternatives and No Action Alternative.

3.9.2.2 Alternative A – Centralized Geothermal System with Ground-Mounted Solar Array (Centralized Alternative)

Alternative A would impact DFC soils in the southeast field and along the proposed geothermal pipeline network. Encountering contaminated soils is possible; however, the risk is low, as discussed in section 3.9.1.1.

As the groundwater contamination plume does not underlie the southeast field, the potential to contact contaminated groundwater under Alternative A would exist only during the installation of the geothermal pipeline network. As most groundwater contamination occurs at depths greater than ten feet (GSA 2023f) and pipelines would be installed at depths of six feet or shallower, there is little likelihood of encountering contaminated groundwater during pipeline installation. Additionally, as discussed in section 3.4.2.2.2, proper installation of boreholes (see also section 2.2.1) would prevent migration of contaminants into groundwater and from one aquifer to another.

Alternative A would avoid any ground-disturbing activities in areas where above ground storage tanks (ASTs) are located.

Short-term adverse impacts associated with hazardous materials and waste resulting from construction of Alternative A would be direct, site-specific, and minor. Prior to the disturbance of any building materials on or inside buildings, a hazardous material pre-alteration assessment would be required in accordance with federal and state asbestos control regulations and GSA policy. Additionally, as part of the program of requirements, the project team would perform a geotechnical study and subsurface analysis of the proposed site to determine the existence of debris and contamination. Areas of contamination and types of contaminants would be identified in proposed areas of disturbance prior to construction, allowing the project team to prepare for potential exposure and proper management. GSA would remediate areas impacted under Alternative A, if necessary. Appropriate standards for construction on the DFC (e.g., site remediation and excavation “dig” permit, etc.) would be followed. Any hazardous materials identified would be properly handled during construction. Any contaminated groundwater generated through dewatering or contaminated soil generated by soil cuttings from excavations and drilling boreholes would be properly managed in accordance with the CDPHE Order on Consent and applicable federal and state waste regulations.

During operation of the proposed ECMs under Alternative A, there would be short- and long-term, site-specific and regional, negligible, adverse impacts from hazardous materials and waste. The proposed ECMs would not include any asbestos-containing materials, lead-containing paint, or polychlorinated biphenyl-containing electrical equipment. Any encountered site contamination would have been remediated during construction. Infrastructure associated with any of the proposed ECMs would not generally be expected to contaminate subsurface resources; however, some solar PV panels do contain metals, like lead and cadmium, which are harmful to human health and the environment at high levels. The same is true for battery storage systems, which may contain heavy metals and/or acid. This would be a concern when the solar PV panels and batteries are discarded or recycled at an off-campus facility at the end of their life cycle. Impacts from disposal of the solar PVs and batteries would be long-term. Potential impacts would be site-specific and regional, as disposal would be conducted offsite, likely at the nearest appropriate disposal facility. Disposal procedures would be in accordance with EPA end-of-life requirements (EPA 2023a).

The potential impact of these materials would be mitigated through proper management and proper disposal. Potentially hazardous materials such as paints and cleaners would be used in facility maintenance activities, likely in small amounts. Impacts from materials used and generated during

facility/system maintenance would be long-term and site-specific; however, impacts would be minor as hazardous materials and waste would be managed in accordance with applicable federal, state, and local regulations.

3.9.2.3 Alternative B – Decentralized Geothermal System with Ground-Mounted Solar Array (Decentralized Alternative)

Impacts from hazardous materials and waste during construction and operation of ECMs proposed under Alternative B would be similar to those identified for Alternative A. As with Alternative A, the potential for encountering contaminated soils, while of low risk (see section 3.9.1.1), is possible in the areas of proposed geothermal bore fields and along the proposed pipeline network. The dispersed nature of the bore fields under Alternative B and the fact that they are located closer to buildings and landscaped areas where use of chemicals (pesticides, fertilizer) is more likely, may result in a slightly increased potential of encountering contaminated soils.

Also, as with Alternative A, contaminated groundwater would not likely be encountered based on the location of the contamination plumes shown in the most recent monitoring report (GSA 2023f) compared to the locations of geothermal bore fields and because the pipeline network would be constructed shallower than groundwater.

The preliminary location of an Alternative B bore field is in the area of an AST. The layout of this bore field would need to either be adjusted to ensure the AST is not affected or the AST may need to be relocated (temporarily or permanently, as appropriate).

Requirements for identifying and remediating any encountered contamination would be the same as with Alternative A. Impacts resulting from operation of the proposed ECMs under Alternative B would be the same as those discussed for Alternative A.

3.9.2.4 Alternative C – No Action

Under the No Action Alternative, current facilities and infrastructure at the existing DFC would remain essentially unchanged; therefore, negligible impacts would occur as there would be no change in risks to hazardous materials usage or waste generation. Ongoing maintenance to the DFC would continue, which would require negligible amounts of hazardous materials usage and generate negligible amounts of hazardous waste.

3.10 Transportation

This section discusses the transportation network within and surrounding the DFC, including motorized vehicle, pedestrian, and bicycle facilities and transit routes.

3.10.1 Affected Environment

The DFC is bounded by four major roadways (6th Avenue to the north, Kipling Street to the east, Alameda Avenue to the south, and Routt Street to the west). Sixth Avenue (U.S. 6) is a six-lane controlled-access freeway. Kipling Street is a four-lane arterial with a posted speed limit of 45 miles per hour (mph) and has a partial cloverleaf interchange with 6th Avenue. It is also designated as State Highway 391 and is classified as a non-rural principal highway. Alameda Avenue is a four-lane arterial with a posted speed limit of 45 mph. Routt Street is a two- to three- (center-turn-lane) lane connector with a posted speed limit of 35 mph. The majority of the street system within the DFC is two lanes with two-way traffic; however, one-way streets are present, including a portion of Center Avenue, and portions of Main, Center, and North Avenues and all of 7th Street have four lanes with two-way traffic.

The DFC has five functional access points. Two gates (1 and 2) are off Kipling Street, one gate (7) is off Alameda Avenue, and two gates (4 and 5) are off 4th Avenue at Routt Street and 2nd (Center) Avenue at Routt Street, respectively. All gates are secured entrances.

Once traffic enters the DFC, it is distributed via a network of collector and local streets. Generally, the collector streets provide four travel lanes (two lanes in each direction). The other streets are classified as local streets and are two lanes wide (one lane in each direction).

Current average annual daily traffic (AADT), hourly volumes, and volume-to-capacity (V/C) ratios on CDOT highways surrounding the DFC are shown in table 10. The hourly capacity is the total number of vehicles the highway can handle over one hour before congestion becomes noticeable. The V/C ratio is the existing hourly volume divided by the hourly capacity. A V/C ratio of 1.0 or higher indicates congestion and a roadway that is exceeding capacity. As shown in table 10, the CDOT highways surrounding the DFC have a V/C ratio under 1.0 (operating under capacity) although the referenced segment of W. 6th Avenue is approaching capacity with a V/C of 0.93.

TABLE 10: TRAFFIC STATISTICS ON CDOT HIGHWAYS.

Route Start/End	Segments	AADT (vpd)*	% Trucks	(1) Hourly Capacity	(2) V/C Ratio	(3) = (1)x(2) Existing Hourly Volume	(4) = (1) – (3) Hourly Capacity Remaining
W. 6th Avenue (006G)							
@ Sims St./Union Blvd.	278.233	96,000	2.1	12,900	0.66	8,514	4,386
@ Kipling St.	279.325	106,000	2.1	12,900	0.77	9,933	2,967
Kipling Street (391A)							
@ 6th Ave.	5.242	37,000	2.6	3,950	0.93	3,674	276
@ Alameda Ave.	4.269	38,000	2.7	4,300	0.89	3,827	473

Source: CDOT 2023a; CDOT 2023b
AADT = average annual daily traffic; vpd = vehicles per day

The DFC is directly served by a number of Regional Transportation District (RTD) bus routes and a light rail line with service directly to the Federal Center Station at the DFC. The station has 1,000 parking spaces and 18 bus bays. Fifteen bus routes serve the station. These routes consist of local, express, regional, and new feeder services. Access to the station is from both Union Boulevard and Alameda Avenue. Sixteen bus stops are located throughout the DFC, with numerous other stops located along Alameda Avenue, outside the DFC boundary (RTD 2023).

Bicycle paths are located along Kipling Street and Alameda Avenue. Routt Street includes bike lanes on each side of the travel way (City of Lakewood 2023b). The GSA Bike Share Program at the DFC is called the DFCycle program, which is a free program that allows visitors to use DFCycles that are returned to a kiosk (GSA 2024c).

3.10.2 Environmental Consequences

3.10.2.1 Methods and Assumptions

Local traffic data, site mapping, and other publicly available data were used to analyze impacts on traffic and transportation for the action alternatives and No Action Alternative.

3.10.2.2 Alternative A – Centralized Geothermal System with Ground-Mounted Solar Array (Centralized Alternative)

Under Alternative A, direct, minor, adverse impacts on traffic would occur over the short-term, during the estimated two-year construction period. Most impacts would occur within the DFC campus and not on the surrounding roadway network; however, construction impacts to the surrounding roadway network (Alameda Avenue and Kipling Street) would result from construction vehicle access (workers, supplies, drilling rigs, etc.). For construction of the solar PV array and geothermal heating and cooling system, it is anticipated that at peak, 50 to 60 construction workers would be onsite daily, with up to 12 trucks per day entering the site to carry supplies, drill rigs, and other equipment. It is anticipated

that the primary construction access would be via gate 2 at Kipling Street and Center Avenue. Table 10 shows that Kipling Street is approaching capacity (V/C ratios approaching 1.0).

It is likely that most construction workers would enter and exit the site at the same time in the morning and evening hours. Assuming 60 workers, peak, and assuming that 70 percent would drive alone, and 30 percent would carpool (two per vehicle), this could result in around 51 additional vehicles per hour on Kipling Street. As shown in table 10, hourly capacity remaining on Kipling Street is around 300 to 450 vehicles per hour. The 51 additional construction worker vehicles would not exceed this and thus would not cause an exceedance of capacity; however, drivers may experience temporary traffic delays and slowdowns during construction, especially when workers are accessing the site. Staggering construction worker arrival and departure times to off-peak hours (typically outside of the hours from 7:00 a.m. to 9:00 a.m. and 5:00 p.m. to 7:00 p.m.) could help mitigate traffic impacts.

Construction supply truck access could add another four vehicles per hour. This accounts for up to 12 trucks per day with no more than 25 percent (four) of the trucks arriving at any one time. It is unlikely trucks would arrive during the same hours as the construction workers – trucks would likely start arriving one hour after start and stop one hour prior to the end of the construction day. This could result in construction related delays, but roadways would not exceed capacity. As with construction worker access, scheduling truck deliveries for off peak hours would mitigate traffic impacts.

Construction-related impacts to DFC roadways would primarily occur during installation of the pipeline network that is proposed to run along existing roadways and through parking lots. The solar PV array would be connected to the existing GSA electrical grid via spare conduit from an existing manhole in the southeast field, and then connected to an existing switch at 5th Street and Main Avenue. No new conduit would be needed for the solar power connection. Temporary road closures would be anticipated while pipes are installed along and across roadways. Portions of parking lots may also need to be closed during piping installation and lot repaving after installation. Impacts to transit routes could occur within the DFC due to the aforementioned temporary road closures. No bus stops would be directly impacted; however, because pipe installation would occur near several bus stops, the contractor would need to ensure adequate measures are in place to ensure that stops can remain open and safe for the public. No transit routes outside of the DFC would be affected. The project does not impact Routt Street or associated bike lanes. The bike paths along Kipling Street and Alameda Avenue would not be directly impacted. No impacts to the bikeshare program would be anticipated. Because the geothermal bore field and solar PV array proposed under Alternative A would be constructed in the southeast field of the DFC, where no existing activities occur, it is anticipated that most construction would occur without noticeable impacts on traffic operations within the DFC.

Construction or installation of other ECMs would primarily occur within existing building envelopes and would not require ground disturbance.

Alternative A would not result in any long-term traffic impacts. Traffic on roadways surrounding the DFC would return to existing conditions following completion of construction. The proposed project would not result in any increase in staffing at the DFC; therefore, operation of proposed ECMs under Alternative A would not result in impacts to transportation.

3.10.2.3 Alternative B – Decentralized Geothermal System with Ground-Mounted Solar Array (Decentralized Alternative)

Short-term construction access-related impacts under Alternative B would be similar to those described under Alternative A. During construction of the Alternative B dispersed geothermal bore fields, some disruption to parking would occur as many of the fields are proposed under existing parking lots. During construction, these parking lots would be temporarily unavailable until repaving has occurred. Many of the proposed bore fields would abut existing DFC roadways; it is possible that

temporary shutdowns of those roadways would be necessary during construction to ensure safety of both construction workers and the traveling public. Temporary roadway shutdowns would impact traffic movement and could impact transit routes within the DFC. Bus stops could be temporarily impacted during bore field installation, particularly the stops at Center Avenue and 5th and 6th Streets and the northern stop on 6th Street due to their proximity to proposed bore fields. No transit routes outside of the DFC would be impacted. As with Alternative A, no bike lanes or paths would be impacted.

Impacts associated with other ECMs would be the same under Alternative B as under Alternative A. Likewise, as discussed under Alternative A, the implementation of Alternative B would not result in any long-term traffic impacts.

3.10.2.4 Alternative C – No Action

Under the No Action Alternative, current facilities at the DFC would remain and no ground disturbance from implementation of ECMs would occur; therefore, no impacts on the existing roads and traffic conditions would occur.

3.11 Noise and Vibration

The section analyzes project noise and vibration impacts.

3.11.1 Affected Environment

3.11.1.1 Noise

The human ear can hear a wide range of sound levels, and as a result, noise levels are described on a logarithmic scale and are quantified in terms of decibels (dB), a unit that is typically adjusted to dBA. dBA is the decibels on an A-weighted scale to account for the sensitivity of the human ear. Sounds at or below 70 dBA are generally considered safe (CDC 2022). The EPA and the World Health Organization (WHO) recommend maintaining environmental noises below 70 dBA over 24 hours and below 75 dBA over eight hours to prevent noise-induced hearing loss. Over two hours of continuous noise levels between 80 to 85 dBA has the potential to lead to hearing damage (CDC 2022). Table 11 presents common sounds and how they rank in human perception.

Standard buildings typically provide ten dB of noise reduction between exterior and interior noise levels with windows open, and 20 dB with windows closed (FHWA 2018). Regarding traffic noise, the change in noise level generally depends on the traffic volume, traffic speed, and number of trucks. Generally, traffic volumes would need to triple to result in a readily noticeable increase in noise (CDOT 2005).

TABLE 11. SOUND LEVELS AND HUMAN RESPONSE.

Sound Level (dBA)	Common Sounds	Effect
30	Library, soft whisper (at 15 feet)	Very quiet
40	Living room, bedroom, quiet office	Quiet
50	Light auto traffic (at 100 feet)	Moderately quiet
60	Air conditioning unit, conversational speech	Intrusive
70[a]	Freeway traffic, noisy restaurant, office	Phone use difficult
80[b]	Alarm clock (at 2 feet), hair dryer	Annoying
90	Heavy truck (at 50 feet), city traffic	Very annoying
100	Garbage truck, firecrackers	Very loud
110	Pile driver, rock concert	Extremely loud
120	Jet takeoff (at 200 feet), auto horn (at 3 feet)	Maximum vocal effort
130	Thunderclap	(not provided)
140	Carrier deck jet operation, air raid siren	Painfully loud
180	Rocket launching pad (no ear protection)	Irreversible hearing loss

Source: NPC 1997 dBA = A-weighted decibel

[a] Sounds at or below 70 dBA are generally safe but are considered intrusive (CDC 2022).

[b] Over 2 hours of continuous noise levels between 80 to 85 dBA can potentially lead to hearing damage (CDC 2022).

The Noise Control Act of 1972 (PL 92-574) directs federal agencies to comply with applicable federal, state, and local noise control regulations. In 1982, the EPA transferred the primary responsibility of regulating noise to state and local governments. Noise regulations are encoded in the City of Lakewood's municipal ordinances, under Chapter 9.52, Noise, which stipulate that construction activities are restricted on Sundays, designated holidays, and between the hours of 9:00 p.m. through 7:00 a.m. Additionally, the city has the authority to limit, prior to or subsequent to the issuance of any permit, the route for transporting materials or equipment to and from a construction site. In approving or denying such a route, the city can limit the use of streets with adjacent residential properties and request the use of arterial streets when reasonable. To request an exception to the provisions of the noise ordinance, an applicant is required to apply to the city for a temporary exemption (City of Lakewood 2023c). Additionally, Jefferson County's noise abatement policy states that construction project noise levels in residential areas shall not exceed 80 dBA between the hours of 7:00 a.m. and 7:00 p.m. and 75 dBA between the hours of 7:00 p.m. and 7:00 a.m. (Jefferson County 2007).

The OSHA noise standard (29 CFR 1910.95) establishes minimum workplace noise requirements and states that constant noise exposure must not exceed 90 dBA over an eight-hour period. The highest allowable sound level for constant exposed is 115 dBA, which must not exceed 15 minutes within an eight-hour period. The standards limit instantaneous exposure (impact noise) to 140 dBA. If noise levels are exceeded, employers must provide hearing protection equipment (OSHA 2008).

Lakewood is a relatively large, urbanized suburb of the City of Denver. Primary sources of elevated noise levels at the DFC and surrounding areas include traffic, maintenance and construction activities, and aircraft, which is typical of most urbanized areas and cities. Excessive noise can lead to harm or annoyance to receptors or result in conflict with nearby land uses. Noise-sensitive receptors include residences, schools, daycare facilities, libraries, hospitals, nursing home facilities, and public recreational areas. For the purposes of this analysis, the area of interest for noise sensitive receptors is set at 1,000 feet, as any noise associated with the project, primarily during construction, would be tolerable and safe or non-detectable beyond this distance. The boundary distance for a noise study is generally set using professional judgement and a standard of practice that typically uses between 500 to 1,000 feet with 1,000 feet more common in densely populated areas. Table 12 presents noise- and vibration-sensitive receptors within and near the DFC.

TABLE 12. NOISE- AND VIBRATION-SENSITIVE RECEPTORS NEAR/WITHIN THE DENVER FEDERAL CENTER.

Receptor Type	Receptor	General Location
Daycare	Clever Kids Learning Center	Within DFC boundary, building 64
Recreational	Bicentennial Park	Within DFC boundary, intersection of Main Avenue and 31st Street
Recreational	DFC Baseball Fields	Within DFC boundary, 7th Street
School	Fletcher Miller School	Adjacent to eastern DFC boundary
School	Creighton Middle School	Adjacent to eastern DFC boundary
School	Dennison Elementary School	Near the eastern DFC boundary
Hospital	St. Anthony Hospital	Adjacent to western DFC boundary
Residence	Residential areas	Along southern DFC boundary
Residence	Residential areas	Near the northern DFC boundary

3.11.1.2 Vibration

Vibration can lead to disturbance or structural damage to nearby facilities. Vibration can be caused by operating heavy construction machinery and ground-breaking construction activities (e.g., drilling or excavating). The effects of vibration range from feeling the floor shake and experiencing rumbling sounds to structural damage. Vibration is expressed in terms of the peak particle velocity (PPV), in inches per second, when used to evaluate human annoyance and building damage impacts. Vibration levels are highest closest to the source and dissipate with increasing distance, generally at a rate of Dref/D, where D is the distance from the source in feet, and Dref is the reference distance of 25 feet.

Other factors that affecting vibration include soil conditions and the type of equipment and vibration (i.e., continuous or transient). There are no federal standards for vibrations; however, various researchers and organizations have published guidelines, and the Department of Energy provides a published Handbook of Best Practices for Geothermal Drilling (DOE 2010). Table 13 summarizes standard thresholds commonly used to assess human perception and reaction to and effects on buildings from vibration.

TABLE 13. HUMAN RESPONSE AND DAMAGE TO BUILDINGS FROM VIBRATION.

PPV[a] (in/sec)	Human Response	Effect on Buildings
0.01	Barely Perceptible	No effect.
0.04	Distinctly Perceptible	Vibration unlikely to cause damage of any type to any structure.
0.08	Distinctly Perceptible to Strongly Perceptible	Recommended upper level of vibration to which ruins and ancient monuments should be subjected.
0.1	Strongly Perceptible	Virtually no risk of damage to normal buildings.
0.2 – 0.3	Strongly Perceptible to Severe	0.20 or 0.25 PPV are thresholds where there is a risk of damage to historic and older buildings; 0.3 PPV is threshold where there is a risk of damage to older residential dwellings (e.g., plaster or ceilings).
0.5	Severe	Threshold at which there is a risk of damage to newer residential structures.

Source: Caltrans 2020; FTA 2018 in/sec = inches per second
[a] Continuous or frequent intermittent vibration levels

For historic buildings, appropriate vibration limits vary. A conservative PPV limit of 0.1 inch per second may be used, while 0.5 inch per second or even 0.2 inches per second may be considered appropriate (Wilson Ihrig et al. 2012). For structures not designated as historic, typical PPV vibration thresholds are 0.5 inch per second for buildings structurally sound and designed to modern engineering standards and 0.3 inch per second for buildings that are found to be structurally sound but where structural damage is a major concern. For the purposes of this analysis, PPV limits of 0.1 inch per second and 0.3 inch per second are used to conservatively determine potential vibration impacts to historic structures and non-historic structures, respectively.

Humans are generally considered less sensitive to transient (impulsive) vibration, than to similar vibration from continuous (steady state) sources. For continuous vibration (e.g., vibratory compaction or pile driving), human responses usually result from the PPV limits shown in table 13. For this analysis, a PPV limit of 0.2 inch per second was for potential human response to vibration.

The DFC includes two historic buildings: the OCD and building 710 (see section 3.5). The OCD was constructed in 1961 and is primarily below ground, with several feet of earth above it and a small exposed, wood-frame structure extending from the north end of the building. The structure was built as a shelter to be used in the event of a nuclear attack (NPS 1999). Building 710, constructed in 1969, is a two-story building with the lower level completely below ground and the upper level partially below ground, with three feet of earth covering the roof. Like the OCD, building 710 was designed to withstand a nuclear attack and is mainly constructed of reinforced concrete (GSA 2024b; NPS 2000).

Various non-historic buildings also exist on the DFC campus at varying distances from the anticipated construction activities. The area of interest for vibration impacts is 400 feet from construction limits. 400 feet is approximately the distance at which vibration levels from most construction equipment would be anticipated to be well below levels that would cause an impact (FTA 2018). Vibration-sensitive receptors are identified for each action alternative in sections 3.11.2.2 and 3.11.2.3.

3.11.2 Environmental Consequences

3.11.2.1 Methods and Assumptions

To evaluate the potential impacts from noise, the project alternatives were reviewed to determine whether any activities have the potential to cause the addition of new point or line noise sources; conflict with any federal, state, or local noise ordinances; induce long-term perceptible increases in ambient noise levels above regulatory thresholds at sensitive receptors during operations; or cause excessive ground-borne vibration to persons or existing structures. Although the project would not take place within a residential area, the noise thresholds presented in the subsection above are used as reference values to evaluate noise impacts to residential properties near the DFC. A major adverse impact would occur if an alternative would result in noise levels that exceed applicable environmental noise limit guidelines or vibration levels that cause structural damage.

3.11.2.2 Alternative A – Centralized Geothermal System with Ground-Mounted Solar Array (Centralized Alternative)

3.11.2.2.1 Noise

During construction of Alternative A, direct, minor, adverse noise impacts may occur onsite and locally over the short-term. Construction activities under Alternative A would produce intermittent noise level increases from mechanized equipment (primarily drill rigs), commuter vehicles, and trucks transporting equipment, supplies, and wastes. Construction of the proposed solar PV array and geothermal heating and cooling system could begin in the fall of 2024 and last approximately two years. Construction would take place during normal business hours. Increased noise levels are expected to be greatest during earth-moving and excavation activities, when heavy machinery would be used. The specific types of construction equipment and methods utilized are anticipated to be typical of standard building construction. Table 14 presents common construction equipment and corresponding noise levels at various distances.

TABLE 14. NOISE LEVELS OF COMMON CONSTRUCTION EQUIPMENT.

Equipment	Typical Noise Levels at varying distances		
	50 feet (dBA)[a]	500 feet (dBA)	1,000 feet (dBA)
Backhoe	80	60	54
Concrete mixer	85	65	59
Dozer	85	65	59
Grader	85	65	59
Loader	80	60	54
Roller	85	65	59
Scraper	85	65	59
Truck	84	64	58
Combined	**90[b]**	**70**	**64**

a. Source: FTA 2018
b. Calculated assuming simultaneous operation of several pieces of construction equipment.

To estimate the noise level at a receptor, it was conservatively assumed that construction equipment listed in table 14 would be operating simultaneously, resulting in a combined noise level of approximately 90 dBA at 50 feet. Beyond 1,000 feet of the construction limits, construction noise levels would attenuate to levels deemed either highly tolerable and safe or non-detectable. Based on the overall construction noise level, potential noise levels during construction under Alternative A were estimated as shown in table 15.

TABLE 15. ALTERNATIVE A NOISE LEVELS AT RECEPTORS WITHIN 1,000 FEET OF CONSTRUCTION LIMITS.

Receptor Type	Noise Sensitive Receptor	Distance[a]	Noise Level[b, c]
Recreational	Bicentennial Park	500 ft	70 dBA
Recreational	DFC baseball fields	380 ft	72 dBA
Residence	Residential areas (adjacent to southern DFC boundary)	400 ft	72 dBA

dBA = A-weighted decibels; ft = feet
[a] Shortest distance between receptor and construction limit of the bore field.
[b] Based on a combined construction noise source of 90 dBA at 50 feet.
[c] Values shown represent exterior noise levels. Standard buildings typically provide approximately 10 dB of noise reduction between exterior and interior noise levels for buildings with windows open and 20 dB with windows closed (FHWA 2018).

Under Alternative A, construction noise would primarily result from the southeast field, which the three noise-sensitive receptors identified in table 15 could detect. Disturbance for users at Bicentennial Park and DFC baseball fields and some of the residential areas along the southern boundary of the DFC could occur but would be within limits deemed safe by EPA and WHO guidelines (i.e., noise levels should be below 70 dBA over 24 hours and 75 dBA over eight hours to prevent noise-induced hearing loss [CDC 2022]). Also, as shown in table 11, areas along highways and in built-up areas typically experience ambient (normal) noise levels of 70 dBA, which is comparable to the predicted construction noise levels in table 15. The residences closest to the southeast field could experience noise levels at 72 dBA outdoors, with interior noise levels at 62 dBA with windows open and 52 dBA with windows shut. These noise levels would decrease as construction at the borehole locations move further north, away from the residential areas. Construction activities would occur within the hours allowed by the City of Lakewood. Furthermore, the estimated construction noise levels would be within Jefferson County's noise limits for residential properties.

Although most noise impacts under Alternative A would result from activity within the southeast field, increased levels of noise would also result from the construction of the geothermal pipeline network, generally associated with ground excavation and truck traffic. Such impacts would be less intense than those resulting from construction in the southeast field, due to the differing types of construction activities, and because impacts would last no more than a week or two at any given point along the proposed pipeline network. The closest noise-sensitive receptors near the proposed pipeline network include a daycare center (630 feet) and Bicentennial Park (200 feet), which would experience short-term, intermittent exterior noise levels at 64 dBA and 74 dBA, respectively. Additionally, construction of the pipeline network could reach exterior noise levels around 68 dBA at some residential properties near the southwest corner of the DFC. The construction related noise levels are lower than the regulatory levels (75 dBA) set by EPA, WHO, and Jefferson County (the county has a 75 dBA maximum level for nighttime hours and 80 dBA for daytime), as discussed in section 3.11.1.1. In addition, these noise levels are not expected to differ significantly from the background traffic noise that exists in this area. Construction of the pipeline network would result in minor adverse noise impacts over the short-term.

Intermittent and temporary increases in noise levels would also occur from traffic associated with trucks and commuting construction workers. Increases in traffic noise would occur mainly during peak morning and afternoon commuting hours. Approximately 50 to 60 commuting workers and eight to 12 trucks per day are estimated during peak construction, which represent a small fraction of the existing daily vehicles on surrounding public roadways (see section 3.10); therefore, the increase in noise level would result in direct, short-term, minor, adverse noise impacts along primary transportation corridors.

Construction or installation of other ECMs would primarily occur within existing building envelopes and would require little to no ground disturbance. Use of construction equipment and an increase in activity for the duration of construction would result in direct, negligible, adverse onsite noise impacts over the short-term, like those described above. Proposed replacement of existing windows with quad pane, and the addition of supplemental panes made from LEC glass would be expected to slightly lower noise levels in affected buildings.

Potential noise impacts would be minimized to the extent practicable utilizing standard noise control measures, such as project scheduling (conducting noisy activities outside of normal work hours especially when close to buildings or when fewer workers are onsite to avoid noise exposures) and equipment noise controls (e.g., mufflers). Most activities would be consistent with normal construction activities and would be in accordance with the City of Lakewood's noise ordinance. Construction workers may experience high noise levels. OSHA regulations (i.e., wearing hearing protection and limiting exposure) would be followed to reduce the impact of noise on construction workers.

Operation of the proposed ECMs under Alternative A would not affect exterior noise levels. Interior noise levels in buildings with new windows could be reduced slightly.

3.11.2.2.2 Vibration

Adverse impacts from construction vibration may occur due to operation of heavy machinery. Primary construction activities that could result in vibration impacts include site clearing and removal, site grading and soil compaction, trenching for pipeline networks, and borehole drilling. Table 16 presents average source PPVs at varying distances for the types of construction equipment most likely to be used during construction of this project and provides reasonable estimates for a wide range of soil conditions. These values are compared to the PPV limits (section 3.11.1.2) to evaluate potential for structural damage resulting from the implementation of Alternative A, and the effects of human response from vibration.

As noted in section 3.11.1.2, PPV values potentially causing structural impacts are 0.1 inch per second for historic structures and 0.3 inch per second for non-historic structures. Vibration levels causing a human response (annoyance) are approximately 0.2 inch per second. None of the equipment shown in table 16 have PPV levels close to those numbers. A large bulldozer or a drilling operation could damage a historic building at distances of less than 25 feet from the structure. The two historic buildings on the DFC are approximately 800 feet (OCD) and 850 feet (building 710) from where drilling operations would occur. Construction activities closer to those buildings (pipeline installation) would use, at most, a small bulldozer or backhoe. No work in either historic building is anticipated. No vibration impacts would occur from construction of Alternative A.

The other proposed ECMs (e.g., new pumps, windows, etc.) would primarily be installed using hand tools that would not cause any vibration impacts.

Operation of the proposed ECMs under Alternative A would not result in vibration impacts.

TABLE 16. VIBRATION LEVELS FOR CONSTRUCTION EQUIPMENT AT VARIOUS DISTANCES FROM THE SOURCE.

Construction Equipment	PPV (inches per second) at						
	25 feet[a]	50 feet	70 feet	100 feet	150 feet	200 feet	400 feet
Large bulldozer	0.089	0.045	0.032	0.022	0.015	0.011	0.006
Caisson drilling	0.089	0.045	0.032	0.022	0.015	0.011	0.006
Loaded trucks	0.076	0.038	0.027	0.019	0.013	0.010	0.005
Small bulldozer	0.003	0.002	0.001	0.001	0.001	0.0004	0.0002

[a] Source of PPV at 25 feet: FTA 2018

[b] Estimated vibration levels are highest closest to the source and dissipate with increasing distance at a rate of Dref/D, where D is the distance from the source in feet, and Dref is the reference distance of 25 feet.

3.11.2.3 Alternative B – Decentralized Geothermal System with Ground-Mounted Solar Array (Decentralized Alternative)

3.11.2.3.1 Noise

Under Alternative B, construction-related adverse noise impacts would be similar to those discussed under Alternative A. Based on the overall noise level, potential construction noise levels under Alternative B were estimated at the noise-sensitive receptor locations within 1,000 feet of the construction limits for the closest proposed geothermal bore field and are presented in table 17. Noise impacts that differ from Alternative A are highlighted in this section.

Under Alternative B, construction noise would emanate from multiple geothermal bore fields, increasing the extent of noise impacts in comparison to Alternative A. Noise from proposed bore fields would be detected by the six noise-sensitive receptors identified in table 17 and could result in a disturbance at these locations. Outdoor noise levels at the daycare center would be 68 dBA, while indoor noise levels could reduce to 58 dBA with windows open and 48 dBA with windows closed. The residences closest to the dispersed geothermal bore fields could, during construction (primarily southwest of the DFC while the building 810 bore field is constructed), experience noise levels at 78 dBA outdoors, with interior noise levels at 68 dBA with windows open and 58 dBA with windows closed.

The estimated noise levels for the daycare center, baseball fields, Bicentennial Park, and interiors for the residential areas would be within levels deemed safe by EPA and WHO. At 78 dBA, the exterior noise levels for the residential areas near the southwest corner of the DFC could be a disturbance, though it would be temporary and within Jefferson County limits for daytime noise. The noise levels would decrease at these residences as construction at borehole locations move further north, away from the residential areas. Additionally, buildings located immediately adjacent to a proposed bore field under Alternative B could experience disturbance during work hours. As such, drilling activities would result in direct, minor to moderate, adverse noise impacts over the short-term to those receptors described.

TABLE 17. ALTERNATIVE B NOISE LEVELS AT RECEPTORS WITHIN 1,000 FEET OF CONSTRUCTION LIMITS.

Receptor Type	Noise-Sensitive Receptor	Distance[a]	Noise Level[b, c]
Daycare	Clever Kids Learning Center	600 ft	68 dBA
Recreational	DFC Baseball Fields	380 ft	72 dBA
Recreational	Bicentennial Park	270 ft	75 dBA
Residence	Residential areas (adjacent to southwest corner of DFC boundary)	200 ft	78 dBA
Hospital	St. Anthony Hospital	600 ft	68 dBA
Residence	Residential areas (near northern DFC boundary)	780 ft	66 dBA

a. The shortest distance between receptor and construction limit of closest bore field.
b. Based on a combined construction noise source of 90 dBA at 50 feet.
c. Values shown represent exterior noise levels. Standard buildings typically provide approximately 10 dB of noise reduction between exterior and interior noise levels for buildings with windows open and 20 dB with windows closed (FHWA 2018).

The level and type of noise impacts from construction of the pipeline network would be similar to those described under Alternative A but would occur in different areas due to the dispersed layout of the proposed pipeline network under Alternative B. The closest noise-sensitive receptors to a proposed pipeline include the baseball field (360 feet) and Bicentennial Park (200 feet), which would experience short-term, intermittent exterior noise levels at 69 dBA to 74 dBA, respectively. Pipeline construction would result in short-term, minor, adverse noise impacts.

Impacts associated with other ECMs included in the proposed project under both action alternatives would be the same under Alternative B as under Alternative A. Likewise, operations impacts would be the same under Alternative B as under Alternative A.

3.11.2.3.2 Vibration

Similar adverse impacts from construction vibration as discussed under Alternative A would occur under implementation of Alternative B due to operation of heavy machinery. The two historic buildings on the DFC are approximately 70 feet (OCD) and 1,110 feet (building 710) from where the closest drilling operations would occur under Alternative B. Construction activities closer to those buildings (pipeline installation) would occur using, at most, a small bulldozer/backhoe. No work in either historic building is anticipation. No vibration impacts would occur from construction of Alternative B.

Impacts associated with other ECMs included in the proposed project under both action alternatives would be the same under Alternative B as under Alternative A. Likewise, operations impacts would be the same under Alternative B as under Alternative A.

3.11.2.4 Alternative C – No Action

Under the No Action Alternative, none of the proposed construction activities would occur; therefore, there would be no change to noise levels within the DFC campus, and no adverse impacts associated with vibration.

3.12 Utilities

This section describes the potential impacts to public utilities that could result from implementing the proposed project. Utilities refer to the water and sewer, natural gas, electricity, steam, stormwater systems, and communication systems that serve the DFC campus.

3.12.1 Affected Environment

The DFC is served by the local public water utility, Denver Water. The average annual water usage at the DFC is 65,105 kilo gallons (kgal). Sewerage is provided by the City of Lakewood Utilities Department. Electrical service is provided by Xcel Energy, which serves as the transmission and distribution utility for the campus. The average electric usage annually is 41,336,052 kilowatt-hours, which serves an average annual electric demand of 93,571 kilowatts. The DFC purchases natural gas in bulk from Constellation New Energy, with additional transportation charges from Xcel Energy. The average annual gas usage at the DFC is 131,943 MMBTUs (Ameresco 2024a).

The DFC stormwater management and conveyance systems consist of several manmade channels and wetlands constructed in uplands. The Downing Reservoir, located on the east side of the DFC campus adjacent to Kipling Street, is an artificial open water feature that receives water from the Agricultural Ditch. The DFC stormwater system receives water from onsite parking lots and rooftops as well as stormwater originating in the commercially developed area west of the campus (GSA 2023b).

Other utilities, such as telecommunication lines and service lines from existing solar PV arrays, also exist throughout the DFC, both above and below ground.

3.12.2 Environmental Consequences

3.12.2.1 Methods and Assumptions

To evaluate potential impacts on utilities, project alternatives were reviewed to determine whether any activities have the potential to cause alteration of utility facility placement, disruptions to service, or increase/decrease in demand. A major adverse impact to utilities would occur if a project alternative would result in substantial damage or long-term disruption of a utility; negative effects on the local community's access to a utility; or substantial public utility system updates.

3.12.2.2 Alternative A – Centralized Geothermal System with Ground-Mounted Solar Array (Centralized Alternative)

Construction of Alternative A is expected to have direct, negligible to minor, adverse impacts to onsite utilities over the short-term.

During design of the project any utility conflicts will be identified. Conflicts with existing utilities are possible as are the need for minor relocations. During final design of the project, the design engineers will locate proposed piping in ways that avoid utility conflicts. Where conflicts are inevitable, and if relocation is necessary, a utility relocation plan would be developed. The relocation plan would consider ways to avoid onsite utility interruptions. If a service interruption at the DFC would be

required, it would be anticipated to be short-term (less than a few hours) and the affected buildings and tenants would be notified prior to any temporary shutdown. No disruption to public utilities affecting populations or the community outside of the DFC campus would be anticipated. Alternative A would have no utility impacts during operations.

3.12.2.3 Alternative B – Decentralized Geothermal System with Ground-Mounted Solar Array (Decentralized Alternative)

Construction of Alternative B is expected to have the same impacts as those described under Alternative A. Because the proposed geothermal bore fields under Alternative B are dispersed throughout the campus, there is greater potential for utility conflicts; however, the geothermal bore fields were preliminarily sited to avoid utility conflicts to the extent possible. No utility impacts would occur during operation of Alternative B.

3.12.2.4 Alternative C – No Action

Under the No Action Alternative, the proposed ECMs would not be implemented at the DFC and no construction would occur; therefore, there would be no impacts to utilities. There would be no benefits in terms of reduced energy consumption, reduction in reliance on fossil fuels, or emission benefits.

3.13 Safety and Security

This section considers how the proposed project may affect safety and security of employees and visitors to the DFC.

3.13.1 Affected Environment

The DFC has varying levels of safety and security measures depending on the agency occupant, building, and other features as summarized below.

3.13.1.1 Site Security

Currently, the DFC is a secured facility, with a perimeter fence and staffed gatehouses controlling access. The DFC is publicly accessible; however, visitors must present government-issued identification upon entering. Security is an important concern to federal tenants and the surrounding community. The security needs of federal tenants on the site are continuously analyzed and modified as needed. The DFC website includes additional information on security (GSA 2023d).

3.13.1.2 Emergency Services

St. Anthony Hospital is immediately adjacent to the DFC along Routt Street and W. 2nd Place. Several other medical facilities and hospital services exist near the campus, including Lutheran Hospital in Wheat Ridge and Denver Health in Denver, located approximately 4.5 and 7 miles away, respectively. Numerous medical offices and healthcare providers are located within the city limits of Lakewood.

Fire protection and emergency response services are adequate for existing facilities at the DFC. The DFC contracts with the West Metro Fire Protection District for firefighting and emergency response services (GSA 2008a). All emergency calls from the DFC are serviced by Station Number 3, located at 1st Street and Garrison Street in Lakewood.

Police protection within the DFC is provided by the Federal Protective Service (FPS), under the U.S. Department of Homeland Security. FPS provides 24-hour security and controlled access to the DFC. Neither the Lakewood Police Department nor the Denver Police Department patrols the DFC. The areas neighboring the DFC are policed by the Lakewood Police Department. The RTD park-n-Ride, at the Federal Center Station, is patrolled by both FPS and the Lakewood Police Department.

3.13.2 Environmental Consequences

3.13.2.1 Methods and Assumptions

GSA provided information and personal communications were used to analyze potential impacts.

3.13.2.2 Alternative A – Centralized Geothermal System with Ground-Mounted Solar Array (Centralized Alternative)

During construction of Alternative A, the contractor would require access to various parts of the DFC campus. Contractors and vendors would be required to comply with GSA security requirements, which at a minimum include having adequate government-issued identification. In addition, the general contractor would be required to ensure security of the facility during construction operations. Minor, site-specific security concerns could exist over the short-term due to the number of contractors onsite and their need to access buildings for installation of building-related ECMs (windows, HVAC, air handling systems). Following construction, security measures and access would return to existing conditions.

Some additional draw on local emergency service providers could result during construction due to the nature of construction activities and the increased potential for construction related injuries and accidents. The contractor would follow OSHA requirements regarding construction site and worker safety and security. Minor, adverse impacts on emergency service providers could be possible over the short-term due to the temporary, increased potential for injuries and accidents during construction resulting in additional calls to emergency service providers. Conditions would return to normal upon completion of construction.

No long-term safety and security or emergency service impacts are anticipated from implementation of Alternative A during operation of proposed ECMs.

3.13.2.3 Alternative B – Decentralized Geothermal System with Ground-Mounted Solar Array (Decentralized Alternative)

Short-term construction-related impacts from Alternative B would be similar to those described under Alternative A. Construction activities under Alternative B would occur throughout the entirety of the DFC, unlike Alternative A, where most construction would occur in the southeast field. Under Alternative B, construction would take place in various locations throughout the campus during installation of dispersed geothermal bore fields. This could create some additional safety and security concerns above and beyond those of Alternative A since workers would be spread throughout the campus. In addition, road closures required during construction in busier, more populated areas of the campus could create concerns related to emergency vehicle access (see section 3.10). The contractor would need to ensure traffic control measures consider emergency access. Overall, safety and security impacts would be short-term and would be anticipated to be minor. As with Alternative A, no operation impacts would be anticipated.

3.13.2.4 Alternative C – No Action

Under the No Action Alternative, no changes to the DFC would occur. No changes to existing security or emergency services would occur.

3.14 Socioeconomics

Socioeconomics refers to the attributes of the human environment, and include factors associated with population, housing, income, and economic activity. Economic activity is typically described in terms of employment, personal income, and regional industries. This section considers whether the project might impact socioeconomic attributes of the project area.

3.14.1 Affected Environment

The DFC is located within a metropolitan setting surrounded by numerous interdependent neighborhoods, employment centers, and commercial and institutional nodes. Because of these complex existing interrelationships, the socioeconomic impact of changes to the DFC is unlikely to extend far beyond its immediate geographic vicinity (GSA 2008b). The area of interest includes the City of Lakewood, which encompasses the DFC. Table 18 presents the socioeconomic data for the City of Lakewood, with data from Jefferson County included for comparison purposes.

TABLE 18. SOCIOECONOMIC DATA FOR CITY OF LAKEWOOD AND JEFFERSON COUNTY.

Demographic Indicator	City of Lakewood	Jefferson County
Total Population	156,149	580,519
Total Housing Units	71,683	248,785
Vacant Housing Units	3,572	10,413
Labor Force	91,074	335,292
Unemployment Rate	4.4%	3.9%

Sources: U.S. Census Bureau 2022a; U.S. Census Bureau 2022b; U.S. Census Bureau 2022c

The unemployment rate in the City of Lakewood is 4.4 percent, which is slightly greater than the 3.7 percent national unemployment rate. The City employs 6,958 workers in the construction industry or approximately eight percent of the employed civilian labor force (U.S. Census Bureau 2022c).

3.14.2 Environmental Consequences

3.14.2.1 Methods and Assumptions

This analysis considers aspects of the social and economic environment that are sensitive to changes and that may be adversely or beneficially affected by activities associated with each Alternative.

3.14.2.2 Alternative A – Centralized Geothermal System with Ground-Mounted Solar Array (Centralized Alternative)

Construction of Alternative A would be expected to have direct, minor, beneficial impacts on job availability and unemployment over the short-term. An estimated 50-60 workers are anticipated during peak drilling operations. Construction activities would temporarily support employment in the construction industry through the direct hiring of workers and through jobs created in supporting industries due to local construction spending on supplies and materials. The drilling industry in particular may see an increase in employment opportunities. This could provide a minor, temporary reduction in the unemployment rate. Population, housing, schools, and other public and private services would not be impacted by construction under Alternative A. Local retail stores, restaurants, and other establishments would be expected to have the capacity to serve the minor influx of construction workers during peak construction. The City of Lakewood has a rental vacancy rate of 5.1 percent, which would not be significantly impacted if construction workers were to temporarily relocate during construction and, because it is an urban area, sufficient temporary housing would be anticipated to be readily available (U.S. Census Bureau 2022b). Operation of Alternative A would not result in any significant long-term socioeconomic impacts.

3.14.2.3 Alternative B – Decentralized Geothermal System with Ground-Mounted Solar Array (Decentralized Alternative)

The anticipated impacts associated with the implementation of Alternative B would be the same as those discussed under Alternative A.

3.14.2.4 Alternative C – No Action

Under the No Action Alternative, the proposed ECMs would not be implemented at the DFC and no construction would occur; therefore, there would be no socioeconomic impacts.

3.15 Cumulative Effects

CEQ regulations require federal agencies to assess the cumulative effects of federal projects. Cumulative impacts result "from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." (40 CFR 1508.7). This section describes the cumulative impacts that the alternatives, combined with other projects at the DFC, may have on the environment.

3.15.1 Reasonably Foreseeable Future Actions

GSA identified seven reasonably foreseeable future actions, including maintenance-type actions, that would contribute to cumulative impacts in combination with the project impacts described for each resource above. These actions are:

- DFC Parking Lot Repaving Project: This project would replace failing vehicle and pedestrian bridges, replace deteriorating parking lots, curbs, culverts, and roadways, install conduit for future electric vehicle charging stations, and secure the perimeter of the DFC with a new fence. This project would improve safety, drainage and accessibility while utilizing LEC materials such as asphalt, concrete, and steel to meet GSAs carbon reduction goals.
- DFC Infrastructure Project: This project would mitigate sitewide failures of utility infrastructure at the DFC. Components of the project include:
    - domestic water, fire suppression, and sanitary sewer line repair/replacement -- replace connection piping between street/manhole and interior valve connection point;
    - drainage/storm system -- repair drainage issues to reduce flooding and convey water away from foundations;
    - roadway and pavement repairs/replacement -- repair asphalt and concrete pavement throughout the DFC including, but not limited to chip seal, crack seal, mill and overlay, full depth rehabilitation, patching, sidewalk curb and gutter replacement;
    - Architectural Barriers Act requirements, which are under the U.S. Access Board jurisdiction, will be adhered to in terms of parking lot compliance, ramp and step compliance, and fall/trip hazard repair;
    - electrical systems -- feeder replacements;
    - electrical substation security – construct a wall that visually conceals and protects the two main transformers; and
    - abatement -- soil and other hazardous material abatement as required for scope items.
- McIntyre Gulch Bank Stabilization Project: The project proposes to stabilize the actively incising stream channel by reshaping the stream and its banks to reduce channel entrenchment and halt associated soil erosion. The area along the project corridor consists of federal office buildings, undeveloped land, and roads.
- Building Demolitions at the DFC: Six buildings (buildings 6, 20, 21, 47, 74A, and 78) could be demolished to their foundation and any subgrade would be filled with native soil. The demolition of individual buildings would be subject to funding and the strategic priorities of GSA. Some of these buildings are unoccupied, underutilized, and/or contain hazardous materials such as asbestos and lead-containing paint. All environmental issues related to the building demolitions would be addressed in compliance with state and federal law.

- Improvements to the Aqueduct Carrying the Agricultural Ditch Over McIntyre Gulch: The aqueduct is located off the northwest corner of the southeast field just south of Main Avenue. The Agricultural Ditch Company would complete repair or possible replacement of the structure. Effects from this project would be localized at the site of the existing aqueduct and would be limited to potential impacts to McIntrye Gulch and the Agricultural Ditch. Because the structure is existing and would either be repaired or replaced in kind, no long-term impacts including to geology, water resources or the floodplain, would be anticipated.
- Construction of Proposed New FDA Lab: This proposed facility would be located along the west side of 2nd Street to the north of Main Avenue. This site is a previously disturbed area located between a parking lot and 2nd Street that contains a few shrubs and minimal vegetation. Long term impacts would only be anticipated to the minimal vegetation present in this area. Other impacts would be construction related and temporary.
- Operations and Maintenance Activities at the DFC: Regular maintenance activities at the DFC would continue, which may result in negligible ground disturbance. These activities would include, but are not limited to, repair and alteration projects as needed, procurement contracts for professional services and supplies, and real property inspections for compliance needs.

3.15.2 Cumulative Effects Analysis

The DFC and surrounding areas consist primarily of previously disturbed, currently developed land. Periodic, past, and ongoing actions on and adjacent to campus include routine maintenance and minor development of local roadways and nearby facilities, including the St. Anthony Hospital, schools and daycare centers, hotels, and restaurants. Past and ongoing, minor development projects would not be expected to have resulted in long-term impacts that have persisted to present day on any resources analyzed in this EA.

The proposed project would not be completed at the same time as most of the reasonably foreseeable future actions listed in section 3.15.1, other than possibly the aqueduct and the FDA Lab. As a result, short-term, construction-related impacts resulting from the proposed project would resolve prior to the remaining foreseeable projects being implemented, and impacts would not be cumulative. The construction schedules for the aqueduct and FDA Lab are not known and are currently speculative at best. If the aqueduct and FDA Lab projects were constructed concurrently with the proposed project there would be the potential for short-term cumulative construction-related impacts (noise, traffic, air pollution); however, these impacts would resolve after construction was completed and there would be no long-term cumulative effects. Long-term adverse cumulative effects occur only for those resources with the potential to experience long-term adverse effects from the project, as detailed in Table 19. As noted, short-term impacts are not discussed in table 19 as short-term impacts are those that resolve once construction is completed and thereby cannot be cumulative.

TABLE 19. CUMULATIVE EFFECTS.

Resource	Cumulative Effects of Alternatives A or B
Geology	The proposed project is anticipated to have a minor long-term effect on geology; however, it is unlikely that the identified reasonably foreseeable projects would impact site geology long-term, other than possibly the FDA Lab foundation, which would be anticipated to have a negligible effect onsite geology. A negligible adverse cumulative effect would result.
Wildlife	The proposed project could result in negligible to minor adverse impacts on local wildlife due to concerns regarding the potential for solar PV arrays to adversely affect migratory bird populations. The identified reasonably foreseeable projects could have a temporary impact on wildlife during construction but conditions would return to near normal after construction and no long-term impacts would occur; therefore, no cumulative effect is possible.

Resource	Cumulative Effects of Alternatives A or B
Vegetation	The proposed project would result in negligible adverse impacts to onsite vegetation over the long-term. Due to the nature of most of the reasonably foreseeable projects, which do not involve new above ground infrastructure (other than the FDA Lab), Most disturbed areas would be revegetated following construction. Although the McIntyre Gulch Bank Stabilization Project would permanently alter the stream channel, overall vegetation cover would likely remain the same post-construction, and the resulting stabilized channel would decrease the risk of erosion, which would provide a beneficial impact to adjacent vegetation. The area where the FDA Lab would be constructed is already devoid of most vegetation as just a few shrubs and some scrubby vegetated areas exist. Cumulatively there would be a loss of vegetated areas from the DFC campus. The cumulative effect would be negligible to minor.
Air Quality and GHG	The proposed project would result in long-term, negligible adverse GHG impacts and minor, beneficial effects on air quality, GHGs and climate change. The reasonably foreseeable projects would have a negligible, adverse impact on GHGs during the long-term due to construction emissions, which remain in the atmosphere for long periods of time (section 3.6.2.2). It is anticipated that the FDA Lab would be connected to the proposed geothermal and solar panel systems, as the proposed system would have additional capacity, especially under Alternative A, to service the new building. The Alternative A overall system layout has more future load handling ability than any of the individual bore field locations proposed under Alternative B (Ameresco 2024). Under Alternative B, an entirely new geothermal bore field and related infrastructure would likely need to be constructed for the FDA Lab. The FDA Lab would also be designed and constructed to meet GSAs sustainability and energy efficiency requirements. The air quality benefits of the project would offset the construction related long-term GHG adverse effects; therefore, it is anticipated that a cumulative minor beneficial effect would result. [Note that Alternative C would have a long-term, cumulative effect on GHGs and climate change as the No Action Alternative would continue use of fossil fuel generated electricity and emissions would not be reduced].
Land Use and Aesthetics	The proposed project would be anticipated to have minor, adverse impacts to onsite land use and aesthetics over the long-term. The proposed reasonably foreseeable projects, other than the FDA Lab, would not have any adverse effects on land use or aesthetics. While the FDA Lab project would result in a new building on the DFC campus, the building demolition project could remove six existing buildings, thus offsetting the effect of adding one new building in an area that is already part of the built-up environment. A negligible to minor adverse cumulative effect on both land use and aesthetics at the DFC would be anticipated.
Environmental Contamination and Waste Management	The proposed project would have a long-term negligible effect on wastes due to the eventual need to dispose of solar panels. The reasonably foreseeable projects would not be expected to change waste management at the DFC other than a possible negligible increase in wastes from the new FDA Lab. The resultant cumulative effect would be negligible.

3.16 Unavoidable Adverse Environmental Effects

Impacts from the action alternatives on the environment have been described in detail in the previous individual resource sections of this chapter. Table 20 provides a summary of unavoidable adverse environmental effects of the project (only adverse impacts). Alternative C would result in a long-term adverse impact to air quality and would not help address state and federal emission reduction goals.

TABLE 20. UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS.

Resource	Unavoidable Adverse Impact
Geology and Soils	Direct, site-specific, minor (long-term) to moderate (short-term) on geology and short-term, minor impact on soils.
Wildlife and Habitat	Direct, short- and long-term, site-specific, negligible to minor on wildlife and habitat.

Resource	Unavoidable Adverse Impact
Vegetation and Invasive Species	Direct, short- and long-term, site-specific, negligible.
Water Resources	Direct, short-term, negligible to minor localized on surface waters, wetlands, and groundwaters.
Air Quality and GHG	Direct, short-term, site-specific, negligible to minor on air quality and long-term, negligible GHG impacts.
Land Use and Aesthetics	Direct, short- and long-term, site-specific, minor to moderate. Slightly more potential to impact land use and aesthetics under Alternative B due to the dispersed layout of the geothermal bore fields.
Environmental Contamination and Waste Management	Direct, short- and long-term, site-specific and regional, negligible to minor. Slightly more potential to impact contaminated areas under Alternative B due to the dispersed layout of the geothermal bore fields.
Transportation	Direct, short-term, site-specific, minor. Slightly more potential to impact traffic within the DFC under Alternative B due to the dispersed layout of the geothermal bore fields.
Noise and Vibration	Direct, short-term, site-specific and local, minor on noise under Alternative A. Slightly more potential to cause noise impacts to DFC tenants under Alternative B due to the dispersed layout of the geothermal bore fields. Minor to moderate noise impacts would be anticipated under Alternative B. No vibration impacts.
Utilities	Direct, short-term, site-specific, negligible to minor. Slightly more potential to impact utilities under Alternative B due to the dispersed layout of the geothermal bore fields.
Safety and Security	Direct, short-term, site-specific, minor onsite security impact. Slightly more potential to impact site security under Alternative B due to the dispersed layout of the geothermal bore fields (construction activities/personnel in more locations). Direct, short-term, site-specific, minor impact on emergency services.

3.17 Irreversible and Irretrievable Commitments of Resources

A commitment of electricity, construction materials, and workforce labor would be required to complete construction; however, irretrievable commitments of these resources may be minimized through conservation and sustainability practices, such as the diversion of up to 50 percent of materials from the landfill. In addition, it is anticipated that the action alternatives would ultimately require less energy through sustainable building practices.

3.18 Summary of Mitigation Measures

Table 21 provides a summary of the mitigation measures associated with the project.

TABLE 21. SUMMARY OF MITIGATION MEASURES DURING CONSTRUCTION.

Resource	Mitigation Measures during Construction
Geology and Soils	• apply water to exposed soils and revegetating exposed areas immediately following construction using native seed mixes and plants • prepare a detailed SWPPP in accordance with required NPDES permit • implement an approved Erosion Control Plan • grout boreholes, top to bottom • design proposed ECMs to meet seismic safety standards
Wildlife and Habitat	• during final design of the project consideration will be given to ways to reduce glare (panel types, panel tilt, or other available measures)
Vegetation and Invasive Species	• eradicate non-native invasive species in disturbed areas, where possible • revegetate with native seed mixes and plants • construction equipment will be washed, where possible, before entering or leaving the site to avoid transfer of non-native or invasive species to other areas
Water Resources	• implement stormwater controls and BMPs

Resource	Mitigation Measures during Construction
	• implement a detailed SWPPP and approved Erosion Control Plan • revegetate disturbed areas following construction where possible • only permit construction access from existing roadways and bridges (no instream work; no work in wetlands) • grout boreholes, top to bottom • space boreholes a minimum of 19 feet apart to minimize the potential for well damage resulting from the use of heavy equipment at the ground surface • direct construction activities such that heavy equipment does not drive over installed geothermal wells • piping to be hermitically sealed, and pressure tested prior to use • isolate any encountered shallow groundwater to avoid mixing with drinking water aquifers
Cultural Resources	• if previously unidentified cultural resources are discovered during construction, the GSA Region 8 Regional Historic Preservation Officer/COSHPO would be contacted for evaluation
Air Quality and GHG	• use water for dust control when grading roads or clearing land • promptly remove spilled or tracked dirt or other materials from paved streets • minimize the use and number of trips of heavy equipment • maintain and tune all engines per manufacturer specifications to perform at EPA certification levels, where applicable, and to perform at verified standards applicable to retrofit technologies • encourage use of energy and fuel-efficient fleets and best available control technology • conduct periodic, unscheduled inspections to limit unnecessary idling and to ensure that construction equipment is properly maintained tuned and, maintained consistent with established specifications • recycle construction debris to the maximum extent feasible • reduce construction related trips of workers and equipment, including trucks
Land Use and Aesthetics	• revegetate disturbed areas or otherwise return them to pre-construction conditions, where possible
EJ	• when implementing temporary transit and pedestrian rerouting consider the location of transit bus stop locations and the availability of handicapped access routes to minimize impact to disabled individuals working at or visiting the DFC • return parking lots, roadways, and pedestrian routes to existing conditions following construction • limit disturbance that limits access to handicapped parking • implement Architectural Barriers Act-accessible pedestrian detours, where necessary
Environmental Contamination and Waste Management	• conduct a hazardous material pre-alteration assessment prior to the disturbance of any building materials on or inside buildings, in accordance with federal and state asbestos control regulations and GSA policy • conduct a geotechnical study and subsurface analysis of the site to determine the existence of debris and hazardous materials • comply with GSA standard operating procedures related to site remediation and excavation ‘dig’ permits • remediate any encountered contamination in accordance with the CDPHE Orders on Consent and all other applicable federal and state regulations • maintain and adhere to existing spill prevention and response plans • adhere to proper management and disposal requirements
Transportation	• consider staggering of construction personnel and supplier/truck arrival and departure times to avoid peak traffic hours • ensure that adequate measures are in place to prevent bus stop closures and to ensure that access to bus stops remains safe for the public • implement Architectural Barriers Act-compliant pedestrian detours where needed • implement traffic detours where needed, with consideration for emergency service access

Resource	Mitigation Measures during Construction
Noise and Vibration	• utilize standards noise control measures, such as noise controls on equipment, and scheduling construction activities in such a way that minimizes noise disturbance during business hours • ensure properly fitted and functioning mufflers on construction equipment
Utilities	• if utility relocation is necessary, develop an approved utility relocation plan • in the event of temporary utility interruptions, affected buildings/tenants would be notified in advance • minimize temporary interruptions
Safety and Security	• install signs, barriers, and traffic cones to direct vehicles and pedestrians, as needed, in accordance with approved pedestrian and traffic control plans • ensure access for emergency vehicles at all times • require contractors and vendors to present government-issued identification when arriving at the DFC • the general contractor would be responsible for ensuring facility security during construction operations
Socioeconomics	• none – no adverse impacts on socioeconomics are anticipated

4.0 CONSULTATION AND COORDINATION

4.1 Scoping and Public Involvement

4.1.1 Scoping

Scoping is an early and open process for determining the scope of issues to be addressed and for identifying potential significant issues related to a proposed action. Internal scoping began with GSA staff identifying the purpose and need for the project, defining the proposed action, determining the environmental issues potentially required for detailed analysis, and confirming the appropriate NEPA pathway. External scoping began when the public and all interested stakeholders were notified about the proposed action and comments on the project and potential environmental issues were solicited. External scoping began on November 3, 2023, and concluded on December 4, 2023. For this project, external scoping included the following outreach:

- Press Release – A press release was published in the Denver Post with project information, the virtual public meeting details, the public comment period, and the web address for the project on the GSA Region 8 website.
- Interested Stakeholder Scoping – Letters describing the project and ways to submit comments were sent to potentially interested stakeholders.
- Virtual Public and Stakeholder Meeting – GSA held a virtual scoping meeting on November 15, 2023, at 6 p.m. Mountain Standard Time. The meeting, conducted via Zoom, included a 20-minute presentation followed by an opportunity for questions and answers. No attendees asked questions and the meeting adjourned at 6:30 p.m. A recording of the presentation was placed on the DFC website at: https://www.gsa.gov/dfc-environmental-assessment. One substantive comment from CDOT was received, requesting information on any potential impacts to state-owned highways.

4.1.2 Public Review of Draft EA

Public comments on the draft EA will be solicited for 30 days beginning on March 6, 2024, and ending on April 5, 2024. A public meeting is anticipated in March 2024. Public notification of the draft EA availability, comment period, and public meeting will be distributed through the Denver Post. Hard copies of the EA will be placed in the Jefferson County Library – Belmar and Jefferson locations.

4.2 Federal Agencies

USFWS correspondence, dated November 14, 2023, concurred that the project would have no effect on any federally listed candidate, proposed, threatened, or endangered species. The USFWS stated that formal consultation is thus not necessary (USFWS 2023a).

GSA sent an email correspondence to USACE on December 20, 2023, requesting clarification on whether consultation would be required for this project. A meeting was held on January 18, 2024 between USACE and GSA that resulted in USACE requesting construction drawings for the project. USACE noted that a jurisdictional determination may not be needed since one was done previously in the project area. In lieu of a jurisdictional determination, a pre-construction notification could be submitted that documents the purpose and need and the alternatives analysis, along with identifying any wetland or stream impacts. USACE stated that if pipelines are installed below or above the surface of the stream, no permit would be required. Coordination with USACE is ongoing. GSA continues to consult with USACE, as necessary, to comply with the CWA.

4.3 State Agencies

CDOT commented during the public scoping period that it would need to be notified of any state highway impacts. Impacts to transportation are discussed in section 3.10.

In a letter to the COSHPO dated November 2, 2023, GSA stated that both action alternatives would avoid adverse effects to the OCD and building 710. In a concurrence letter dated November 20, 2023, the COSHPO stated, “We concur that neither alternative will directly impact the two National Register-listed properties. Potential visual effects to the properties may occur, but the ultimate impact cannot be known until the size and placement of the proposed infrastructure is further examined and shaped.” As documented in this EA, no visual impacts are anticipated.

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6.0 LIST OF PREPARERS

Name	Title
GSA	
Demi Chavez	Region 8 Director, Portfolio Management and Customer Engagement
Ann Marie Sushinsky	Region 8 Portfolio Business Center Manager
James Richards	Region 8 Portfolio Officer
Derrick W. Rosenbach, AICP	Region 8 NEPA Program Manager
Andrea Collins	Region 8 Historic Preservation Officer
Lisa Wild	Senior Project Manager
Lisa Haskins	Supervisory Program Management Specialist
Clay Weiland	Project Manager
Tyler Cooper	Mechanical Engineer
Michelle Hotaling	Inflation Reduction Act Project Execution Manager
Stephen Smith	DFC Asset Manager
National Renewable Energy Laboratory	
Aaron Levine	Senior Legal and Regulatory Analyst
Consultants (PHE)	
Fred Carey, PE	President
Dawn Schilling, PE, AICP	Associate Principal/Senior Project Manager
Virginia Boone	Environmental Scientist
Erin Kouvousis	Senior Environmental Scientist
Cynthia Ong	Environmental Consultant – Staff Analyst
Stephen Kuch	GIS Specialist
Diego Santaella	Environmental Scientist
Katelyn Kopp	Environmental Scientist
Lukas Lightcap	Environmental Analyst
Designer (Ameresco)	
Matt Gagnon, PE, CEM	Senior Project Engineer
Jared Smith	Project Development, Federal Solutions

APPENDIX A

CONSULTATION AND COORDINATION DOCUMENTATION

USFWS CORRESPONDENCE

November 2, 2023

Sent by e-mail to: craig_hansen@fws.gov

Craig Hansen
Eastern Colorado Ecological Services Field Office
U.S. Fish and Wildlife Service
134 Union Blvd
Lakewood, CO 80228

RE: Technical Assistance Request for the Denver Federal Center Energy Conservation Measures Project / Environmental Assessment

Dear Craig Hansen,

The U.S. General Services Administration (GSA), Rocky Mountain Region, is preparing an environmental assessment (EA) for the proposed Energy Conservation Measures (ECMs) Project at the Denver Federal Center (DFC) in compliance with the National Environmental Policy Act (NEPA) and other applicable laws and regulations. The DFC is located along U.S. Route 6 in Lakewood, Colorado, approximately eight (8) miles west of downtown Denver in Jefferson County (figure 1). The EA will examine the impacts on environmental and other resources from the potential implementation of ECMs such as geothermal heat pumps and a solar photovoltaic (PV) array to provide year-round electric and heating and cooling and replace most fossil-fuel-fired equipment on campus.

The purpose of this letter is to provide the U.S. Fish and Wildlife Service (USFWS) with sufficient detail on the proposed project, determine the extent to which the project may affect threatened, endangered, sensitive, and candidate species or any associated critical habitat, and to request technical assistance from your office.

Project Background

The purpose of the proposed project is to decarbonize and electrify the DFC utilizing clean on-site renewable energy generation and electrification solutions. The proposed project is needed to meet the objectives of GSA's National Deep Energy Retrofit Program by cutting grid purchased energy use by approximately 75 percent and water use by approximately 29 percent across the DFC. This project would also allow GSA to reduce its carbon footprint and to become less dependent on nonrenewable energy sources.

In addition to a no-action alternative, GSA has identified two potential action alternatives that would meet the purpose of, and need for, the project. These alternatives are discussed in more detail below.

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Conceptual Alternatives

NEPA requires GSA to present a reasonable range of alternatives to the proposed agency action—including an analysis of any negative environmental impacts of not implementing the proposed agency action (in the case of a no-action alternative)—that are technically and economically feasible. These alternatives for the proposed project currently include:

- **Alternative A**: Centralized Geothermal System with Ground-Mounted Solar PV Array (figure 2);
- **Alternative B**: Decentralized Geothermal System with Ground-Mounted Solar PV Array (figure 3); and
- **Alternative C**: No-Action.

Alternative A: Centralized Geothermal System with Ground-Mounted Solar PV Array would construct one geothermal bore field co-located with a ground-mounted solar PV array, while *Alternative B: Decentralized Geothermal System with Ground-Mounted Solar PV Array* would disperse the geothermal bore fields across the DFC to minimize the piping distance to the buildings being supported by the system. Both alternatives would install the solar PV array in the southeast quadrant of the DFC. Key elements of these alternatives include:

1. The geothermal system would involve the utilization of closed-loop ground source heat pumps. These systems circulate a water and propylene glycol solution through a high-density polyethylene (HDPE) tubing that is buried in the ground.
2. The HDPE piping would be hermitically sealed per American Society for Testing and Materials (ASTM) standards (ASTM D2610, ASTM D2683) and manufacturer's specifications. A bentonite-based grout plug would be used to case the boreholes from the bottom of the boreholes to the top.
3. The HDPE piping would be pressure tested before and after installation and be filled with potable water from the DFC's existing domestic water system. The system does not extract, or come in to contact with, ground- or surface water.
4. Installation of a 11.3MWAC – 13.9MWDC ground-mounted solar PV array in the southeast quadrant of the DFC.
5. The solar PV array would likely consist of Hanwah 585W Bifacial modules installed onto a fixed tilt ground-mounted system.

Species Effects Analysis

In addition to NEPA, the alternatives to be analyzed in the EA must comply with Section 7 of the Endangered Species Act (ESA). The USFWS' Information, Planning, and Consultation (IPaC) tool was reviewed for the potential occurrence of federally protected species and critical habitat at the DFC (official species report enclosed).[1]

[1] U.S. Fish and Wildlife Service. "Information, Planning, and Consultation Tool: DFC Energy Conservation Measures Project/EA, Jefferson County, Colorado," 2023. October 23. https://ipac.ecosphere.fws.gov/.

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The IPaC tool recognized the potential occurrence of several protected species, including the gray wolf (*Canis lupus*). A court order on February 10, 2022, listed gray wolves as endangered in the contiguous 48 states under the ESA.[2] At the request of the State of Colorado, USFWS is also proposing to establish a nonessential experimental population (NEP) of the gray wolf in the state. Establishment of this NEP would provide for allowable, legal, purposeful, and incidental taking of the gray wolf within a defined NEP area while concurrently providing for the conservation of the species.[3]

The IPaC tool did not identify any critical habitat for these species within the project area. GSA has made preliminary effect determinations for each identified species based on existing site conditions:

Common Name	Latin Binomial	Listing Status	Habitat[4]	Preliminary Effect Determination
Gray Wolf	*Canis lupus*	Endangered	This species has a wide range of habitat, including temperate forests, mountains, tundra, taiga, and grasslands.	**No effect**. Colorado Parks and Wildlife cannot provide a specific population number for wolves in Colorado. In 2020, six congregating wolves were identified in northern Moffat County. In 2021, an established mating pair producing a litter of six pups were confirmed in Jackson County.[5] No known breeding or non-breeding populations occur on the DFC.
Piping Plover	*Charadrius melodus*	Threatened	This species largely utilizes coastal habitats such as sand spits and sandbars and forages primarily on	**No effect**. Nesting areas on six reservoirs in Bent and Kiowa counties have been observed, but these sites have not contributed significantly to the

[2] U.S. Fish and Wildlife Service. "2022 Gray Wolf Questions and Answers," 2022. June 1. https://www.fws.gov/media/2022-gray-wolf-questions-and-answers.

[3] U.S. Fish and Wildlife Service. "Establishment of a Nonessential Experimental Population of the Gray Wolf in Colorado; Proposed Rule," 2023. February 17. https://www.fws.gov/species-publication-action/establishment-nonessential-experimental-population-gray-wolf-colorado

[4] U.S. Fish and Wildlife Service. "Environmental Conservation Online System," 2023. June 1. https://ecos.fws.gov/.

[5] Colorado Parks and Wildlife. "Wolves in Colorado FAQ," 2023. October 27. https://cpw.state.co.us/learn/Pages/Wolves-in-Colorado-FAQ.aspx.

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			mud flats and in ephemeral pools.	population; predation and water level fluctuations limit reproductive success.[6] No known habitat or breeding or non-breeding populations occur on the DFC.
Whooping Crane	*Grus americana*	Endangered	This species utilizes coastal marshes, estuaries, inland marshes, lakes, ponds, shallow bays, and salt marshes. Other known habitat includes upland swales, wet meadows, rivers, pastures, and agricultural fields.	**No effect**. According to Colorado Parks and Wildlife, whooping cranes have not been seen in Colorado since 2010.[7] No known breeding or non-breeding populations occur on the DFC.
Pallid Sturgeon	*Scaphirhynchus albus*	Endangered	This species inhabits large, deep turbid river channels, usually in strong current over firm sand or gravel.	**No effect**. Pallid sturgeons do not occur in Colorado, and water depletions in the North Platte, South Platte, and Laramie river basins may affect these species where they occur in Nebraska.[8] No known habitat or breeding or non-breeding populations occur on the DFC.
Monarch Butterfly	*Danaus plexippus*	Candidate	This species lives in fields, naturally open areas, wet areas, and urban gardens where milkweed and flowering plants are	**May effect, not likely to adversely affect.** The majority of the project area consists of urban development, with open areas containing native

[6] U.S. Fish and Wildlife Service. "Piping Plover," 2023. October 27. https://www.fws.gov/species/piping-plover-charadrius-melodus
[7] Colorado Parks and Wildlife. "Whooping Crane," 2023. October 27. https://cpw.state.co.us/learn/Pages/SpeciesProfiles.aspx?species=whooping
[8] U.S. Fish and Wildlife Service. "Featured Species," 2023. October 27. https://www.fws.gov/office/colorado-ecological-services-field-office/species

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			present. This species migrates in winter to the oyamel fir trees of central Mexico.	grasses such as buffalo grass (*Buchloe dactyloides*) and blue grama (*Bouteloua gracilis*). Non-native smooth brome (*Bromus inermis*), crested wheatgrass (*Agropyron cristatum*), cutleaf teasel (*Dipsacus laciniatus*), and great mullein (*Verbascum thapsusare*) are also widely dispersed. Milkweeds (*Asclepias* spp.), which serve as host plants to monarch caterpillars, may be found in a variety of habitats, including disturbed areas and roadsides in Colorado. Showy milkweed (*Asclepias speciosa*) has been documented in riparian areas of the DFC.[9] If milkweed plants are observed within the proposed project area, they would be avoided or transplanted outside of the proposed project area to the extent practicable.
Ute Ladies'-tresses	*Spiranthes diluvialis*	Threatened	This species occurs in moist meadows associated with perennial stream terraces, floodplains, and oxbows.	**No Effect.** The Ute ladies'-tresses orchid is supported primarily in riparian areas; these areas are present in the southern portion of the DFC. However, the

[9] U.S. General Services Administration. "Denver Federal Center Master Plan / EIS," 2008. January 1. https://www.gsa.gov/about-us/regions/region-8-rocky-mountain/buildings-and-facilities/colorado/denver-federal-center/denver-federal-center-master-plan

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				riparian areas do not exhibit the terraced topography and subsurface hydrology preferred by the species[9]. The proposed project would largely avoid the riparian areas. Surveys to confirm the absence of Ute ladies'-tresses orchid would be conducted prior to construction if riparian areas would be disturbed.
Western Prairie Fringed Orchid	*Platanthera praeclara*	Threatened	This species occurs in moist tallgrass prairies and sedge meadows and is well-adapted to survive fires.	**No effect**. The species occurs in Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and Oklahoma. Upstream depletions to the Platte River system in Colorado and Wyoming may affect the species in Nebraska.[10] No known habitat or populations occur on the DFC.

Eleven migratory species also have the potential to occur at or near the DFC (unofficial species report enclosed). With the possible exception of the bald eagle (*Haliaeetus leucocephalus*) and golden eagle (*Aquila chrysaetos*), each have a low probability of presence in the project area. Few available nesting sites exist in the project area beyond the various plains cottonwood (*Populus deltoides monilifera*) that are dispersed along McIntyre Gulch.[11]

According to the USFWS National Wetland Inventory (NWI) and a *Wetlands and Aquatic Resources Delineation Report for the DFC* (2023, enclosed), wetlands do occur on the DFC. The closest mapped features to the project area are McIntyre Gulch, an unnamed tributary, and an agricultural ditch. Downing Reservoir and stormwater facilities also occur on the DFC. Consultation and coordination with the US Army Corps of Engineers is ongoing for any potential impacts to these water resources.

[10] U.S. Fish and Wildlife Service. "Western prairie fringed Orchid," 2023. October 27. https://ecos.fws.gov/ecp/species/1669

[11] U.S. Fish and Wildlife Service. "Information, Planning, and Consultation Tool: DFC Energy Conservation Measures Project/EA, Jefferson County, Colorado," 2023. October 23. https://ipac.ecosphere.fws.gov/.

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Technical Assistance Request

We would greatly appreciate your technical assistance identifying any additional resources that could be affected by the proposed project and your input on our preliminary effect determinations. Should you have any immediate questions or concerns, please contact me directly by phone at **(720) 648-7187** or by email at **derrick.rosenbach@gsa.gov**.

GSA will also host a virtual public and stakeholder scoping meeting for the proposed project on **November 15, 2023**, from **6:00 pm to 7:30 pm MST** via Zoom. Your office is encouraged to attend and participate in this meeting. Please follow this hyperlink to access the meeting: https://us06web.zoom.us/j/89074789834

Sincerely,

Derrick W. Rosenbach, AICP
Regional NEPA Program Manager
GSA | Public Buildings Service | Region 8
Portfolio Management & Customer Engagement Division

Attachments:
Figure 1. DFC Project Area
Figure 2. Alternative A: Centralized Geothermal System with Ground-Mounted Solar PV Array
Figure 3. Alternative B: Decentralized Geothermal System with Ground-Mounted Solar PV Array

Enclosed:
Official USFWS IPaC Report
Unofficial USFWS IPaC Report (contains list of migratory birds)
Wetland and Aquatic Resources Report for the DFC (2023)

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ATTACHMENTS

Figure 1. DFC Project Area

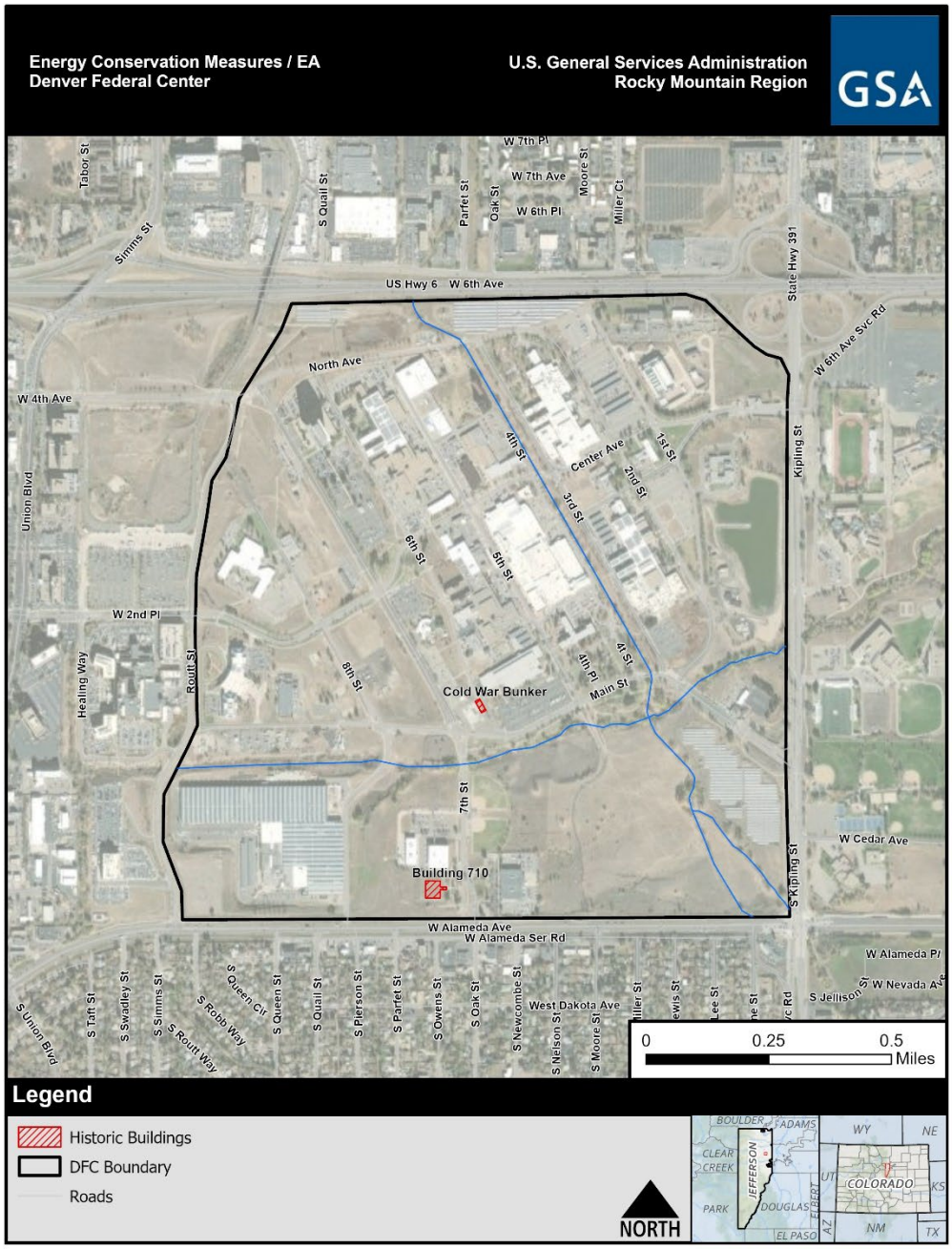

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Figure 2. Alternative A: Centralized Geothermal System with Ground-Mounted Solar PV Array

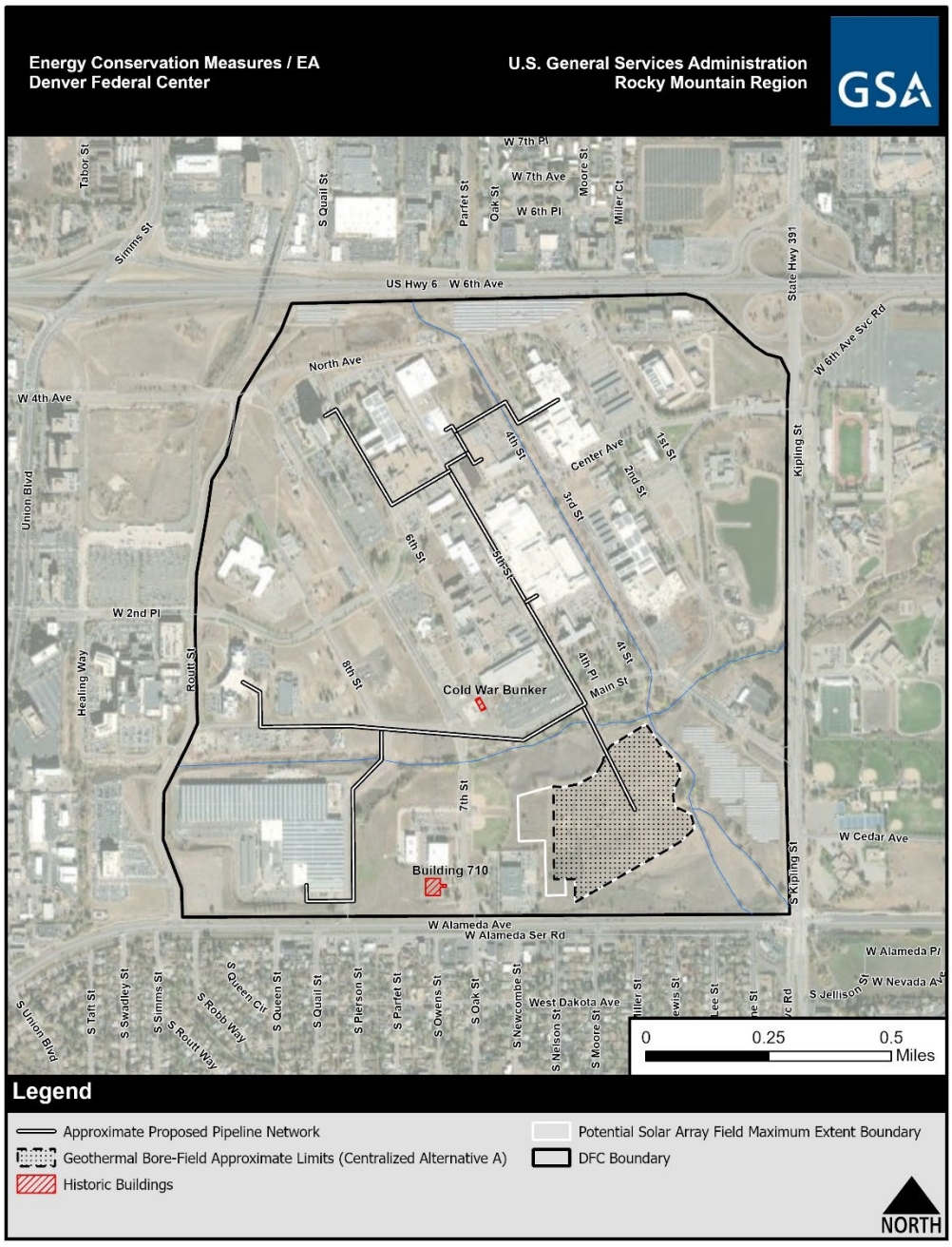

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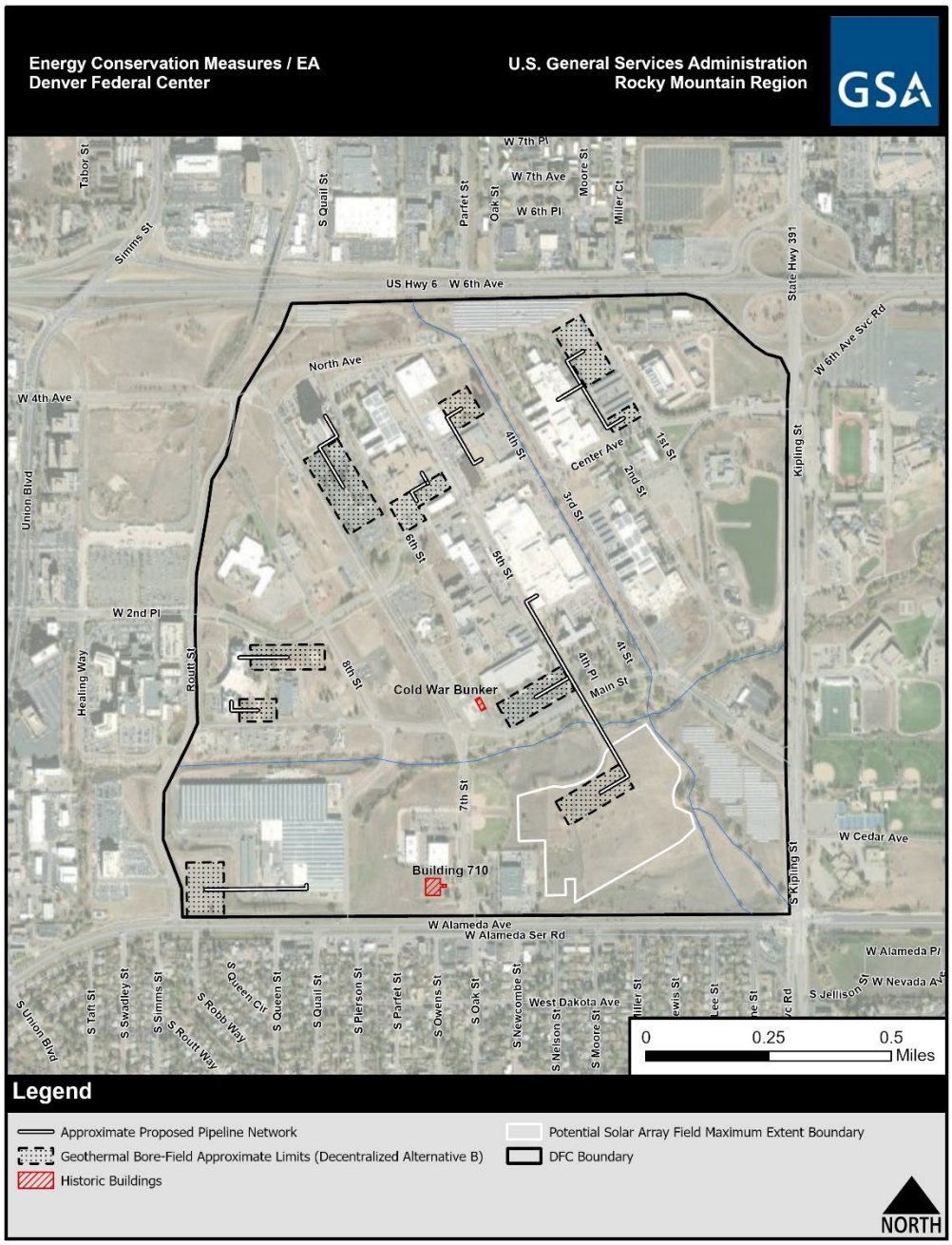
Figure 3. Alternative B: Decentralized Geothermal System with Ground-Mounted Solar PV Array



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From: Derrick Rosenbach – 8PTBB
To: Fwd: DFC ECMs EA: Technical Assistance Request
Subject: Tuesday, November 14, 2023 5:02:20 PM
Date:

Hello Team,

Please find the US Fish and Wildlife Service's response to our technical assistance request below. They have concurred that there would be no effect on species listed under the Endangered Species Act and no further consultation is necessary.

Thank you,

---------- Forwarded message ---------
From: **ColoradoES, FW6**
Date: Tue, Nov 14, 2023 at 2:54 PM
Subject: Re: [EXTERNAL] DFC ECMs EA: Technical Assistance Request
To: Derrick Rosenbach - 8PTBB

Hi Derrick,

Yes, the Service concurs with the effect determinations and formal consultation is not necessary.

Sincerely,
Emily Berchem

U.S. Fish and Wildlife Service
Colorado Ecological Services Field Office
134 Union Blvd.
Lakewood, CO 80228

USACE CORRESPONDENCE

To: Ellison.A.Koonce@usace.army.mil
Cc: William Fieselman - 8PSD-C; Tyler Cooper - 8PMBA
Subject: DFC ECMs Project / Environmental Assessment: Pre-Application Consultation
Date: Wednesday, December 20, 2023 4:09:57 PM
Attachments: 20231220_v2_DFC_ECMs_PreApp_Consultation_USACE.pdf
McIntyre Gulch Wetland Delineation Report (2023-10-06).pdf

Dear Ellison Koonce,

The U.S. General Services Administration (GSA), Rocky Mountain Region, is preparing an environmental assessment (EA) for the proposed Energy Conservation Measures (ECMs) Project at the Denver Federal Center (DFC) in compliance with the National Environmental Policy Act (NEPA) and other applicable laws and regulations. The DFC is located along U.S. Route 6 in Lakewood, Colorado, approximately eight (8) miles west of downtown Denver in Jefferson County. The EA will examine the impacts on environmental and other resources from the potential implementation of ECMs such as geothermal heat pumps and a solar photovoltaic array to provide year-round heating and cooling, electricity, and to replace most fossil-fuel-fired equipment on campus.

The purpose of the **attached** letter is to provide the U.S. Army Corps of Engineers (USACE) with sufficient detail on the proposed project, determine the extent to which the project may affect wetlands and other waters at the DFC, and to request consultation from your office.

Recently, we submitted a jurisdictional determination request under USACE project # NWO-2023-01830-DEN. That request appended a *Wetland and Aquatic Resources Delineation Report for the DFC,* which also has been included in this e-mail. The report may be useful during review of our letter pertaining to the aforementioned project.

We would greatly appreciate your technical assistance identifying any additional resources that could be affected by the proposed project and your recommendations for applicable permitting. Should you have any immediate questions or concerns, please contact me directly by phone at (720) 648-7187 or by email at derrick.rosenbach@gsa.gov.

Sincerely,

U.S. General Services Administration

Derrick W. Rosenbach, AICP

Regional NEPA Program Manager

GSA | Public Buildings Service | Region 8

Portfolio Management & Customer Engagement Division
One Denver Federal Center
P.O. Box 25546 | Building 41
Lakewood, CO 80225

Mobile: (720) 648-7187

From: Holland, Ronetta G CIV USARMY CENWO (USA)

Sent: Monday, December 4, 2023 9:51 AM
To: Hickey, Pat M.
Cc: Koonce, Ellison A CIV USARMY CENWO (USA)

Subject: [EXTERNAL] NWO-2023-01830-DEN (Denver Federal Center (JD))

Dear Dave William and Patrick Hickey:

This email is to inform you that we received your email or letter request on 3 December 2023. Your request has been given the above file number and will be reviewed by Ellison Koonce of this office. Please reference the above file number in any correspondence regarding this project.

Sincerely,

Ms. Ronetta G Holland

Office Automation Assistant

CENWO-ODR-CO

9307 S Wadsworth Blvd

Littleton CO 80128

Office #: 720-922-3843

Mobile #: 720-284-9037

The Denver Regulatory Office is now accepting digital submittals! Effective immediately, please submit new requests in digital form to DenverRegulatoryMailbox@usace.army.mil for initial in-processing. (NOTE: Emails including attachments cannot exceed 40Mb). Further information and instructions regarding submitting requests electronically can be found at: https://www.nwo.usace.army.mil/Missions/Regulatory-Program/Colorado/

U.S. General Services Administration

Denver Federal Center (DFC)
Energy Conservation Measures
Environmental Assessment

Meeting with U.S. Army Corps of Engineers
Denver Regulatory Office

January 18, 2024

11:00 AM MST
Held on Google Meet

ATTENDEES

Meeting Participants	
Name	**Organization**
Derrick Rosenbach	GSA
Tyler Cooper	GSA
Frank Campagna	GSA
Clay Weiland	GSA
Bill Fieselman	GSA
Ellison Koonce	USACE

INTRODUCTIONS

DISCUSSION

After introductions, GSA stated that the agency received funding to help decarbonize and electrify the Denver Federal Center (DFC), located in Lakewood, Colorado. This would involve the installation of a geothermal heating and cooling system and a solar photovoltaic (PV) system, among other energy-efficient measures. GSA also noted that the DFC already has several solar PV arrays on campus—both ground mounted and rooftop. The new systems would help GSA meet the objectives of Executive Order 14057 and other strategic goals of the agency.

GSA stated that they are currently drafting an environmental assessment for the proposed improvements at the DFC and are currently considering three alternatives. The first would be to not pursue the project and most buildings at the DFC would continue to use fossil-fuel powered equipment. The other two alternatives include a centralized geothermal system or a decentralized geothermal system. Under both of those alternatives, the solar PV array would be located in the southeast quadrant of the DFC. The centralized geothermal system would be located beneath the solar PV array while the decentralized geothermal system would consist of individual bore-fields adjacent to each building being heated and cooled to reduce pumping losses.

GSA mentioned that the centralized alternative could cross McIntyre Gulch in two locations and an agricultural ditch in one location for a total of three stream crossings. The decentralized alternative would only cross McIntyre Gulch in one location—near the southeast quadrant.

USACE mentioned that a pre-application consultation, as stated in Mr. Rosenbach's e-mail, is more involved and this project appears to be well under the limits to initiate that process. However, there could be cases where GSA would need to go through that process based on the final design of the project. Since GSA already has a preliminary plan/layout for construction, and more importantly, there has already been jurisdictional determinations (JD) made in the past for the project area, it might be possible to forego a new JD.

Another option would be to submit a pre-construction notification (PCN). This would require an analysis of the alternatives and purpose and need for the project. The PCN would also need to identify the specific impacts to wetlands and streams. Mitigation is required for any impacts to wetlands greater than a tenth of an acre. Since impacts may be minimal, a nationwide permit (e.g., NWP 51. Land Based Renewable Energy Generation Facilities) could be a good pathway.

USACE inquired if GSA intended to route the geothermal pipelines through the streambed. GSA stated that the tentative plan is to attach the pipelines to existing infrastructure such as a bridge that cross McIntyre Gulch near the southeast quadrant. They also noted that they are only at the 50 percent *Investment Grade Audit* stage of the project and still need to determine if directional boring would be a requirement at the stream crossings.

USACE stated that they would need relatively complete engineering drawings regarding the type of boring or stream crossing being considered. The drawings do not need to be design deliverables since schematics also work. If GSA could provide a schematic and the type of definitive crossing to be utilized, USACE can make a determination on whether further consultation would be necessary and if a permit is required. If the pipelines are installed below or above the surface of the stream, no permit may be needed.

COSHPO CORRESPONDENCE

November 2, 2023

Mr. Mark Tobias
Section 106 Compliance Manager
Colorado State Historic Preservation Officer
1200 Broadway
Denver, Colorado 80203

Re: Denver Federal Center Energy Conservation Measures Project / Environmental Assessment

Dear Mr. Tobias:

The U.S. General Services Administration (GSA) is writing to inform the Colorado State Historic Preservation Office (COSHPO) of a potential undertaking at the Denver Federal Center (DFC) in Lakewood, Colorado, that would introduce a Geothermal Heating and Cooling System and a new Ground-Mounted Solar Photovoltaic (PV) System to the site as part of the implementation of an Energy Conservation Measures (ECMs) project. Funded through the Inflation Reduction Act (IRA) of 2022, the landmark United States federal law aimed at investing in domestic energy production while promoting clean energy, the goal at the DFC is to achieve a net zero campus by 2045, utilizing a variety of sustainability technologies and funding strategies to cut energy consumption and greenhouse gas emissions while reducing costs.

As part of the ongoing planning process for this effort, and in accordance with Section 106 of the National Historic Preservation Act (NHPA), GSA is taking into consideration the two National Register of Historic Places listed properties on the campus, the Office of Civil Defense Emergency Operations Center (OCD) and Building 710. Additionally, given the borings necessary to install the geothermal system that would provide heating and cooling to DFC facilities, determining an appropriate archeology oversight and monitoring scope is also a priority consideration. In accordance with 36 CFR §800.3., GSA is informing the COSHPO of this effort and inviting your office to participate in Section 106 consultation, recognizing that GSA remains in a planning phase and a final undertaking has yet to be defined. It is GSA's intent to conduct the Section 106 consultation process concurrently in alignment with development of the NEPA Environmental Assessment.

Office of Civil Defense Emergency Operations Center
The Office of Civil Defense Emergency Operations Center (OCD) was built in 1961 and listed in the National Register of Historic Places in 1999 for its association with the Cold War and was constructed as a temporary structure until a more permanent bunker (Building 710) could be completed. The OCD is a Quonset style bunker partially buried underground and was intended to provide protection in the event of a nuclear attack. As a temporary structure, the building was not intended for permanent occupancy or use and GSA, in consultation with your office in 2016, and in accordance with Section 110 of the NHPA, successfully stabilized and mothballed the property. Additionally, and also working with the COSHPO, GSA installed substantial and permanent interpretative signage alongside the OCD to educate employees and visitors to the DFC of its historic significance.

Building 710
Building 710 is an underground bunker designed to withstand a nuclear blast. Constructed by the Army Corps of Engineers and completed in 1969, Building 710 was a base for federal operations expected to be performed by the Defense Civil

Preparedness Agency (DCPA) in the event of a nuclear attack. On August 2, 2000, the concrete and steel structure, largely concealed below an earthen berm, was listed in the National Register of Historic Places for its association with the Cold War, how its design and construction reflect this era, as well as its continuous national preparedness and response function. It is now occupied by the Federal Emergency Management Agency (FEMA), successor to the DCPA.

Primary Goal of ECMs
The primary goal of the proposed project is to decarbonize and electrify the DFC campus as much as possible, utilizing clean on-site renewable energy generation and electrification solutions. To achieve this goal, GSA's contractor for the project has proposed 13.9 megawatts (MW) of ground-mounted solar photovoltaic (PV) systems as well as 67.9 million British Thermal Units (MMBtu)/hour of geothermal energy to provide year-round electric heating and cooling and replace fossil fuel-fired equipment. The ECMs at the DFC would generate taxpayer value in realizing the objectives of GSA's National Deep Energy Retrofit (NDER) Program, cutting grid-purchased energy use by approximately 75 percent and water use by approximately 29 percent. The ECMs would also modernize infrastructure on the DFC, reduce lifecycle operating costs, and mitigate risk associated with future fossil-fuel price volatility.

National Environmental Policy Act of 1969
In accordance with the National Environmental Policy Act (NEPA), GSA will prepare an Environmental Assessment (EA) to analyze and disclose potential environmental impacts of the proposed development and any alternatives, including analysis of a no-action alternative. NEPA was created to ensure federal agencies consider the environmental impact of their actions and decisions and, to that end, will hold its first virtual public scoping meeting on Wednesday, November 15th from 6:00 pm to 7:30 pm MST via Zoom. Please follow this hyperlink to access the meeting: https://us06web.zoom.us/j/89074789834

With this letter, GSA is inviting the COSHPO to attend the NEPA virtual public scoping meeting to learn more about the project and to see the level of consideration being given to the OCD and Building 710 resources to ensure a no adverse effect determination. The current schedule anticipates the EA would be completed by June of 2024 and construction groundbreaking in October 2024 with a two-year duration.

Key Energy Priorities
This project would also address other key energy and sustainability priorities including compliance with the Council on Environmental Quality's *Guiding Principles for Sustainable Federal Buildings*. In total, the proposal identifies 88 energy efficiency and renewable energy opportunities recommended for implementation at the DFC including geothermal heating and cooling with dedicated heat-recovery chillers, solar PV, battery energy storage systems, new building automation systems and controls strategies, exhaust air heat recovery, and transformer replacements. These proposed ECMs provide tangible facility improvements and recurring reductions in utility costs.

- *Geothermal Heating and Cooling System*
  The geothermal system would involve the utilization of closed-loop ground source heat pumps (GSHP). These systems circulate a water and propylene glycol solution through a high-density plastic-type (HDPE) tubing that is buried in the ground. The HDPE piping would be pressure tested before and after installation and be filled with potable water from the DFC's existing domestic water system. The geothermal system does not extract, or come in to contact with, ground- or surface water. The borings for the closed-loop GSHP would be done by a state-certified and licensed driller in accordance with Colorado Department of Natural Resources, Division of Water Resources, State Engineer's Office geothermal well regulations (2 Colorado Code of Regulations [CCR]-402-10), as well as

International Ground Source Heat Pump Association (IGSHPA) and National Ground Water Association (NGWA) guidelines. Typical closed-loop GSHP systems consist of 6-inch vertical or horizontal boreholes. Manifolds would connect the loops to the heat pumps. A heat exchanger would then transfer the heat between the refrigerant in the heat pump and the propylene glycol solution in the tubing.

- *Ground-Mounted Solar PV System*
  GSA would also install between 8-12MW of new solar PV to the campus as part of this project. To achieve this, GSA's contractor proposes to install a 11.3MWAC – 13.9MWDC ground-mounted solar project on the site identified as Gate 7 on the south side of the site—at the corner of W. Alameda Avenue and Kipling Street. The solar PV array would consist of Hanwah 585W Bifacial solar modules installed onto a fixed tilt mounting system. The tilt would be 25 degrees facing due south. Up to 27 acres of already cleared land would be utilized.

In addition to a No Action Alternative, GSA has identified two potential action alternatives for consideration as part of the NEPA process. These alternatives, which will be presented in detail at the November 15th virtual public scoping meeting include: (1) a Centralized Geothermal System with Ground-Mounted Solar Array (Alternative A: Centralized Alternative), and (2) a Decentralized Geothermal System with Ground-Mounted Solar Array (Alternative B: Decentralized Alternative). The ground-mounted solar array would be in the southeast quadrant of the DFC under each alternative. Key features of each alternative are provided below.

- *Alternative A: Centralized Alternative*
  For the Centralized Alternative, one geothermal bore field would be co-located with the ground-mounted solar PV array as presented in Figure 2 and described above. The piping network would be located through a screening process to avoid sensitive areas while minimizing piping distances to the buildings and related heat and pumping losses. Disturbance to existing parking lots and roads would occur while constructing the connecting pipeline network and during repaving. Figure 2 presents a conceptual layout of this alternative.

- *Alternative B: Decentralized Alternative*
  The Decentralized Alternative would utilize multiple bore fields. The bore fields would be strategically located to minimize piping distance to the buildings that they would support, minimizing heat and pumping losses. Bore fields would be sited in areas identified through a screening process in order to avoid sensitive areas and could be placed under existing parking lots, which would require demolition and repaving. The solar PV array would be placed in the location presented in Figure 3. As presented in Figure 3, this alternative includes separate geothermal bore-fields.

The DFC was constructed beginning in the 1940s and relies heavily on energy purchased from outside sources and generated from carbon-heavy methods. This project would allow GSA to upgrade the facility to reduce the carbon-footprint and to become less dependent on nonrenewable energy sources. Both the Centralized and Decentralized alternatives would avoid adverse effects to the OCD and Building 710 by keeping clear the boundaries of each property from ground and construction disturbance resulting from: bore fields, the placement of PV panels, construction, and staging area placement, and to any and all vibration that could potentially occur from neighboring work. Both resources, and including the interpretive signage for the

OCD bunker, would be protected by construction fencing during any activity within proximity to the resource(s). See Figure 1 for an Overview Map of the DFC and location of the two National Register Listed properties.

Given that the OCD bunker is not occupied, or functioning, heating and cooling would not be supplied. No connection to Building 710 will be made with this project. Building 710 will continue to utilize existing heating and cooling systems already in place.

In addition to the November 15th NEPA virtual public scoping meeting, GSA would like to schedule a meeting with your office to review this undertaking in detail. GSA would be pleased to host the meeting at the DFC so that representatives from the COSHPO can tour the site and the GSA project team can answer any questions you may have about proposals being set forth and the ongoing planning process. This visit will give us the opportunity to discuss archeological issues and GSA's proposal for monitoring and carrying forth in compliance with Section 106.

As stated above, GSA is committed to achieving a no adverse effect determination for this undertaking, working in consultation with the COSHPO and others to direct this exciting and critical project through to completion exceeding Section 106 consultation compliance considerations and expectations. We look forward to continuing our planning process in partnership with your office.

If you have any questions or would like to talk more about the upcoming scoping meeting, please give me a call at 303.726.2118. I look forward to seeing you and/or your representatives at the scoping meeting and hopefully meeting you on site at the DFC in the coming weeks.

Sincerely,

Andrea Collins
GSA Regional Historic Preservation Officer

ELECTRONIC COPY TO:
Alexis Moore, City of Lakewood, Planning/Historic Preservation Commission
Beth L. Savage, GSA Federal Preservation Officer
Derrick W. Rosenbach, AICP, GSA Region 8 NEPA Program Manager

Attachments redacted - see figures 1, 3, and 4 in the main body of the EA

History Colorado

20 November 2023 HC #83773

Andrea Collins
Regional Historic Preservation Officer
U.S. General Services Administration
Building 41, Room 240
Denver, CO 80225

RE: Proposed Energy Conservation Measures, Denver Federal Center, Lakewood, Jefferson County

Dear M. Collins:

Thank you for your recent correspondence received 2 November 2023, concerning a proposal to install a Geothermal HCS and a Ground-Mounted PVS at the Denver Federal Center in support of an Energy Conservation Measures project. Our office has reviewed the submitted materials. The Denver Federal Center (5JF.1048) is eligible for listing on the National Register of Historic Places. In addition, the DFC contains Building 710 (5JF.1048.14) and the Emergency Operations Center (5JF.1048.13), which contribute to the significance of the DFC and are also each listed individually on the National Register of Historic Places.

GSA has identified two possible alternatives for this undertaking. One places most of the system infrastructure in the southeast portion of the Federal Center, occupying a large open area. The other alternative spreads the geothermal infrastructure across the Federal Center but concentrates the ground-level solar arrays in the same southeastern location. Both alternatives will require some ground disturbance in the form of a network of piping between infrastructure and DFC buildings.

We concur that neither alternative will directly impact the two National Register-listed properties. Potential visual effects to the properties may occur, but the ultimate impact cannot be known until the size and placement of the proposed infrastructure is further examined and shaped. We look forward to working with GSA as the project moves forward under both NEPA and NHPA.

If you have any questions, please contact Joseph Saldibar, Architectural Services Manager, at (303) 866-3741.

Sincerely,

Dawn DiPrince
State Historic Preservation Officer