Department of Commerce Boulder Laboratories

Campus Master Plan Final Environmental Assessment

June 2017

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Campus Master Plan
Final Environmental Assessment

June 2017

National Institute of Standards and Technology
Boulder, Colorado

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Abstract:

The Department of Commerce (DoC) has developed a 20-year Master Plan for the DoC Boulder Laboratories Campus located in Boulder, Colorado. The need for the Master Plan, and the campus improvements prescribed therein, is driven by both institutional policy and the inability of existing facilities and infrastructure to support current and projected mission requirements at the DoC Boulder Laboratories Campus.

Two alternatives were considered in detail in the Environmental Assessment. The Proposed Action would implement the DoC Boulder Laboratories Master Plan to guide the physical development of the campus to advance the agency's mission-related goals over the next 20 years. The Master Plan emphasizes quality and collaborative research in addition to sustainable and efficient operations. The Master Plan addresses current campus needs and delineates future development through phasing packages. When and if funding becomes available, DoC would execute new construction, additions, renovation, demolition, landscape improvements, utility improvements, and circulation improvements under the Master Plan. The No-Action Alternative would continue current DoC operations and would not implement the Master Plan. The No-Action Alternative would ultimately result in a site that would no longer support the advanced research requirements of DoC and would render much of the campus obsolete. DoC's preferred alternative is the Proposed Action alternative.

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Abbreviations, Acronyms, and Symbols

ACHP	Advisory Council on Historic Preservation
APEN	Air Pollution Emission Notice
BCC	Boulder Computing Center
BCCP	Boulder County Comprehensive Plan
BGEPA	Bald and Golden Eagle Protection Act
BHP	Boiler horsepower
BMP	Best management practice
BSHED	Boulder Safety, Health, and Environment Division
BVCP	Boulder Valley Comprehensive Plan
CAA	Clean Air Act
CCF	Central Computing Facility
CDPHE	Colorado Department of Public Health and Environment
CDR	Construction, demolition, and renovation
CO	Carbon monoxide
CSA	Combined Statistical Area
CTL	Communications Technology Laboratory
CUP	Central Utility Plant
CWA	Clean Water Act
dBA	A-weighted decibel
DoC	Department of Commerce
EA	Environmental Assessment
EAB	Emerald ash borer
EISA	Energy Independence and Security Act
EO	Executive Order
ES	Equipment structure
ESA	Endangered Species Act
ESC	Erosion and sediment control
FY	Fiscal year
GCR	General Conformity Rule
GHG	Greenhouse Gas
GSA	General Services Administration
GSF	Gross square feet
hp	Horsepower
HVAC	Heating, ventilation, and air conditioning
IDA	International Dark Sky Association
IES	Illuminating Engineering Society
ITL	Information Technology Laboratory
kW	Kilowatts
LEED	Leadership in Energy and Environmental Design
LID	Low Impact Development
MBTA	Migratory Bird Treaty Act
MML	Material Measurement Laboratory
MOA	Memorandum of Agreement
MS4	Municipal Separate Storm Sewer System
N/A	Not applicable/not available
NAAQS	National Ambient Air Quality Standards
NdD	Nederland
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NIST	National Institute of Standards and Technology
NO2	Nitrogen dioxide
NOx	Nitrogen oxides
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NTIA	National Telecommunications and Information Administration
NWI	National Wetlands Inventory
O3	Ozone
OAHP	Office of Archaeology and Historic Preservation
OFPM	Office of Facilities and Property Management
OSHA	Occupational Safety and Health Administration
OSMP	City of Boulder Open Space and Mountain Parks Department
PACE	Partners for a Clean Environment
Pb	Lead
PCBs	Polychlorinated biphenyls
PEVs	Plug-in Electric Vehicles
PM	Particulate matter
PML	Physical Measurement Laboratory
POV	Privately owned vehicle
Pph	Pounds of steam per hour
PSCo	Public Service Company of Colorado
PV	Photovoltaic
RCRA	Resource Conservation and Recovery Act

RHA	Rivers and Harbors Act
RL-1	Low Density Residential
RTD	Regional Transportation District
SDWA	Safe Drinking Water Act
SF	Square feet
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SO_2	Sulfur dioxide
SSPP	Strategic Sustainability Performance Plan
Super IGA	Boulder County Countywide Coordinated Development Plan
SWAP	State Wildlife Action Plan
SWMP	Stormwater Management Plan
Te	Terrance Escarpments
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
VOC	Volatile organic compound
WQCV	Water Quality Capture Volume

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1 Executive Summary

Background

The 206-acre Department of Commerce (DoC) Boulder Laboratories Campus, located in Boulder, Colorado, is home to research programs of the National Institute of Standards and Technology (NIST), the National Oceanic and Atmospheric Administration (NOAA), and the National Telecommunications and Information Administration (NTIA). A total of 1,761 research scientists, engineers, administrators, and support personnel work in 34 buildings and structures at the campus, of which 29 are occupied buildings. The campus is situated within a strikingly beautiful setting with Kohler Mesa and the Flatirons as a backdrop to the buildings and landscape. The entrance and buildings are oriented toward the east, bordering on Broadway (Colorado State Highway 93). The remainder of the property is surrounded by residential development and recreational land, with a cemetery bordering the campus at the north. The land gently rises toward the west, culminating in a steep rise to Kohler Mesa at the western end of the property. Two ephemeral water bodies transect the site: Skunk Creek and Anderson Ditch, an irrigation channel. Much of the property is designated *Open Space*, protected from development under a Memorandum of Agreement with the City of Boulder together with an association of Native American tribes.

Purpose and Need for Action

The Master Plan analyzed in this Environmental Assessment (EA) reflects DoC's vision for the physical development of the campus and for a flexible strategy for implementation. DoC is ever evolving and needs flexible, integrative, and collaborative support spaces to effectively promote scientific research. The overall purpose of the Master Plan analyzed in this EA is to guide fulfillment of the following objectives:

- Create a comprehensive and coordinated framework for physical development of the campus;
- Develop appropriate facilities and infrastructure for the evolving and advancing scientific research;
- Respect the campus location, historic context, and agreements with the local community and Native American tribes;
- Encourage collaboration and interaction among the laboratories and researchers, with welcoming facilities and staff amenities;
- Accommodate interchange with the public and outside colleagues, using both conference facilities and technology;
- Create an attractive campus, respecting both the science and the staff;
- Promote good stewardship of the natural environment, and support and advance the sustainable design goals of DoC, the General Services Administration (GSA), NIST, and NOAA; and
- Develop a plan for gradual change, that is complete at each step.

The need for the Master Plan, and the campus improvements prescribed therein, is driven by both institutional policy and the inability of existing facilities and infrastructure to support current and projected mission requirements. DoC requires that its agencies have a physical master plan for their sites, reflecting both the anticipated special needs of the user groups and the impact of its activities on the surrounding community. Master plans aid DoC planners in their decision-making while accommodating changing circumstances and agency priorities.

Proposed Action

The Proposed Action is a Master Plan to guide the physical development of the campus to advance the agency's mission-related goals over the next 20 years. The Master Plan emphasizes quality and collaborative research in addition to sustainable and efficient operations. The Master Plan addresses current campus needs and delineates future development through phasing packages. Full execution of the Master Plan would increase the employee population by approximately 12% from its current

population of 1,761 to 1,973 by 2031 and would result in a net increase in facility space by approximately 13% (DoC, 2017).

DoC would execute new construction, additions, renovation, demolition, landscape improvements, utility improvements, and circulation improvements under the Master Plan. The Master Plan would focus on a core center of the campus and associated green space used to connect existing, renovated, and new laboratories. The Master Plan also involves the consolidation of administrative buildings and support facilities at the western end of the campus green. Aging, deteriorating, and some temporary buildings would be phased out and replaced by updated facilities.

No-Action Alternative

The No-Action Alternative would not implement the Master Plan and would maintain the present course of action at the campus by continuing ongoing research, management, and maintenance activities. The No-Action Alternative would ultimately result in a site that would no longer support the advanced research requirements of DoC and would render much of the campus obsolete. The No-Action Alternative would not meet the purpose and need criteria for the campus. As a result, DoC considers the No-Action Alternative to be less desirable than the Proposed Action.

Decision to be Made

Based on environmental analysis, public comments on the Draft EA, and other considerations, DoC will decide whether to proceed with the Proposed Action or the No-Action Alternative. The EA scope is confined to issues and potential environmental consequences relevant to this decision.

Summary of Environmental Effects and Mitigation Measures

The Council on Environmental Quality regulations implementing the National Environmental Policy Act require consideration of environmental effects and prescribe mitigation where practical to limit those effects.

The Proposed Action would result in temporary impacts from construction, renovation, and demolition activities, as well as some minor continuing impacts due to operation of the new facilities and the modest increase in DoC personnel over the course of 20 years. The No-Action Alternative would not result in temporary impacts, demolition activities, or other improvements under the Master Plan. The environmental effects and mitigation measures associated with the Proposed Action and No-Action Alternative are described in Table 1-1 (Summary of Environmental Effects and Mitigation Measures) below.

Table 1-1. Summary of Environmental Effects and Mitigation Measures

Resource	Proposed Action (DoC Boulder Laboratories Master Plan)	No-Action Alternative
Land Use and Socioeconomics		
Land Use and Regional Planning	Effects: • Improved connectivity, stronger campus identity, and encouraged collaboration amongst employees. • No impact on land use designations on the campus. Continued preservation of open space and natural features. • No impact on zoning or regional planning outside the campus. Mitigation: • No mitigation necessary.	Effects: • No impact on land use or regional planning.
Social and Economic Resources	Effects: • Minimal long-term impact on population, housing, and education trends due to the projected increase of approximately 200 staff over the course of 20 years. • Minor long-term economic benefits associated with improved productivity and available resources as well as a marginal improvement to employment levels associated with increased staff on the campus. Staff increases would likely benefit the local economy and job market. • Temporary minor impact on the population and availability of housing during construction (due to potential influx of construction workers). • Temporary economic benefits to the local community during construction activities (e.g., meals and incidentals for construction workers). • No disproportionate impact on children, minorities, or low income populations. Mitigation: • No mitigation necessary.	Effects: • No impact on social and economic resources. • No economic benefits to the region.
Open Space	Effects: • No long-term or temporary impact on open space, protected areas, or recreational areas. Mitigation: • No mitigation necessary.	Effects: • No impact on open spaces.
Trails	Effects: • No impact on public trails located within the Protected Area on campus. • Potential improvement to trails leading to off-campus recreation areas, multi-use trails, and the designated bicycle route areas. • Improvement to circulation and safety on campus for pedestrians and bicyclists. • Potential temporary trail closure or detour during construction activities. Mitigation: • No mitigation necessary.	Effects: • No impact on trails. • No improvement to trails, circulation, or safety.

Table 1-1. Summary of Environmental Effects and Mitigation Measures

Biological Resources		
Vegetation	Effects: • Removal of vegetation due to construction in previously undeveloped areas. • No impact on rare, threatened, or endangered plant species or to vegetation in stream buffers or wetlands. • Improvement to urban landscape due to replacement of water-intensive, non-native plants with drought-resistant, native species (requiring less irrigation). • Improvement to urban landscape due to planting additional trees for cover and shade and additional native vegetation in association with the pedestrian promenade and vegetated arroyo. • Improvement to urban landscape due to removal and replacement of ash trees, which provide emerald ash borer habitat. Mitigation: • Reseeding native grasses and vegetative species in disturbed areas following completion of construction activities to the extent feasible. • Replacement of trees removed. • Management of ponderosa pine stands to prevent infestation by bark beetles. • Management of hardwood trees to prevent the spread of the emerald ash borer. • Consolidation of facilities in previously developed areas.	Effects: • No impact on vegetation. • No removal of non-native invasive species and replacement with native species in accordance with Executive Order (EO) 13112. • No improvement to urban landscape.
Wildlife	Effects: • Temporary minor reduction in potential wildlife, migratory bird, and pollinator habitat during construction activities. • Temporary potential impact on wildlife due to noise during construction. Negligible long-term noise impacts. • No disturbance within the boundaries of the existing prairie dog colony located in the protected area. • Unlikely impact on rare, threatened, and endangered species since there are no critical habitats within the project areas. • Potential minor impact on aquatic life due to runoff of sediment or other contaminants. • Minor improvement to wildlife and pollinator habitat due to replacement of non-native plants with native vegetation and planting additional trees. Mitigation: • Consolidation of facilities within previously developed areas. • Avoidance of tree clearing until it is verified that no migratory bird eggs and/or young are present. • Consultation with the U.S. Fish and Wildlife Service and implementation of appropriate mitigation measures if threatened or endangered species are discovered on the campus during the course of planning or execution of the Master Plan. *(continued on next page)*	Effects: • No impact on wildlife or habitat. • No enhancement to habitats for native wildlife and pollinators.

Table 1-1. Summary of Environmental Effects and Mitigation Measures

Resource	Proposed Action (DoC Boulder Laboratories Master Plan)	No-Action Alternative
Wildlife *(continued)*	Mitigation *(continued)*: • Reassessment of the prairie dog colony boundaries prior to project implementation to determine whether a potential conflict exists. Non-lethal, non-removal methods would be implemented for resolving any conflicts. • Implementation of stormwater management and pollution prevention measures to reduce impact on aquatic life. • Management of ponderosa pine stands to prevent infestation by bark beetles. • Management of ash trees to prevent the spread of the emerald ash borer.	
Topography, Geology, and Soils		
Topography	Effects: • Minor impact on topography due to construction activities, which would require grading in previously disturbed areas. • Potential for minor changes to existing drainage patterns in the immediate vicinity of new facilities. • No impact on topography of Kohler Mesa. Mitigation: • No mitigation necessary.	Effects: • No grading or associated impact on topography.
Geology and Soils	Effects: • Moderate disturbance due to construction, demolition, and renovation projects that would impact previously disturbed soils. Potential for surface and subsurface compaction and soil relocation during construction and demolition activities. • Minimal potential for extensive soil erosion. Mitigation: • Implementation of erosion and sediment control (ESC) measures during earth disturbance. • Installation of post-construction best management practices (BMPs) for projects that disturb 1 acre or greater of land.	Effects: • No impact on geology or soils.

Table 1-1. Summary of Environmental Effects and Mitigation Measures

Resource	Proposed Action (DoC Boulder Laboratories Master Plan)	No-Action Alternative
Water Resources		
Surface Water	Effects: • Potential impact on surface waters due to runoff from construction activities and changes in the quality and quantity of post-construction stormwater runoff. • Potential improvement to surface water quality at the campus associated with design and implementation of post-construction BMPs and improved stormwater management techniques such as Low Impact Development (LID) features. • Potential increase in wastewater discharge to the City of Boulder sanitary sewer system due to increased campus population. No change in wastewater quality. • Potential increase in wastewater discharge to the campus stormwater system due to increased cooling loads. Mitigation: • Implementation of ESC measures during all construction activities to prevent sediment transport to Skunk Creek and Anderson Ditch.	Effects: • No impact on surface waters. • No implementation of LID or improvement to existing stormwater management practices to meet the intent of local, state, and federal rules and regulations.
Groundwater	Effects: • No impact on groundwater consumption. • Potential impact on groundwater quality during construction and demolition activities. • Potential for enhanced groundwater recharge during storm events due to installation of BMPs and implementation of advanced stormwater management techniques. Mitigation: • Implementation of appropriate pollution prevention and ESC measures during construction and demolition activities to avoid spills and exposure of groundwater to contamination.	Effects: • No impact on groundwater consumption. • No construction-related impact on groundwater. • No potential for enhanced groundwater recharge during storm events.
Wetlands	Effects: • No construction, demolition, or renovation within wetlands or wetland buffers. • Potential for long-term changes in the quality and quantity of stormwater runoff discharged to the wetland surrounding Skunk Creek following construction of the new Childcare Center and parking garage. Mitigation: • Installation of stormwater management BMPs to reduce potential for sediment and contaminant transport.	Effects: • No impact on wetlands.

Table 1-1. Summary of Environmental Effects and Mitigation Measures

Resource	Proposed Action (DoC Boulder Laboratories Master Plan)	No-Action Alternative
Floodplains	Effects: • Reconfiguration of Curie Circle within the current 100-year floodplain. No construction, demolition, or renovation within the city's proposed 100-year floodplain. • Renovation of portions of Building 1 within the city's proposed 500-year floodplain. • No construction, demolition, or renovation within the current or proposed conveyance zone or high hazard zone. Mitigation: • Permitting or consultation with Boulder Planning and Development Services Center. • Proper siting and design of new facilities to avoid impacts to floodplains and ensure consistency with federal regulations and EOs. • Minimization of stormwater runoff from new development to Skunk Creek and Anderson Ditch.	Effects: • No changes within the current or proposed 100-year floodplain, 500-year floodplain, conveyance zone, or high hazard zone.
Utilities and Infrastructure		
Potable Water Supply	Effects: • Minor increase or potential decrease in potable water demand. • Potential for improvement to water efficiency via improved availability of chilled water, installation of efficient water fixtures, and addressing water leaks. • New potable water line installation. Mitigation: • Implementation of water conservation practices.	Effects: • No change in potable water demand. • No improvement to water efficiency within the campus. • No impact on existing potable water infrastructure.
Wastewater	Effects: • Increase in wastewater generation from increased population and increased cooling loads. • New sanitary sewer line installation. Mitigation: • Installation of water-efficient fixtures in new and renovated buildings.	Effects: • No increase in wastewater discharge. • No impact on existing wastewater infrastructure.
Stormwater Management	Effects: • Temporary impact on stormwater from sediment associated with renovation, demolition, and construction activities. • Potential long-term improvement to stormwater quality and reduction in stormwater quantity via removal of impervious surfaces and installation of post-construction BMPs, control measures, and LID technologies. Reduction in impervious areas within the campus by 4.8% with full implementation of the Master Plan. Mitigation: • Implementation of approved ESC and stormwater management plans during construction activities.	Effects: • No impact on stormwater. • No improvement to stormwater management practices on the campus to meet the intent of local and federal rules and regulations.

Table 1-1. Summary of Environmental Effects and Mitigation Measures

Resource	Proposed Action (DoC Boulder Laboratories Master Plan)	No-Action Alternative
Energy Systems - Electricity	Effects: • Expected 1-2% increase in electrical demand due to operation of lighting systems, laboratory equipment, and HVAC systems associated with new buildings. • Removal of inefficient small and temporary buildings. • Improved energy efficiency for new and renovated buildings. • Potential for reduced consumption of electricity from the grid with installation of photovoltaic energy systems and a solar panel field. • Potential for new buildings to achieve net-zero energy consumption. • No extensive modifications to the existing electrical distribution network. Mitigation: • No mitigation necessary.	Effects: • No impact on electrical infrastructure or demand. • No improvement to energy efficiency.
Energy Systems - Heating and Cooling	Effects: • Expected 1-2% increase in electrical (including cooling demand) and 1-3% increase in heating demand. • Removal of inefficient and under-insulated small and temporary buildings. • Improvement to insulation and efficiency of heating and cooling for new facilities. Mitigation: • No mitigation necessary.	Effects: • No change in heating and cooling demand. • No improvement to energy efficiency.
Sustainable Development		
--	Effects: • Moderate overall improvement to campus sustainability through replacement of inefficient facilities and upgrading outdated equipment. • Improvement of energy efficiency; stormwater management; and transportation efficiency. • Short-term and continuing generation of waste and commitment of resources (e.g., raw construction materials, fossil fuels) to support facility construction and operation. • Achievement of LEED Silver certification (or better) for each new or renovated building. • Adaptive reuse of an outdated laboratory building to become the Campus Center. Mitigation: • Recycling of construction and demolition debris to the extent practicable.	Effects: • No change in energy demand or infrastructure on the campus. • No improvement to energy efficiency, stormwater management, or overall campus sustainability in accordance with EO 13693.
Solid and Hazardous Waste		
--	Effects: • Temporary generation of construction and demolition waste, potentially including materials containing polychlorinated biphenyls, lead, or asbestos. • Minor long-term increase in operational waste due to increase in staff and operational space. Mitigation: • Recycling of construction and demolition debris to the extent practicable. • Handling and disposal of wastes in accordance with Colorado Department of Public Health and Environment regulations.	Effects: • No change in the generation, storage, or disposal of solid or hazardous waste. • No removal of hazardous building materials.

Table 1-1. Summary of Environmental Effects and Mitigation Measures

Resource	Proposed Action (DoC Boulder Laboratories Master Plan)	No-Action Alternative
Transportation		
Vehicle Circulation and Parking	Effects: • Reduced vehicle congestion and queuing at the campus entrance and Security Center. • Improved vehicle circulation and maneuvering. • Slight increase in vehicles entering and exiting the campus due to personnel increase. • Minor reduction in vehicle use within the campus due to improved pedestrian access to and between buildings. • Improved parking configuration. • Temporary increase in traffic and decrease in parking availability during construction and demolition activities. Mitigation: • Coordinate construction activities and create temporary parking and staging areas to avoid parking overflow during construction and demolition activities.	Effects: • No impact on the local transportation network or traffic levels. • No change in vehicle use or parking availability within the campus. • No improvement to campus ingress or vehicle circulation within the campus.
Public and Alternative Transportation	Effects: • Slight increase in public transit ridership due to increase in employees. • Improved access to the campus from bus stops due to improved pedestrian walkways. • Improved safety and accessibility for bicycle commuters. Mitigation: • No mitigation necessary.	Effects: • No impact on public and alternative transportation.
Air Quality		
--	Effects: • Minor long-term increase in air emissions from onsite boilers and emergency generators and new or relocated laboratory activities. • Minor long-term increase in local air emissions from mobile sources associated with 12% increase in employee population and associated increase in vehicle use. • Temporary increase in air emissions due to demolition, construction, and renovation activities. • Air emissions would be below the *de minimis* thresholds each calendar year for nonattainment criteria pollutants and their precursors. Mitigation: • Continued use of low-NOx burners in new boilers. • Implementation of BMPs during demolition, construction, and renovation activities to reduce criteria pollutant and fugitive dust emissions. • Removal and disposal of lead-containing materials, asbestos-containing materials, and ozone-depleting substances in accordance with applicable regulations.	Effects: • No impact on air emissions from onsite stationary sources, mobile sources, or temporary activities.

Table 1-1. Summary of Environmental Effects and Mitigation Measures

Resource	Proposed Action (DoC Boulder Laboratories Master Plan)	No-Action Alternative
Climate Change		
--	Effects: • Minor long-term increase in direct and indirect greenhouse gas (GHG) emissions from boilers, emergency generators, and operation of new facilities (including purchasing of electricity). • Temporary increase in GHG emissions due to demolition, construction, and renovation activities. • Potential contribution to effects of climate change through potential minor increase in potable water demand. Mitigation: • Implementation of BMPs during demolition, construction, and renovation activities to reduce GHG emissions. • Installation of solar energy systems to further offset GHG emissions from the campus.	Effects: • No impact on direct or indirect GHG emissions. • No change in contribution to climate change effects. • Increased susceptibility of non-native landscape vegetation to climate change-induced drought.
Cultural and Historic Resources		
Architectural Resources	Effects: • Potential adverse effect associated with renovation of historic Building 1. • No impact on Anderson Ditch or historic properties outside the campus. Mitigation: • Continued consultation with the Colorado Office of Archaeology and Historic Preservation to identify appropriate mitigation measures to reduce or avoid adverse effects to Building 1.	Effects: • No impact on potentially historic properties.
Archeological Resources	Effects: • No adverse effects on tribal protected areas, archeologically sensitive areas, or previously identified archeological sites. Mitigation: • No mitigation necessary.	Effects: • No adverse effects on tribal protected areas, archeologically sensitive areas, or previously identified archeological sites.
Visual Impacts		
Viewscapes	Effects: • Minimal impact on the viewscape from surrounding areas due to new construction, which would not obstruct visibility of Kohler Mesa when viewed from Broadway and 27th Street. • Temporary impact on the viewscape from surrounding areas due to construction activities. • Improvement of viewscape on the campus by replacing dated buildings with new buildings. Mitigation: • No mitigation necessary.	Effects: • No impact on viewscapes. • No enhancement of viewscapes on the campus.

Table 1-1. Summary of Environmental Effects and Mitigation Measures

Resource	Proposed Action (DoC Boulder Laboratories Master Plan)	No-Action Alternative
Light Pollution	Effects: • Negligible change in light trespass outside the campus boundary. • Potential minor temporary light trespass from supplemental lighting during construction activities. • Potential increase in glare in the vicinity of the campus due to sunlight reflected from solar panels. • Potential increase in light trespass on the campus from interior lighting due to skylights and windows in proposed facilities. Mitigation: • Conducting construction work during daylight hours. • Ensuring that all new exterior lighting systems would be directed and sized appropriately; designed in accordance with current guidance and the Boulder County Outdoor Lighting Ordinance; and would generate light with a color temperature that is appropriate for reducing nighttime light pollution. • Screening with tree plantings on the campus to intercept light trespass outside the campus boundary. • Ensuring that solar panel designs incorporate glare reduction measures and that the panels are sited in a manner to avoid creating excessive glare. • Continued use of automatic lighting controls. • Continued evaluation of whether additional design and landscaping measures would be necessary to mitigate light trespass outside the campus boundary.	Effects: • No impact on lighting at the campus. • No improvement to existing interior or exterior campus lighting.
Noise Levels		
--	Effects: • Negligible impact on overall operational noise levels. • Temporary increase in noise during construction activities. Mitigation: • Limitation of construction activities to normal daytime working hours. • Use of hearing protection by operational and construction workers as needed. • Continued evaluation of whether additional design and landscaping measures would be necessary to mitigate noise trespass into adjacent residential properties.	Effects: • No impact on ambient or interior noise levels.

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2 Introduction

2.1 Campus Background

The 206-acre Department of Commerce (DoC) Boulder Laboratories Campus, located in Boulder, Colorado, is home to research programs of the National Institute of Standards and Technology (NIST), the National Oceanic and Atmospheric Administration (NOAA), and the National Telecommunications and Information Administration (NTIA). A total of 1,761 research scientists, engineers, administrators, and support personnel work in 34 buildings and structures at the campus, of which 29 are occupied buildings.

The roughly L-shaped campus, donated to DoC by the Boulder Chamber of Commerce in 1950, is situated within a strikingly beautiful setting with Kohler Mesa and the Flatirons as a backdrop to the buildings and landscape. The site was considered ideal for the measurement science and research that NIST conducted, and its close proximity to University of Colorado promised outstanding scientific resources. The entrance and buildings are oriented toward the east, bordering on Broadway (Colorado State Highway 93). The remainder of the property is surrounded by residential development and recreational land, with a cemetery bordering the campus at the north. The land gently rises toward the west, culminating in a steep rise to Kohler Mesa at the western end of the property. Two ephemeral water bodies transect the site: Skunk Creek and Anderson Ditch, an irrigation channel. Much of the property is designated *Open Space*, protected from development under a Memorandum of Agreement (MOA) with the City of Boulder together with an association of Native American tribes.

The three DoC agencies with programs situated at the DoC Boulder Laboratories Campus are described below.

NIST promotes U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life. NIST occupies five major buildings at the campus (Buildings 1, 2, 3, 24, and 81) and manages the remaining buildings with the exception of the two NOAA facilities (Buildings 33 and 34). NIST has four laboratory components located here: Communications Technology Laboratory (CTL), Information Technology Laboratory (ITL), Material Measurement Laboratory (MML), and Physical Measurement Laboratory (PML). These laboratories, together with administrators and support groups, have approximately 740 employees and affiliates on campus. Research is conducted in the areas of materials reliability, opto-electronics, quantum electronics and physics, time and frequency, and electromagnetics.

NOAA at Boulder conducts research in atmospheric and space sciences, with approximately 950 employees and affiliates, including General Services Administration (GSA) operations and management personnel. NOAA occupies Buildings 33 (David Skaggs Research Center) and 34 (Solar Observatory). These two buildings, the associated parking areas, and the grounds immediately adjacent (totaling about 15 acres) are managed by GSA. Three research, forecasting, and information programs share these facilities: the Office of Oceanic and Atmospheric Research, the National Weather Service, and National Environmental Satellite Data and Information Services.

NTIA is principally responsible for advising the President on telecommunications and information policy issues. It has one laboratory headquartered at the campus, the Institute for Telecommunication Sciences. This group, with approximately 70 people, researches cutting-edge areas of telecommunication technology, principles, and applications. They work closely with PML's time and frequency research components and with CTL.

Figure 2-1 and Figure 2-2 illustrate the location and general features, respectively, of the DoC Boulder Laboratories Campus. Table 2-1 provides basic information regarding each of the buildings at the campus. Refer to the Master Plan for more background about the history, evolution, and facilities of the campus.

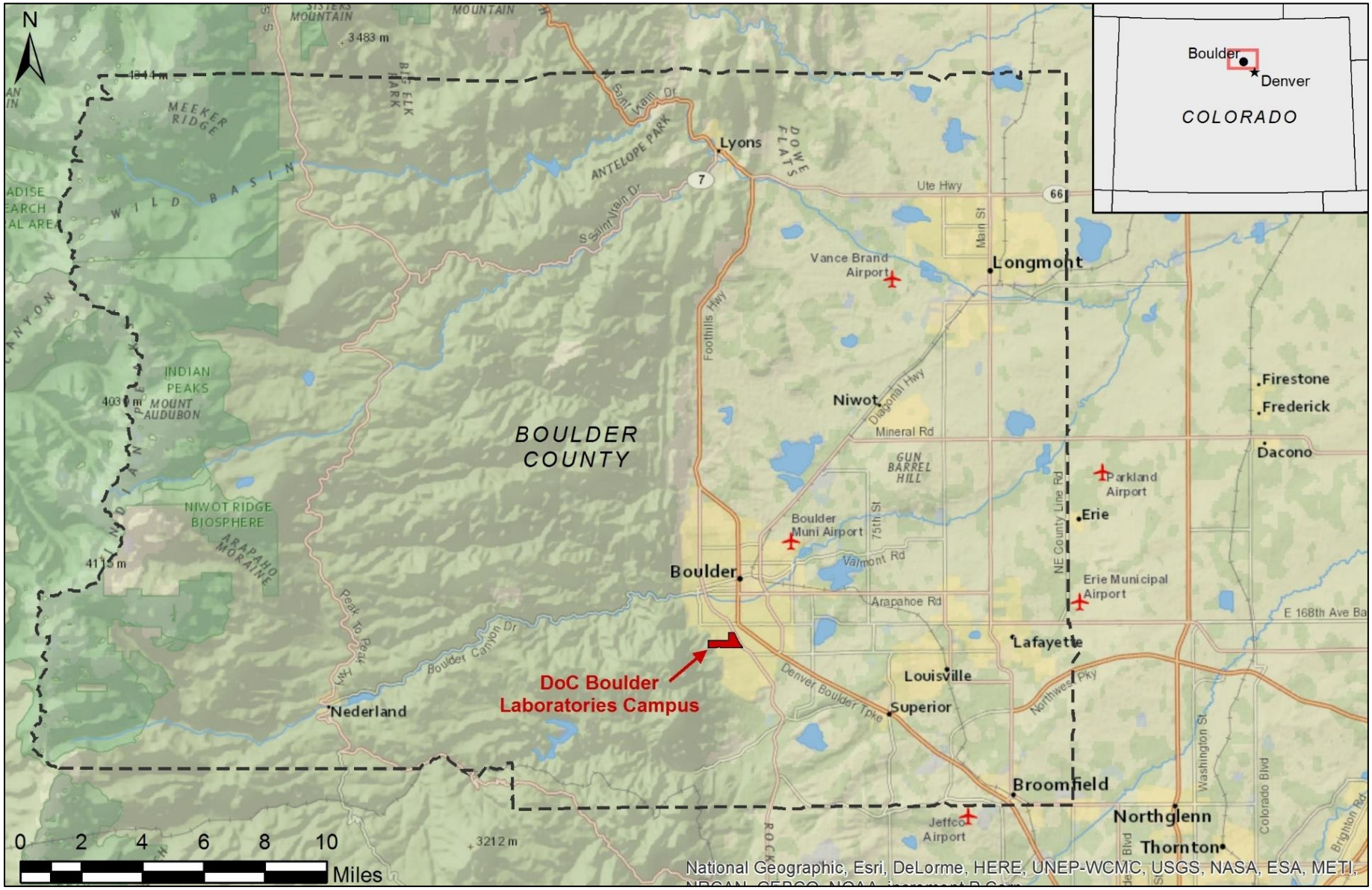

Figure 2-1. Location of DoC Boulder Laboratories Campus within Boulder County, Colorado

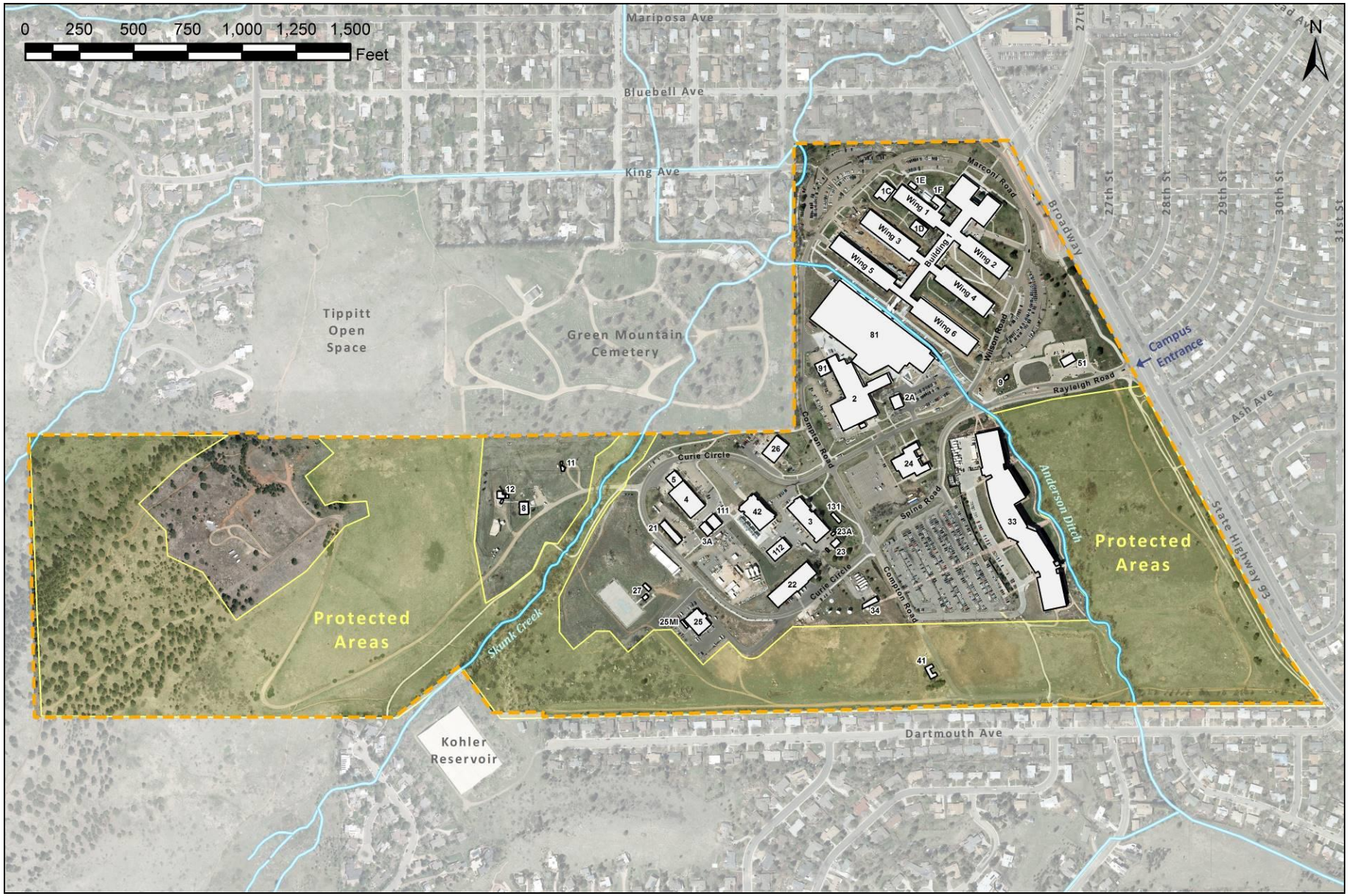

Figure 2-2. Overview of DoC Boulder Laboratories Campus

Table 2-1. Summary of Campus Buildings

Building Number and Name		Size (GSF)	Stories	Year Completed	Occupants	Spaces
1	Radio Building (Wings 1-6, Spine)	336,909	1-5	1954	Various Labs and Admin.	Labs, Offices; Public; Support
1C	Annex	4,611	1	1989	PML	Offices (research)
1D	Annex	3,456	1	1992	PML	Offices (research)
1E	Annex	ES	—	N/A	—	Mechanical Equipment
1F	Annex	ES	—	N/A	—	Mechanical Equipment
2	Cryogenic	69,771	2	1951	PML, MML	Labs; Offices (research)
2A	Cryogenic Annex	2,880	1	1989	PML	Labs; Offices (research)
3	Liquifier	17,403	1	1952	Vacant for Renovation	Labs; Support
3A	OFPM Annex	2,160	1	1989	OFPM	Offices (admin)
4	Camco	15,795	1	1951	OFPM	Offices (admin)
5	Camco Annex	3,149	1	1951	OFPM, CTL	Offices (admin); Lab
8	Cryogenic Mesa Test	2,400	1	1953	MML	Labs
9	Gas Meter Bldg.	ES	—	1958	—	Water Pump Equipment
11	Ionospheric Observatory	466	1	1958	NOAA	Labs
12	Hydrogen Test Facility	1,446	1	2010	MML	Lab, Support
21	Maintenance Garage	3,999	1	1963	OFPM	Support; Offices (admin/support)
22	Warehouse	17,530	1	1964	NOAA	Support (Shipping and Receiving, Warehouse)
23	Hazardous Materials	984	1	1989	Safety, Health & Environ.	Support
23A	Hazard. Materials Annex	ES	—	1989	—	Mechanical Equipment
24	Plasma Physics	32,723	3	1967	CTL, PML	Labs; Offices (research)
25	Maintenance Shop	8,306	1	1966	OFPM	Support (workshops); Offices (support)
25 MI	Building 25 Annex	525	1	N/A	OFPM	Offices; Support
26	Day Care Center	7,776	1	1989	OFPM manages	Public; Classrooms; Support
27	High Frequency Field	1,045	1	1992	CTL	Lab (Antenna testing w/ RF Shielding)
41	High Speed Switch	ES	—	N/A	—	Electrical Equipment
42	Central Utility Plant	45,845	3	2005	OFPM	Support (Utility); Offices (support)
51	Security Center	1,470	1	2006	Police	Support (Visitor Screening)
81	Katharine Blodgett Gebbie Laboratory	286,674	1	2012	PML, CTL, MML	Labs; Offices (research); Public (conference center)
91	Construction Research	3,561	1	2008	OFPM	Offices (admin)
111	Building 4 Annex	2,821	1	2011	Acquisition Mgmt. Div.	Offices (admin)
112	Butler Building	5,795	1	2011	OFPM	Support (storage)
131	Office	1,440	1	2013	OFPM	Offices (admin.)
—	Concourse	1,234	1	2013	—	Connector—Buildings 1 and 81
	NIST Total	**882,174**				
33	David Skaggs Research Center	372,000*	4	1999	NOAA	Labs; Offices; Public
34	NOAA Solar Observatory	Incl. above	1	1999	NOAA	Lab

Source: DoC, 2017.

* NOAA now reports 415,973 gross square feet (GSF) as existing, because of changed measurement methodology (DoC, 2017).

Acronyms: CTL (Communications Technology Laboratory); ES (equipment structure); MML (Material Measurement Laboratory); N/A (not available); NIST (National Institute of Standards and Technology); NOAA (National Oceanic and Atmospheric Administration); OFPM (Office of Facilities and Property Management); PML (Physical Measurement Laboratory).

2.2 Purpose and Need for Action

The DoC Boulder Laboratories Campus Master Plan analyzed in this Environmental Assessment (EA)—hereafter referred to simply as the Master Plan—reflects DoC's vision for the physical development of the campus and for a flexible strategy for implementation.

DoC is ever evolving and needs flexible, integrative, and collaborative support spaces to effectively promote scientific research. The overall purpose of the Master Plan analyzed in this EA is to guide fulfillment of the following objectives:

- Create a comprehensive and coordinated framework for physical development of the campus;
- Develop appropriate facilities and infrastructure for the evolving and advancing scientific research;
- Respect the campus location, historic context, and agreements with the local community and Native American tribes;
- Encourage collaboration and interaction among the laboratories and researchers, with welcoming facilities and staff amenities;
- Accommodate interchange with the public and outside colleagues, using both conference facilities and technology;
- Create an attractive campus, respecting both the science and the staff;
- Promote good stewardship of the natural environment, and support and advance the sustainable design goals of DoC, GSA, NIST, and NOAA; and
- Develop a plan for gradual change, that is complete at each step.

The need for the Master Plan, and the campus improvements prescribed therein, is driven by both institutional policy and the inability of existing facilities and infrastructure to support current and projected mission requirements. DoC requires that its agencies have a physical master plan for their sites, reflecting both the anticipated special needs of the user groups and the impact of its activities on the surrounding community. Master plans aid DoC planners in their decision-making while accommodating changing circumstances and agency priorities. The most recent campus master plan, prepared in 1992, is outdated and no longer reflects DoC's vision for the physical development of the campus.

While DoC commissioned the Master Plan in response to institutional policy, the campus improvements prescribed therein are needed to address real deficiencies with the existing facilities, infrastructure, and organization, including the following:

- Modernized laboratory space (including improved environmental control) and flexible, integrative, and collaborative space is needed to promote advancing research;
- The current campus layout does not have a unifying vision of organization;
- Existing conditions lack a central meeting place for collaboration between researchers, resulting in limited collaboration opportunities;
- Administrative functions throughout the facility are housed in seven separate buildings, creating inefficiencies in collaboration, coordination, and overall logistical correspondence;
- Existing conditions, including visitor screening requirements and campus layout, make it difficult for the public to access the facility; and
- Circulation and screening conflicts result in congestion at the entrance to the campus and the Security Center where badging and vehicle screening occurs.

Refer to the Master Plan for additional discussion of these facility, infrastructure, and organizational deficiencies that drive the need for the DoC Boulder Laboratories Campus Master Plan.

2.3 Public Scoping

Scoping is an early and open process for determining the range of significant issues to be analyzed in a National Environmental Policy Act (NEPA) document. During the scoping period, the public can provide comments on the proposed action, alternatives, issues, and potential environmental impacts to be analyzed in the NEPA document. Scoping may involve public meetings and other means to obtain public comments.

While not required for a NEPA EA, an agency may choose to include public scoping as part of EA development to ensure that the analysis considers those issues that are of interest to the public. Because of the expected high level of public interest in the Master Plan, DoC held a public scoping meeting from 6 p.m. to 8 p.m. at the Boulder Public Library on January 12, 2016 to kick-off the public scoping period. The public scoping meeting was followed by a 31-day comment period.

Outreach

DoC published legal notices indicating the date, location, time, and a brief description of the scoping meeting in local newspapers. Notices were published in the *Boulder Weekly* (December 31, 2015 through January 13, 2016) and the *Boulder Daily Camera* (December 21 through December 23, 2015). In addition, DoC worked with the Boulder City liaison to contact Martin Acres, Olde Columbine, and Dartmouth neighborhood organizations via email. DoC also went door-to-door down most of Dartmouth Avenue and Columbine Avenue handing out hard copies of the notice.

Public Meeting

The public scoping meeting incorporated the following components:

- Posters with information for attendees to peruse before the meeting was underway – e.g., existing conditions, the preliminary development concepts, an overview of the NEPA process, and tips for providing effective public comments;
- A presentation that addressed the history of the campus and needs for improvement, the master planning process and goals, the preliminary development concepts being considered for incorporation in the Master Plan, and the NEPA process;
- An opportunity for members of the public to provide spoken comments for the record;
- A stenographer/videographer to record the meeting and document comments; and
- Handouts to send home with attendees.

Following the meeting, the presentation was made available to the public at www.nist.gov/director/ofpm/boulder-master-plan.cfm.

Public Comments Received

Following the presentation, attendees were afforded the opportunity to provide oral comments and ask questions. Following the meeting, members of the public were afforded the opportunity to provide written comments until February 12th, 2016. Seventeen attendees made comments at the meeting and twelve households submitted comments following the meeting. Comments covered a range of topics related to campus accessibility, noise and light pollution, viewscape, wildlife, vegetation, facility improvements, and campus growth. DoC considered all public comments during development of the Master Plan and EA.

Selection of Master Plan Concept

Prior to the public scoping period, DoC developed four preliminary Master Plan concepts to meet the purpose and need for action (Section 2.2). These preliminary concepts are described in detail in Section 4.4 (Master Plan Development) of the Master Plan. Based on input received during the scoping period, DoC crafted a single concept from a fusion of the most desirable elements of each preliminary concept. Key elements selected for inclusion in the final concept include consolidation of management staff and services, a pedestrian spine both outdoors and within buildings, a campus center for staff amenities and services, and replacement of obsolete laboratory space. The resulting hybrid concept, described in Section 3.1 (Proposed Action), was selected as the Master Plan and is evaluated in this EA. DoC determined that the potential environmental impacts associated with the preliminary concepts would likely be similar to those associated with the final hybrid concept selected as the Master Plan.

2.4 Public Review of Draft EA

The Draft Master Plan and Draft EA were made available for review by federal, state, and local agencies as well as the interested public. The subsections that follow summarize the procedures followed to conduct Government and public outreach while highlighting some examples of the types of comments received from each entity and how they were addressed. All comments received were taken into consideration during development of the Final Master Plan and Final EA.

Governmental Outreach

DoC distributed copies of the Draft Master Plan and Draft EA to the agencies and entities listed in Section 9 (Distribution List). In response, the following federal, state, and local agencies submitted comment letters to DoC:

- The U.S. Fish and Wildlife Service (USFWS) Colorado Field Office provided a response of "no comment" on the Draft Master Plan and Draft EA.
- The U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Colorado State Office provided comments regarding farmland protection and erosion control.
- The Colorado Department of Public Health and Environment (CDPHE) provided comments regarding protection of air quality.
- The City of Boulder provided comments on a variety of topics affecting both the Draft Master Plan and Draft EA.

These comment letters are provided in Appendix A. This Final EA incorporates minor text revisions to address the comments from NRCS and CDPHE. This EA

also incorporates the following edits to address comments received from the City of Boulder:

- Acknowledgement that continued discussions with the City of Boulder are necessary regarding reconfiguration of the bicycle path along Broadway near the campus entrance, with the goal of encouraging cyclists to slow down and creating a better line of sight for motorists.
- Modifications to reduce stormwater flows to Anderson Ditch. Specifically, DoC revised the Final Master Plan and Final EA to emphasize the use, where feasible, of the existing detention basins that provide storage and infiltration capacity prior to overflow to Bear Canyon Creek. DoC also clarified that the arroyo would be designed not only to manage the increased flows from proposed development, but also to decrease the overall flow rate of stormwater runoff into Anderson Ditch from developed areas within the campus (e.g., using check dams).
- Acknowledgement that prairie dog colonies are dynamic and that DoC is committed to reassessing the prairie dog colony boundaries throughout development and implementation of the Master Plan. DoC is further committed to complying with the decision-making process outlined in the city's prairie dog protection ordinance to emphasize the use of non-lethal, non-removal methods for resolving any conflicts that arise.
- Acknowledgement of the land use designation change for 385 Broadway from Transitional Business to Low Density Residential.

Public Outreach

DoC initiated a public comment period on the Draft Master Plan and Draft EA on October 19, 2016 and accepted comments through December 5, 2016. The draft documents were available for public review on the NIST website and at the Boulder Public Library. DoC's public outreach efforts for the review of the draft documents included the following:

- Publishing a Notice of Availability (NOA) of the Draft Master Plan and Draft EA in local publications, which initiated the public comment period. NOAs were published in the *Boulder Daily Camera* (October 19-21, 2016) and the *Boulder Weekly* (October 20-26, 2016);
- Providing hard copies of the Draft Master Plan and Draft EA at the Boulder Public Library, with a poster to request public review and comment;
- Hanging posters at a local grocery store (King Soopers), coffee shops, and restaurants;
- Distributing flyers to neighbors and directly contacting neighbors who had previously expressed concerns about operational impacts from the campus;
- Sending emails directly to each member of the public who provided comments during the public scoping phase of the Master Plan; and
- Presenting the Draft Master Plan to the Boulder City Council on October 18, 2016.

In addition to the above, DoC conducted outreach to staff at the DoC Boulder Laboratories Campus to encourage their feedback on the Draft Master Plan and EA. This outreach consisted of giving a presentation during an all-hands meeting, publishing notices on DoC and NIST internal websites, and directly emailing NOAA staff.

Public Comments Received

DoC considered all public comments during development of the Final Master Plan and the Final EA. Several of the more substantial comments highlighted the following community concerns:

- Commenters suggested that the Master Plan should take further measures to reduce light pollution and noise, improve aesthetics, and discourage use of street parking in adjacent neighborhoods by campus personnel and construction crews. DoC considered these concerns and revised the Final Master Plan and Final EA to include more tree plantings along the campus exterior, including along the south side of the Building 33 parking lot. The revisions also acknowledge the need to further evaluate potential noise and light pollution concerns for individual projects as they enter the design phase (e.g., the Building 34 expansion) and to incorporate additional design and landscaping measures to mitigate these concerns as necessary. DoC also revised the Final Master Plan and Final EA to acknowledge the need to provide sufficient construction vehicle parking and material staging areas during each phase of development so that parking overflow outside of the campus can be avoided.
- Commenters suggested that stormwater should be managed in such a way as to prevent future flooding. DoC considered this concern and revised the Final Master Plan and Final EA to minimize stormwater runoff to Anderson Ditch (as described previously) and Skunk Creek.
- Commenters suggested that the landscaping plan should incorporate a deciduous landscape approach instead of a ponderosa pine savannah landscape approach due to better shading in summer, better snow and ice melt in winter, and concerns associated with susceptibility of ponderosa pines to attack by bark beetles. DoC considered these suggestions, but decided to retain the prescribed landscape approach which includes the use of ponderosa pines and Rocky Mountain juniper

around the perimeter of the site in Planting Zone 1 to maximize drought tolerance and to blend with the surrounding natural setting. The Master Plan would also plant deciduous trees toward the interior of the campus where shade is needed. DoC revised this Final EA to include a discussion of bark beetles in Section 4.2.1 (Vegetation).

3 Alternatives

3.1 Proposed Action

The Proposed Action is a Master Plan to guide the physical development of the campus in order to advance the agency's mission-related goals over the next 20 years. The Master Plan emphasizes quality and collaborative research in addition to sustainable and efficient operations. The Master Plan addresses current campus needs and delineates future development through phasing packages. The core concept of the Master Plan includes a linear arrangement of connected laboratories and a campus center, joined by a campus green. The Master Plan improves campus flow, promotes energy efficiency, and harbors an integrated and sustainable space for research and collaboration. Full execution of the Master Plan would increase the employee population by approximately 12% from its current population of 1,761 to 1,973 by 2031 (DoC, 2017).

Full implementation of the Master Plan would result in a net increase in facility space by approximately 13%, from 1,254,174 gross square feet (GSF) to 1,419,626 GSF (DoC, 2017). The Master Plan would focus on a core center of the campus and associated green space used to connect existing, renovated, and new laboratories. The Master Plan also involves the consolidation of administrative buildings and support facilities at the western end of the campus green. Aging, deteriorating, and some temporary buildings would be phased out and replaced by updated facilities. Partial or entire realization of the Master Plan will depend on DoC priorities, government policy decisions, as well as budgetary considerations. The Master Plan represents neither the pre-approval of any individual project nor the pre-approval of the particular needs of specific programs to be accommodated on the campus. The financing of such projects and programs must be addressed within the annual DoC budget process and congressional budget approval. Furthermore, the Master Plan is not a commitment for the agency to build these facilities within a specific timeframe.

3.1.1 Components of the Proposed Action

Below is a summary of the new construction, demolition, and other improvements that DoC would execute under the Master Plan. Figure 3-1 presents the vision for the campus following completion of all components of the Master Plan. Refer to the Master Plan for additional details regarding the scope of facility improvements.

New Construction, Additions, Renovation, and Demolition

- New Research Buildings. This component would involve the construction of new research facilities, linking new facilities to existing renovated facilities, and shaping the campus center and associated green space. New laboratories would provide the flexibility, infrastructure, and controlled environments necessary for advanced research.
- New Management Resources Center. This new facility would provide a central location for consolidation of the existing NIST administrative functions and support facilities. This consolidated facility would replace eight temporary facilities and as a net-zero energy facility would increase energy efficiency and provide for more efficient service for the campus.
- New Childcare Center. This new net-zero energy facility would replace the existing Childcare Center and would be designed to meet the GSA Child Care Center guidelines.
- New Parking Garage. This new three-story garage near Building 81 would provide parking for new research buildings near the campus center.
- Campus Center. Building 24 would be renovated to function as a campus center for employee services and amenities including a fitness center, cafeteria, health center, service desks, meeting rooms, and informal collaboration spaces.

Figure 3-1. Master Plan

- Conference Center and Public Zone. Renovations to Building 1 would involve the addition of a new entry pavilion to accommodate security badging and provide support facilities for the Conference Center. Modifications to the visitor screening and parking configuration would also allow improved utility of the Conference Center at Building 1 for conferences and public forums.
- Building 1 Renovation. This renovation is a continuation of the Building 1 Renovation Program and would involve improvements to the central spine and four of the building's six wings. These improvements would include complete interior renovation, utility system replacement, recladding, and the addition of utility galley space. The initial phase of the Building 1 Renovation Program, renovation of Wings 3 and 6 and a portion of the spine, is nearly complete.
- Building 3 Addition. This project would construct an addition to Building 3 to support antenna laboratories.
- Demolition. This component would involve the demolition of 16 small, temporary, and inefficient buildings throughout the campus resulting in a total of 153,448 GSF of demolition.
- Retained Research Buildings. The David Skaggs Research Center, Katharine Blodgett Gebbie Laboratory, and smaller specialty research buildings, including the Hydrotest Facility, would be retained.

Landscape Plan

The goal of the Landscape Plan is to unify the campus, minimize the irrigation and maintenance of vegetation, and embrace the natural settings. Major design features and themes under the Landscape Plan include the following:

- Development of a Campus Green – A corridor that integrates a range of social spaces and green infrastructure into the physical design.
- Construction of a Central Promenade – A pedestrian promenade that connects Building 1 on the north end of campus all the way to Building 4 on the western edge.
- Achievement of an Activated Campus – Activation of outdoor spaces accomplished by providing for a wider range of social spaces and recreational amenities.
- Development of an Arroyo – An aesthetically pleasing, large vegetated arroyo that also functions to channel, slow, and filter stormwater runoff from buildings and roads.

The Landscape Plan also provides design language that prescribes contemporary design aesthetic that expresses DoC's technological mission and a naturalistic aesthetic that reflects the natural setting with ecologically functional native plantings. Planting guidelines take the setting of a ponderosa pine savannah into consideration and encourage replacement of much of the water-intensive lawns that currently surround the campus buildings with low grasses and clustered evergreens characteristic of savannah vegetation.

Utility Framework Plan

The goal of the Utility Framework Plan is to improve overall energy efficiency and sustainability, and to accommodate the anticipated growth and evolving research needs by replacing aging infrastructure and utility systems. The Utility Framework Plan prescribes the following:

- Extension of the existing Central Utility Plan (CUP) services (e.g., provision of chilled water, steam, and compressed air) to the new and renovated NIST laboratory buildings under the Master Plan;
- Provision of the Childcare Center with either dedicated heating and cooling systems independent of the campus systems or alternately connected to the campus steam and chilled water system;
- Provision of the NOAA Laboratory and the Security Center with dedicated independent heating and cooling systems; and
- Extension of normal electrical power and data communications services from the campus distribution systems.

The Utility Framework Plan also prescribes reduction of energy demand, selection of energy efficient equipment and systems, and provision of a clean renewable energy supply by promoting implementation of the following design strategies:

- Natural Ventilation – Natural and passive ventilation for new and renovated campus buildings (especially the Management Resources Center), except for laboratory components that require more carefully controlled environments.
- Improved Envelope – Improving the cohesion of aesthetics, solar radiation, heat transfer, moisture transfer, visual connection, and natural air movement for new and renovated buildings.
- Lighting Load Reduction – Effective use of natural light and incorporation of highly efficient lighting technologies in the Management Resources Center, the Campus Center, and office areas within research buildings.
- Plug Load Reduction – Use of more efficient equipment and occupant-sensing technologies.
- Air-side Energy Savings – Efficient air distribution, decoupled cooling and ventilation systems for spaces with high sensible loads, and consideration of natural ventilation for the non-lab buildings.

- Water-side Energy Savings – Distribution of cooling energy via water (rather than air) and use of zone-level cooling.
- Solar Energy Systems – Installation of photovoltaic (PV) technologies such as solar panels on top of buildings (especially the Management Resources Building, Childcare Center, and the Campus Center), over the canopy shielding parking areas, and in the Building 25 site following its demolition.

Circulation Plan

The goal of the Circulation Plan is to improve the circulation on campus. Circulation modifications would be implemented in phases, mimicking those of construction. Design proposals include the following:

- Removal of the central roadway between Building 3 and Building 81;
- Reconfiguration of Curie Circle;
- Potential limitation of the use of a segment of Compton Road to bicycle, pedestrian, and emergency traffic use; and
- Reconfiguration of the roadways and screening areas surrounding the Security Center.

The Circulation Plan also describes changes in visitor and delivery screening processes, a new loading dock at the research buildings, and a relocated dock at Building 1. Parking elements of the Circulation Plan include the following:

- Construction of a three-story garage near Building 81 to provide parking for new research buildings near the campus center; and
- Relocation and replacement of an existing parking lot near Building 1 and the Security Center to provide added flexibility in accommodating visitor parking during special events.

In addition to these Circulation Plan elements, the Master Plan suggests replacing the large parking lot near Building 33 with a parking garage to reduce impervious surfaces within the campus.

3.1.2 Phasing of the Master Plan

Phasing for the implementation of the Master Plan involves an integrated approach that meets short-term needs and also provides steps for redevelopment and consolidation of the campus in the future. Phasing for the Master Plan is provided in packages that could be implemented independently of one another.

The Master Plan Steering Committee prioritized research facility improvements, consolidation of the administrative facilities, and modifications that would improve circulation and flow at the campus. Support building project phasing would follow the priority projects. The support building project phasing packages are independent and could be initiated at any time. Refer to Table 3-1 below for an overview of prescribed phasing packages. Phasing diagrams depicting the changes during the implementation of each phasing package are provided in Appendix B.

Prior to initiating any of the phasing packages, DoC would develop plans to ensure that sufficient space is available for construction vehicle parking and material staging areas during that phase. These plans would prioritize the use of previously developed areas such as the sites of demolished buildings and vacated parking lots.

3.2 No-Action Alternative

The No-Action Alternative would not implement the Master Plan. The No-Action Alternative would maintain the present course of action at the campus by continuing ongoing research, management, and maintenance activities. The No-Action Alternative would ultimately result in a site that would no longer support the advanced research requirements of DoC and would render much of the campus obsolete. The No-Action Alternative would not affect the number of employees at the campus. Section 4 (Affected Environment and Environmental Consequences) discusses the potential environmental impacts and consequences of the Proposed Action and the No-Action Alternative. The No-Action Alternative would not meet the purpose and need criteria defined in Section 2.2 (Purpose and Need for Action). As a result, DoC considers the No-Action Alternative to be less desirable than the Proposed Action.

Table 3-1. Summary of Phasing Packages and Associated Major Components under the DoC Master Plan

Phasing Packages	Major Components	Comments
NIST Research Buildings	• Building 1 renovations • Building 3 repurposing	Multi-step process to ensure research continuity.
	• New research buildings (replace Building 2, 2A, 24) • Demolition of Buildings 2 and 2A • Creation of campus center, campus green, and new parking garage • Road/parking modifications	
Campus Center	• Renovation of Building 24 • Covered connection to new research buildings • Pedestrian and parking modifications	Coincides or is combined with creation of new research buildings.
Visitor Center, Parking and Vehicle Screening	• New visitor pavilion (Building 1) • Conference center renovations • Parking lot modification • Addition to Building 51 • Roadway/vehicle screening modifications • Building 1 loading dock relocation	Independent package, could proceed at any time.
Management Resources Center	• New Management Resources Center • Swing space for Building 4 and 5 occupants • Demolition of 10 support buildings • Roadway, parking, and utility yard modifications • Installation of solar collection field	Independent package, could proceed at any time. Completion would free up some space in Building 1.
NOAA Research Building	• New research building or expansion of Building 34 • Roadway/parking modifications • Road/truck maneuvering expansion at Building 22	Independent package, could proceed at any time.
Childcare Center	• New Childcare Center, replacing existing Building 25 • Landscaped play areas • Removal of remainder of center road and relocation • Completion of campus green	Independent package, could proceed at any time. Must be completed if/when future lab buildings are desired.

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4 Affected Environment and Environmental Consequences

4.1 Land Use and Socioeconomics

4.1.1 Land Use and Regional Planning

Affected Environment

Land use planning helps determine the best use for each parcel of land in a municipality with the goals of serving community needs, minimizing land use conflicts, and protecting natural resources. Land use planning may take into account geological, ecological, economic, health, and sociological factors. Proper land use planning can favorably impact development and sustainment costs, traffic congestion and commute times, air pollution, energy consumption, preservation of open space and habitat, equitable distribution of economic resources, and the sense of community. Community sustainability requires proper land use planning to create and maintain livable environments.

Local government entities operating in the Boulder region provide planning and development services. These include the Boulder County Land Use Planning Division and the City of Boulder Planning Board.

A number of planning initiatives set forth guidelines for development and growth within the region:

- Boulder County Comprehensive Plan (BCCP). The goal of the BCCP is to direct future land use decisions toward the following goals: channeling growth to municipalities, protecting agricultural lands, and preserving environmental and natural resources. The 1996 Second Edition of the BCCP was updated on July 14, 2015.
- Boulder Valley Comprehensive Plan (BVCP). The BVCP is a joint initiative between the City of Boulder and Boulder County to direct future planning and guide decisions about growth and development. Updates to the BVCP are scheduled for completion in 2016.
- Boulder County Countywide Coordinated Development Plan (Super IGA). The Super IGA combines all of the comprehensive planning agreements within Boulder County and coordinates interests such as planning and management.

There are two main land use designations on the DoC Boulder Laboratories Campus, according to the BVCP. The largest is *Public Use*. This refers to a variety of public and private nonprofit uses that provide a community service, and also includes government laboratories (City of Boulder, 2010).

The remainder of the property is designated as two different types of *Open Space*. Research Zone 1 on Kohler Mesa is designated as *Open Space, Other*. This refers to public and private land that is protected through various preservation methods. The remainder is designated as *Open Space, Developmental Rights*.

Two agreements were signed in the 1990s that shaped the future of development on the campus. The first, the April 1995 Programmatic Agreement with the Tribes, was extended to the Medicine Wheel Coalition and federally recognized American Tribes. It provided an irrevocable easement that establishes the Protected Area, an undeveloped area along the eastern side of the campus. It established responsibilities and rights to the City of Boulder Open Space and Mountain Parks Department (OSMP) to manage the Protected Area along with NIST. The area functions as a natural buffer between the campus and the neighborhood, but is not a conservation easement.

The second agreement, the 1998 First Amended MOA between the City of Boulder, NIST, and DoC, updated a previous MOA signed on December 8, 1993. It addressed DoC's and NIST's present and future research needs and the City's interests in preserving the open space on campus that does not fall within the Protected Area, and providing access for public use and enjoyment. The MOA defines development zones, research zones and protected areas and describes how NIST and the City of Boulder will work together

regarding any developments in the protected areas and the research zones. The MOA also sets limits on campus total square footage, parking, building heights, and view to Kohler Mesa (formerly known as Long Mesa). Refer to the Master Plan for an overview of the land use provisions (DoC, 2017).

While there are three designated research zones described in the MOA, two of them are restricted in their use. The largest of the three, Research Zone 3, is also designated as the "Development Zone" where additional buildings, parking, and roadways should be concentrated. The Development Zone can be grouped into three districts based on common usage and physical characteristics (Figure 4-1). The system of roads within the campus promotes the separation of the districts, further emphasized by changes in grade. Each district has a distinct appearance and the feeling of connectivity between them is lacking. The districts are described as follows:

- NIST Laboratory District. This cluster of buildings is located near Broadway. The centerpieces of this district are the original laboratories Building 1 (Radio Building) and Building 2 (Cryogenic Building), as well as the recently constructed Building 81 (Katharine Blodgett Gebbie Laboratory).
- Support District. This district is to the west on the campus. Buildings include Building 42 (CUP), administration and support buildings, and a few lab functions. Each building has a parking area here.
- NOAA District. This roughly triangular district consists of the NOAA buildings and parking area (DoC, 2017).

Properties adjacent to the north, east, and south campus boundaries have a land use designation of *Low Density Residential* (RL-1), defined as two to six units per acre. The campus is bordered to the west by land designated as *Open Space, Acquired*.

Environmental Consequences – Proposed Action

Implementation of the Master Plan would create an organized and cohesive campus identity by replacing and consolidating aged, small, and scattered buildings. The Master Plan would include a number of open space zones, each with distinctive features and functions that would characterize and define the areas. The Campus Green and Campus Walk would provide connectivity between various areas on campus and would provide for a physical organization for new buildings. Through this improved land use, the Master Plan would allow for better connectivity, provide a stronger campus identity, and encourage collaboration amongst employees.

The Master Plan would not impact land use designations on the campus and would be consistent with the current institutional land use on the campus. The preservation of the open space and protected areas on campus would continue.

The Master Plan would have no impacts on zoning or regional planning outside the campus. The campus is expected to remain consistent with the county planning and zoning regulations.

Environmental Consequences – No-Action Alternative

The No-Action Alternative would not impact land use.

4.1.2 Social and Economic Resources

Affected Environment

Social Resources

Social resources consist of elements of the environment integral to personal and community dynamics, including population, housing, education, and open spaces. Access to these resources is essential to maintaining sustainable communities.

A subset of social resources is environmental justice. Environmental justice considers sensitive populations, such as children, minorities, and low-income communities. Sensitive populations are identified in two Executive Orders (EOs):

- EO 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations*, serves to avoid the disproportionate placement of adverse environmental, economic, social, or health impacts from federal actions and policies on minority and low-income populations.
- EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, states that federal agencies will identify and address environmental health and safety risks from their activities, policies, or programs that may disproportionately affect children.

The Denver-Aurora-Boulder Combined Statistical Area (CSA) is home to over 61% of Colorado's resident population although it covers less than 13% of the state's total land area. It is the sixteenth most populous of the 166 CSAs in the United States (DoC, 2017).

The City of Boulder has a population of about 100,000, with a projected increase to 123,000 by 2040 (City of Boulder, 2015a). Residents are considerably younger than the county, state, and national rates, with the median age of the city at 29.9 years. The population of residents over 65 (10.2%) is also small compared to the state (12.7%) and national rates (14.5%) (BEC, 2015).

The Boulder Valley School District has 56 schools, with approximately 30,000 students and 4,000 employees. Residents of the City of Boulder tend to be highly educated. According to the Boulder Economic Council, the percentage of residents with a bachelor's degree or higher education attainment is almost twice that of national levels (DoC, 2017).

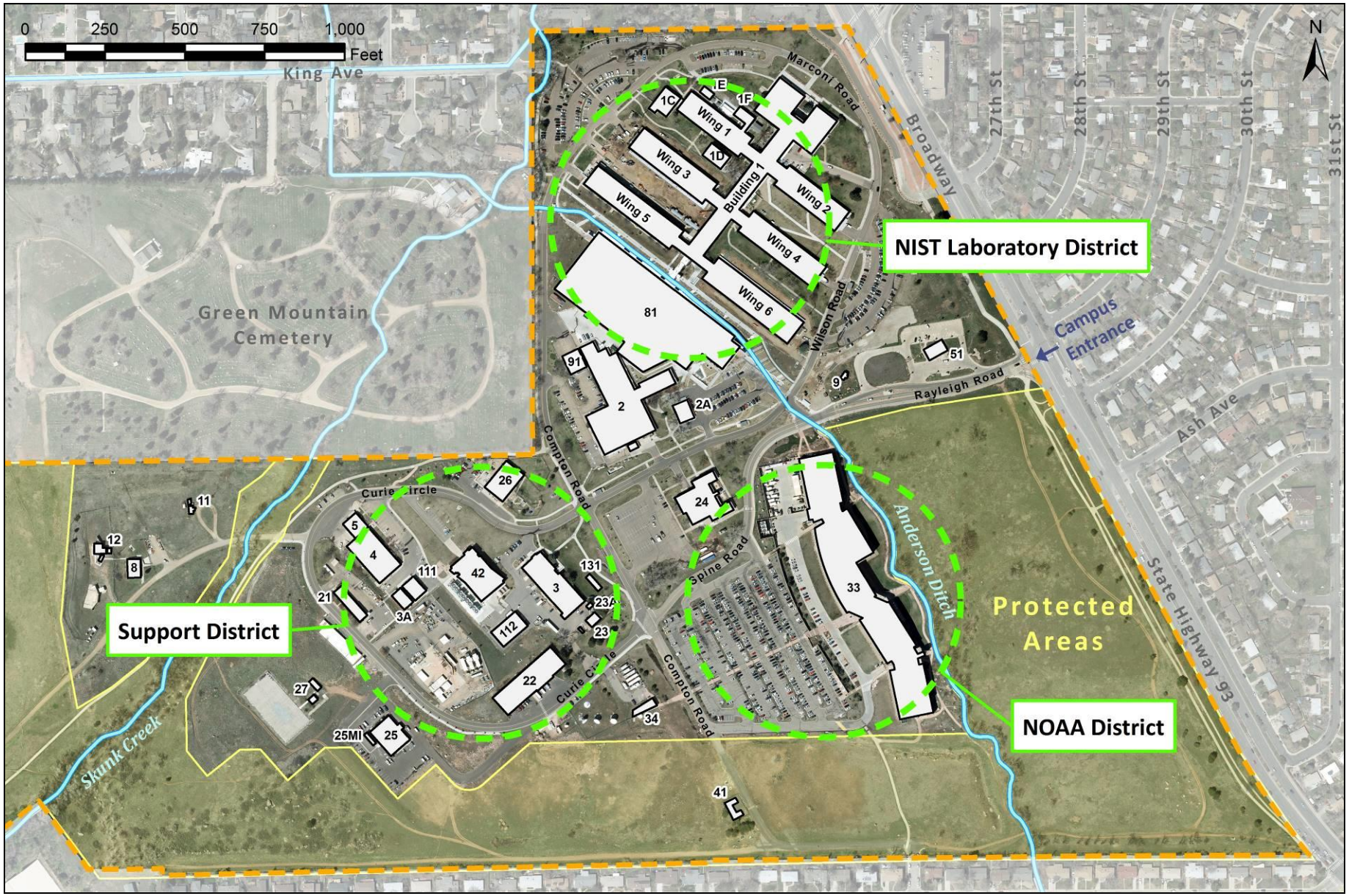

Figure 4-1. Development Zone Districts at the DoC Boulder Laboratories Campus

Housing availability for Boulder City and County is relatively low, with lower vacancy rates (7%) than for the state or the nation (around 11%). The 2015 Boulder Community Profile indicates 51% renter-occupied units, in comparison to the county, state, and national rates of 35%-37%. This increased rate of rental units is likely due to the number of University of Colorado Boulder students living in rental units (DoC, 2017).

Sensitive populations, such as children and low-income minority populations, are present within the city. However, prevalence is significantly lower in the city than in Boulder County and the state as a whole (U.S. Census Bureau, 2010).

Economic Resources

The City of Boulder Department of Community Planning and Sustainability estimates that there were 98,510 jobs in the city as of 2014. About 45% of these jobs are held by city residents whereas 55% are held by commuters. Trends indicate that the city will have about 117,000 jobs by 2035 (City of Boulder, 2015a).

The unemployment rate for Boulder County has steadily declined from 7.8% in 2009 (BEC, 2015) to 3.8% in 2015 (City of Boulder, 2015a). The city and county have unemployment rates that are lower than those of the CSA, the state, and the nation (DoC, 2017).

The per capita income for city residents is almost 22% higher than that of the state and 35% higher than the national levels. The median household income for city residents is higher than that of the nation, and the percentage of households earning $200,000 or more per year is double that of the national levels (DoC, 2017).

NIST and NOAA are major employers within the City of Boulder (BEC, 2015). In 2015, NOAA was one of the top ten largest employers in Boulder (City of Boulder, 2015a). The University of Colorado Boulder's Business Research Division conducted a review in 2003 on the economic benefits of the DoC laboratories (including NIST, NOAA and NTIA/ITS) to the City of Boulder, Boulder County, and Colorado. It concluded that the federal labs provide strong economic benefits to the city, county, and state. For the period 2001 to 2005, this study estimated that the DoC laboratories provide a net economic benefit of $340 million to the city; $1.3 billion to the county; and $2.0 billion to the state. The majority of these benefits were derived from employee wages and related indirect benefits (CU Boulder, 2003). In 2012, the federally funded labs contributed $743.2 million and employed nearly 3,600 people in the City of Boulder and Boulder County, including NIST and NOAA (BEC, 2016).

Environmental Consequences – Proposed Action

Implementation of the Master Plan would allow for continued advancement of measurement standards and technology, thereby benefitting the national economy. Improvement of research facilities would facilitate achievement of NIST's mission to promote industrial competitiveness on a national level.

The Master Plan would have minor long-term economic benefits. The proposed campus reorganization and updated facilities would provide an economic benefit by improving productivity and available resources at the DoC Boulder Laboratories Campus. The increase in staff of approximately 200 over the projected 20-year period would marginally improve employment levels and would not displace existing jobs in Boulder County.

Implementation of the Master Plan would result in temporary minor impacts on the population and the availability of housing, due to construction workers who might temporarily relocate to the area. During construction of the Master Plan elements, construction jobs and related incidentals would temporarily add to the local economy.

The Master Plan would have minimal impacts on population, housing, and education trends in the area. The projected increase of approximately 200 staff over the course of 20 years is considered minor and would not negatively impact social or economic resources in the area. Any staff increases would likely benefit the local economy and job market.

The City of Boulder, including the areas immediately surrounding the campus, has relatively low proportions of children, minority, and low-income populations. Therefore, the Master Plan would not result in disproportional impacts on sensitive populations.

Environmental Consequences – No-Action Alternative

The No-Action Alternative would have no effects on the population, including sensitive populations. Jobs and population growth would continue as projected in the region. The No-Action Alternative would result in no improvements to employment or income in the area.

4.1.3 Open Space

Affected Environment

Open space areas are an integral feature of the City of Boulder as well as the DoC Boulder Laboratories Campus. Open space surrounding the campus includes Tippitt Open Space to the north and Boulder Mountain Park along the western border. These areas are popular for recreational activities, including hiking and biking.

The City of Boulder's open spaces are managed by the OSMP. The Department oversees more than 45,000 acres, including 151 miles of trails. These areas are preserved for "…scenic, agricultural and buffer value." It estimates annual visitation at 5.3 million per year (City of Boulder, 2016a).

Open space covers about half of the land on campus, approximately 104 acres, and includes areas protected under agreement, as discussed below. The protected area begins at Broadway in front of Building 33 (David Skaggs Research Center) and continues across the southern section and western third of campus. A secondary research area is included in this area at the top of Kohler Mesa.

Trails and open space on the campus are extensions of the trail and recreation system off campus. Trails from both Boulder Mountain Park and Tippitt Open Space cross the campus and are maintained by OSMP. Refer to Section 4.1.4 (Trails) for additional information.

Two agreements established protected areas on campus: the April 1995 Programmatic Agreement with the Tribes, and the 1998 First Amended MOA. Refer to Section 4.1.1 (Land Use and Regional Planning) for more information. These agreements defined protected areas, development zones, and research zones. NIST and the City of Boulder collaborate on preserving these areas.

Environmental Consequences – Proposed Action

The Master Plan would not impact open space, protected areas, or recreational areas. Campus open space would be maintained in a natural state.

The Master Plan would not include any development in the Protected Area. Any proposed developments would occur only in the Development Zone and would comply with the above referenced agreements.

Temporary construction-related noise levels would be minor and would not affect the recreational use of nearby parks and open spaces; refer to Section 4.13 (Noise Levels) for more information. Air emissions from operations and construction activities would not be expected to affect ambient air quality within nearby parks and open spaces; refer to Section 4.9 (Air Quality) for more information.

Environmental Consequences – No-Action Alternative

The No-Action Alternative would not affect open spaces on, or in the vicinity of, the DoC Boulder Laboratories Campus.

4.1.4 Trails

Affected Environment

The campus features a network of trails that are integrated into the trail system that is maintained by OSMP. Refer to Figure 4-2 for an illustration of the trail network (City of Boulder, 2016b). This network connects to trails in the adjacent off-campus recreation areas – Boulder Mountain Park to the west and Tippitt Open Space to the north.

Kusch Road, a NIST service road, is a soft surface hiking trail that passes through the Protected Area and connects the campus road system to Kohler Mesa and Boulder Mountain Park. Extending off Kusch Road is Four Pines Trail, also a soft surface hiking trail, which joins Boulder Mountain Park to Tippitt Open Space.

The City of Boulder also maintains a public designated bicycle route throughout the campus that is part of a city-wide system. Most of the roads on campus are part of this network, with the route beginning at the Broadway entrance. It continues along Rayleigh Road and Curie Circle. At the connection between Kusch Road and Curie Circle, the bicycle route then connects to the Skunk Canyon Path, a city multi-use path.

The city maintains two multi-use paths on campus that are designated for non-motorized users such as pedestrians and bicyclists. One path follows along Broadway at the eastern border of the campus and is separated from the street. It connects to the designated bicycle route at the campus entrance and continues along Broadway in either direction. The second multi-use path, Skunk Canyon Path, follows Skunk Creek and connects to the designated bicycle route at Curie Circle.

A Safety Study was conducted in 2014 to address bicycle/vehicle traffic conflict at the campus entrance. The study presented solutions that would alleviate collisions and near misses at this intersection (DoC, 2017). DoC and OSMP are collaborating on a project to create a designated environmentally sustainable trail system on campus. Elements of this project include establishing trails between Skunk Creek and Broadway, closing and restoring undesignated trails, constructing new trails to connect existing trails and multi-use paths, and working with the Anderson Ditch Company to design and install a crossing (DoC, 2017).

Environmental Consequences – Proposed Action

The Master Plan would not impact public trails located within the Protected Area on campus, as per the agreements described earlier; refer to Section 4.1.1 (Land Use and Regional Planning). Trails leading to off-campus recreation areas, as well as multi-use trails and the designated bicycle route areas, would remain the same or would be improved.

The Master Plan is designed to improve circulation on campus for pedestrians and bicyclists. In addition to creating more direct connections and better flow, the Master Plan promotes development of a cohesive wayfinding plan to improve visibility and clarity of signage, which would improve navigation and safety of the trail network.

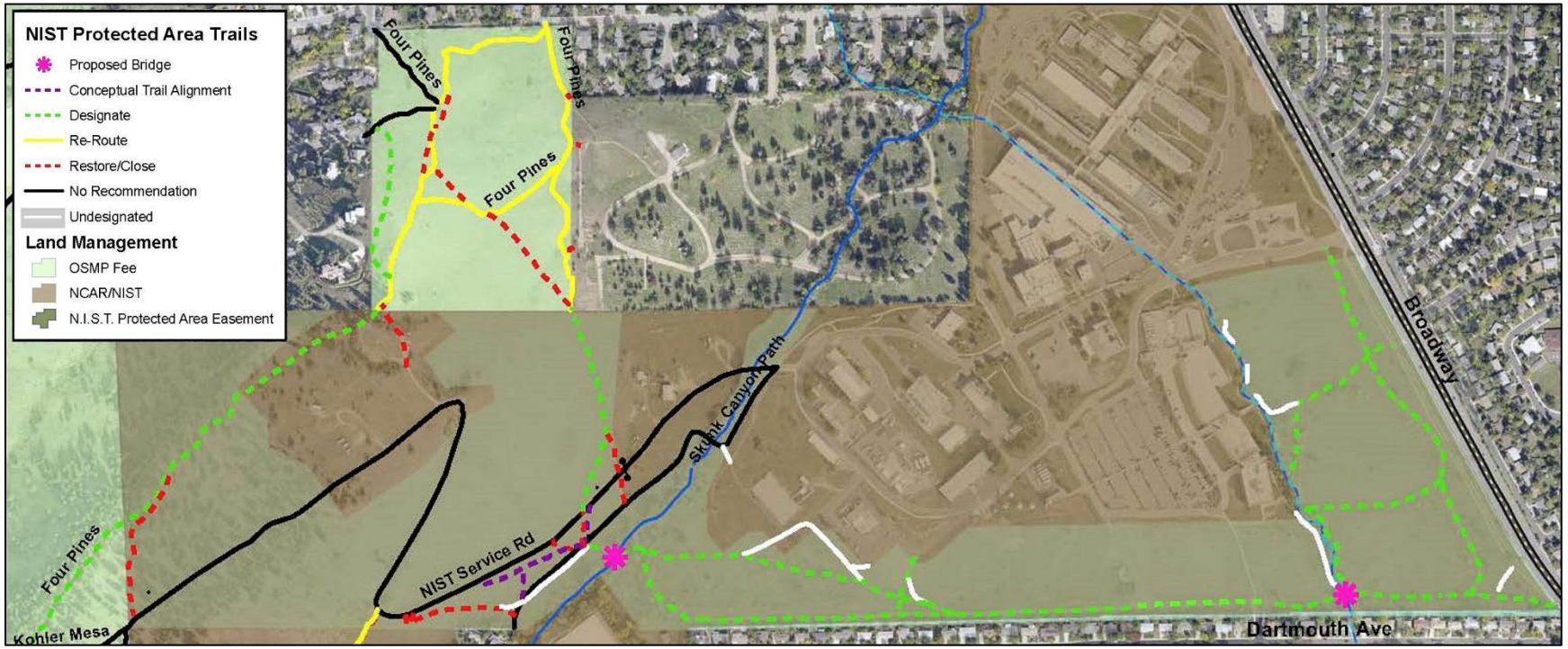

Figure 4-2. City of Boulder Existing and Proposed Trails

The Master Plan would affect the designated bicycle route within the campus by removing a portion of Curie Circle that connects to Rayleigh Road, essentially replacing it with a pedestrian promenade. This promenade would be accessible to bicyclists but would not be part of the designated bicycle route, which would still lead to the campus entrance via Curie Circle, Spine Road, and Rayleigh Road. In addition to these Master Plan elements, OSMP is considering an undesignated, unpaved path along the southern campus boundary to provide an additional alternative bicycle route leading to Broadway.

The Master Plan recommends reconfiguration of the bicycle path along Broadway near the campus entrance to encourage cyclists to slow down and to create a better line of sight for motorists. The final alignment would be developed in consultation with the City of Boulder. Some of these changes could include reconfiguration of the path, added signage, or signalization at the intersection.

During construction, trails may be temporarily closed or rerouted for the duration of the project. Once construction is completed, the usability of the trails would return to pre-construction status.

Environmental Consequences – No-Action Alternative

The No-Action Alternative would not affect trails on or in the vicinity of the DoC Boulder Laboratories Campus.

4.2 Biological Resources

4.2.1 Vegetation

Affected Environment

Vegetation performs the following important functions:

- Slows the flow of stormwater runoff, allowing water to soak into the ground to replenish aquifers;
- Helps maintain the water quality of nearby waterways by filtering runoff and removing harmful sediment and pollutants;

- Prevents erosion by reducing the impact of rain on soil and by holding soil in position with roots;
- Shades paved surfaces, reducing heat island effect and stormwater runoff temperatures that affect aquatic habitats; and
- Provides habitat for a variety of organisms.

A diversity of plant species is necessary to maintain a functioning habitat or ecosystem. Plant species within a particular ecosystem may compete with one another for water, light, and overall sustenance. Therefore, the loss of a particular species may negatively affect an ecosystem. The Endangered Species Act was enacted in 1973 to protect species in danger of extinction. This act requires federal agencies to ensure that their actions will not jeopardize the continued existence of any threatened or endangered species or result in the destruction or adverse modification of the critical habitat associated with these species.

In 1999, EO 13112 was signed establishing the National Invasive Species Council. EO 13112 encourages federal efforts to minimize the harm to the economy, the environment, and human health caused by invasive species. Section 6-6-2 of the City of Boulder Municipal Code includes regulations regarding the removal of dead, diseased, or dangerous trees and grants the city the authority to order the removal of said vegetation.

Vegetation on the DoC Boulder Laboratories Campus was severely disturbed during the mid-1950s and much of the previously native vegetation at the campus was replaced with invasive species. A survey conducted in the 1990s revealed approximately 1,500 species of vascular plants in the Boulder region and nearly 430 species (representing 77 families) on the campus. During the 1990s, the majority of the vegetation at the campus consisted of non-native grasses and forbs including Kentucky bluegrass, cheat grass, orchard grass, and crested wheatgrass. Native vegetation on the campus included grasses such as switchgrass, Canada wild rye, and western wheatgrass and comprised less than 1% of the vegetative cover at the campus. Kohler Mesa primarily served as a transitional space for native mountain species including ponderosa pines and plants including big bluestem, pasture sage, Canada bluegrass, prairie dropseed, needle-and-thread, cinquefoil, prickly pear, and rose (GSA, 1996).

As part of this EA, DoC consulted with the USFWS to obtain records of rare, threatened, or endangered species on the campus. The Official Species List, provided by the Colorado Ecological Services Field Office, indicates that the following species of threatened plants may be present on the campus: Colorado butterfly plant, Ute ladies'-tresses, and western prairie fringed orchid (Appendix A). According to the Colorado Rare Plant Guide, these three plant species are threatened throughout their range (Colorado Natural Heritage Program, 2014). No endangered flora is expected to occur on the campus.

Vegetative buffers are present along Anderson Ditch and Skunk Creek. A freshwater forested/shrub wetland is also located at Skunk Creek. Refer to Section 4.4.1 (Surface Water) and Section 4.4.3 (Wetlands), respectively, for additional information.

The emerald ash borer (EAB), a federally quarantined, invasive tree pest responsible for the death or decline of more than 50 million ash trees in 25 states, has recently been confirmed within the City of Boulder. In order to prevent the spread of the EAB, the Colorado Department of Agriculture has enforced quarantine on the movement of ash tree products and related firewood out of Boulder County. According to the city's website, between 2014 and 2015, approximately 200 declining ash trees were removed from public property in the City. An additional 50 ash trees are planned to be removed and replaced on public properties throughout the City during 2016 (Emerald Ash Borer Information Network, 2016). DoC has identified a large number of ash trees on the campus (notably lining Anderson Ditch in front of the David Skaggs Research Center) and plans to preserve the deciduous tree population by diversifying the tree canopy.

Bark beetles, including the mountain pine beetle and *Ips* beetle, have historically caused devastating impacts on ponderosa pines, lodgepole pines, and five-needle pines throughout Colorado. In recent years, however, the epidemic has subsided (Colorado State University, 2017). Healthy, uncrowded ponderosa pine forests create a suite of conditions that are unfavorable to infestation by bark beetles (Boulder County, 2017a).

Environmental Consequences – Proposed Action

Implementation of the Master Plan would minimize impacts on vegetation by consolidating facilities within previously developed areas. Construction activities associated with the implementation of the Master Plan, especially construction of the proposed NOAA expansion and the Childcare Center, would impact vegetation at the campus. Native grasses and similar vegetative species, however, would be re-seeded in the disturbed areas following completion of construction activities to the extent feasible. The size of vegetative areas that would be disturbed varies by Master Plan phasing package. Some of the phasing packages add vegetated pervious surface while others reduce it. Refer to Section 4.5.3 (Stormwater Management) for additional information regarding pervious surface area at the campus.

Implementation of the Master Plan is not expected to impact rare, threatened, or endangered plant species or vegetation in stream buffers or wetlands on the campus because areas proposed for development predominantly consist of non-native grasses and forbs.

The Master Plan prescribes replacement of non-native invasive vegetative species with native species and planting additional trees to provide cover and shade throughout the campus. A variety of native flora species would also be planted at the edges and open spaces and in the center of the campus. Under the

Master Plan, water-intensive plants throughout the campus would be replaced by low-maintenance grasses, evergreens, and other native vegetation to mimic native savannah vegetation. As such, vegetation prescribed under the Master Plan would be more drought-resistant and require less irrigation than the existing non-native vegetation. DoC would manage the ponderosa pine stands using established practices to prevent infestation by bark beetles. These practices could include appropriately spacing and regularly thinning stands to ensure trees remain adequately spaced; surveying for and removing infested trees; and limiting tree cutting during beetle flights in spring and fall. If tree cutting during beetle flight season is necessary, green logs should not be stacked near living trees and freshly cut material should be removed from the site expediently (Boulder County, 2017b). The Master Plan also recommends diversifying the canopy by gradually removing ash trees, thus eliminating habitat for the invasive EAB, and replacing them with other native deciduous species (DoC, 2017). Hardwood tree removal would be managed in such a way as to prevent the spread of the EAB.

Under the Master Plan, a pedestrian promenade would be the basis for connecting Building 1 on the north end of the campus to the new Management Resources Center on the western edge of the campus. Establishment of the promenade would include installation of native vegetation and a large tree-covered plaza. DoC would also install a vegetated arroyo, which would function as an attractive vegetated area and as a stormwater management best management practice (BMP), along this pedestrian promenade.

Environmental Consequences – No-Action Alternative

The No-Action Alternative would not result in the disturbance of vegetated areas. However, the potential to further improve the existing landscaped areas in accordance with EO 13112 via removal of invasive species and replacement with native species would not be realized under the No-Action Alternative.

4.2.2 Wildlife

Affected Environment

According to the U.S. Fish & Wildlife Service, all living things are part of a complex, often delicately balanced network, with a great diversity of species that rely upon one another for survival. Wildlife not only plays a significant role in maintaining the equilibrium of an ecosystem, but also provides an effective way to assess the quality of the environment, and provides benefits for medicine, agriculture, economics, and other resources. According to the U.S. Congress, threatened and endangered species of wildlife are of "esthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people." As a result of the recognition of the vital role wildlife plays in supporting functional ecosystems, U.S. Congress enacted the Endangered Species Act of 1973 to protect wildlife from extinction and in turn, protect natural ecosystems as a whole.

The Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) afford protection to birds. Any intentional or unintentional activity that results in the killing of migratory birds, including eagles, is unlawful unless permitted by the USFWS. The Fish and Wildlife Conservation Act was enacted in 1980 to authorize financial and technical assistance to the States for the development, revision, and implementation of conservation plans and programs for nongame fish and wildlife. The 1998 amendment to the Fish and Wildlife Conservation Act mandated that the USFWS "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act (ESA)." In response to this mandate, USFWS published the 2008 *Birds of Conservation Concern* report, which includes listings of bird species of conservation concern throughout the Nation, including some that are not otherwise protected under the MBTA of 1918 (USFWS, 2015). Colorado Parks and Wildlife submitted and received approval from the USFWS to implement the State Wildlife Action Plan (SWAP). The SWAP identifies the top priority species and habitats in the state with the highest demand for conservation efforts. The SWAP classifies species within the state into Tier 1 and Tier 2 categories, depending upon conservation priority (Tier 1 being the highest priority).

Due to recent and severe declines in pollinators (such as honeybees) and the potential for associated devastating effects on ecosystems and the economy, President Barack Obama issued a Presidential Memorandum on June 20, 2014 requiring that executive departments and agencies (including DoC) take immediate measures to support pollinators (The White House, 2014). Prescribed measures include planting pollinator-friendly vegetation and increasing flower diversity in plantings, limiting mowing practices, and avoiding the use of pesticides in sensitive pollinator habitats.

As part of this EA, DoC requested an Official Species List from USFWS to fulfill the requirement under section 7(c) of the ESA. The list revealed that threatened or endangered species, and migratory birds, as well as Tier 1 and Tier 2 conservation priority species may be present on the campus (USFWS, 2016a). Refer to Appendix A for correspondence with USFWS, including the list of migratory bird species potentially present on the campus. Refer to Table 4-1 for a list of state and federally listed threatened and endangered species that have the potential to be present on the campus or otherwise be impacted by activities on the campus.

Vegetative buffers along Anderson Ditch and Skunk Creek and a freshwater forested/shrub wetland in the southwestern area of the campus may provide habitat for various wildlife species on the campus. The area of Skunk Creek exiting the campus is potential habitat for Preble's Meadow Jumping Mouse, though tracking through the City of Boulder has not yet confirmed the species in this area (Swanson, 2016). Skunk Creek is shallow and ephemeral, indicating that the creek likely does not provide habitat for a diverse wildlife assemblage

(Carpenter and Brown, 2004). Refer to Section 4.4.1 (Surface Water) and Section 4.4.3 (Wetlands), respectively, of this report for additional information.

Table 4-1. Threatened and Endangered Species that could be Present or Otherwise Impacted by Activities on the Campus

Species	Conservation Status
Birds	
Mexican spotted owl (*Strix occidentalis lucida*)	Federally threatened; state threatened
Piping plover (*Charadrius melodus*)	Federally threatened; state threatened
Least tern (*Sternula antillarum*)	Federally endangered; state endangered
Whooping crane (*Grus Americana*)	Federally endangered; state endangered
Burrowing owl (*Athene cunicularia*)	State threatened
Amphibians	
Boreal toad (*Anaxyrus boreas*)	State endangered
Fishes	
Greenback cutthroat trout (*Oncorhynchus clarkia stomias*)	Federally threatened; state threatened
Common shiner (*Luxilus cornutus*)	State threatened
Pallid sturgeon (*Scaphirhynchus albus*)	Federally endangered; state endangered
Mammals	
Preble's meadow jumping mouse (*Zapus hudsonius preblei*)	Federally threatened; state threatened
Canada lynx (*Lynx Canadensis*)	Federally threatened; state endangered

The western area of the campus is located within the "Group Two Natural Ecosystem Zone", which is considered important in providing ecosystem connections and buffers. Wildlife corridors for the open space parks are located to the west of the campus, but are not located on the campus.

The USFWS conducted faunal surveys in 1992 on the campus which included Skunk Creek, Anderson Ditch, and areas adjacent to Kohler Mesa. According to the surveys, yellow-bellied marmots, black-tailed prairie dogs, cottontail rabbits, mice, and shrews were common within the campus; coyote, bobcat, and red fox were uncommon; and mountain lion, black bear, and beaver were likely rare transients in the campus (GSA, 1996). More recently, campus staff occasionally observe mountain lions and bobcats near the western edge of the developed portion of campus, while coyotes, foxes, and raptors are routinely seen foraging within the protected area near the prairie dog colony (discussed below). Other wildlife frequently seen around the developed portion of campus include deer, rabbits, raccoons, snakes, and black bears. City staff indicate that beaver, yellow-bellied marmot, and leopard frogs are now less common than in previous years (City of Boulder, 2016i).

An extensive black-tailed prairie dog habitat is present within the protected area south of the NOAA facilities (Figure 4-3). Prairie dogs are ecosystem engineers that change the land to make it safer and more comfortable for their family groups. Prairie dog-modified landscapes provide food and shelter for many native wildlife species, including burrowing owls, black-footed ferrets, hawks, and eagles. The Colorado Natural Heritage Program lists the black-tailed prairie dog as vulnerable to extirpation and Colorado Parks and Wildlife considers it a state special concern species (City of Boulder, 2016c). In 2005, the Boulder City Council adopted a final wildlife protection ordinance that emphasizes minimization of human-prairie dog conflicts through non-lethal, non-removal methods.

The City of Boulder's OSMP has identified two active golden eagle nests slightly more than one mile west of the campus. These are alternative nesting sites for the same pair of eagles. OSMP also identified two peregrine falcon nests (separate pairs of falcons) and one prairie falcon nest approximately one mile west of the campus. Raptors are known to occasionally roost and forage within the campus, including within the prairie dog colony.

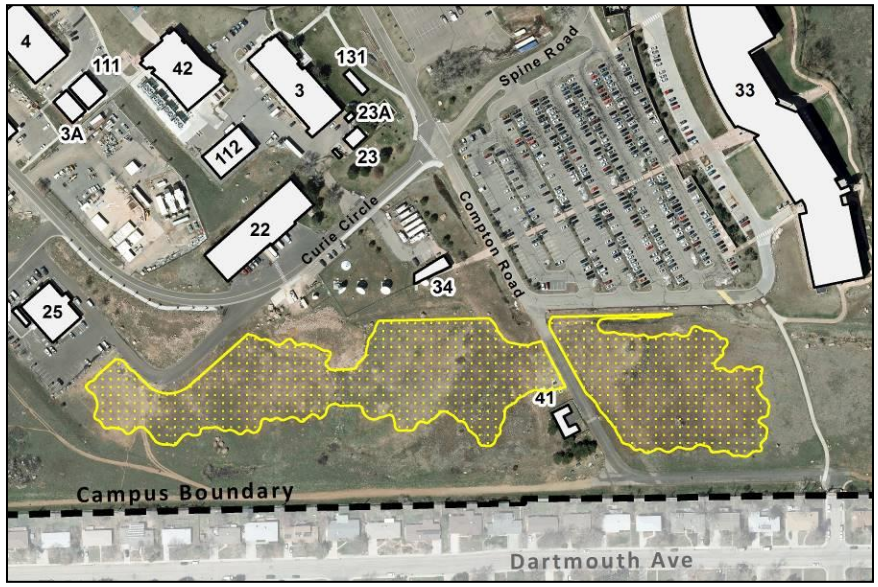

Figure 4-3. Prairie Dog Habitat at the DoC Boulder Laboratories Campus

Environmental Consequences – Proposed Action

Implementation of the Master Plan could result in minor impacts on wildlife. The temporary reduction in grassy vegetated areas discussed in Section 4.2.1 (Vegetation) represents a minor reduction in potential wildlife and pollinator habitat. The Master Plan aims to minimize impacts on wildlife by consolidating facilities within previously developed areas. Much of the affected grassy areas to be disturbed under the Master Plan are routinely landscaped and offer less foraging and habitat value than other vegetated areas (e.g., large contiguous tracts and stream buffers) around the campus; however, construction of the proposed Childcare Center in an undeveloped portion of the western area of the campus could have a slightly higher potential for impacts on wildlife habitat. The size of vegetated areas that would be disturbed varies by Master Plan phasing package; some of the phasing packages add vegetated pervious surface while others reduce it. Refer to Section 4.5.3 (Stormwater Management) for additional information regarding pervious surface area at the campus.

The Master Plan would avoid disturbance within the boundaries of the prairie dog colony located in the protected area. However, certain Master Plan elements would be located in close proximity to the colony (e.g., the NOAA expansion of Building 34 and the demolition of Building 25 and the associated parking lot). Given that prairie dog colonies are dynamic and colony growth on an annual basis is common, the colony boundaries could expand over the course of the Master Plan. Prior to implementing these projects, DoC would reassess the colony boundaries to determine whether a potential conflict exists with the planned development. If such a conflict exists, DoC would follow the decision-making process outlined in the city's prairie dog protection ordinance to emphasize the use of non-lethal, non-removal methods for resolving the conflict.

As discussed in Section 4.2.1 (Vegetation), non-native vegetation throughout the campus would be replaced by native grasses, evergreens, and other native vegetation to mimic native savannah vegetation. In addition, the Master Plan calls for planting additional trees to provide cover and shade throughout the campus. Replacement of non-native plants with native vegetation and planting of additional trees would ultimately improve wildlife and pollinator habitat. DoC would manage the ponderosa pine stands using established practices to prevent infestation by bark beetles.

While minimal tree removal is anticipated for construction activities associated with the Master Plan, the removal of some trees may temporarily affect migratory bird populations and pollinators on the campus. Trees to be cleared may need to be surveyed to comply with the MBTA (16 U.S.C. §703). DoC would verify that no bird eggs and/or young protected under the MBTA are present. If DoC determines that eggs and/or young are present, tree clearing would proceed only after it is verified that the young have fledged. Ash trees removed from the property would be managed to prevent the spread of the EAB.

Noise emissions from the construction activities conducted under the Master Plan may disturb wildlife in and around the project sites, including nesting migratory birds; however, these impacts would be temporary. As explained in Section 4.13 (Noise Levels), after the completion of construction, negligible changes in operational noise levels on the campus would be expected due to minor upgrades and expansions to campus facilities. Construction and operational activities would comply with all applicable local, state, and federal noise regulations.

Though impacts on rare, threatened, or endangered species are possible associated with implementation of the Master Plan, they are unlikely since there are no critical habitats within the project areas. Also, since the Master Plan does not involve activities within surface waters, downstream impacts on the following threatened and endangered species are not anticipated: least tern, piping plover, whooping crane, and pallid sturgeon. If, during the course of planning or execution of any of the project elements in the Master Plan, threatened or endangered species are discovered on the campus, DoC would consult with USFWS and implement appropriate mitigation measures.

As discussed in Section 4.4.1 (Surface Water) and Section 4.4.3 (Wetlands), implementation of the Master Plan could result in minor impacts on campus streams and wetlands due to runoff from construction sites. Runoff to streams could include sediment or other contaminants, which have the potential to adversely impact aquatic organisms that dwell in the streams. As discussed in Section 4.5.3 (Stormwater Management), DoC would implement stormwater management and pollution prevention measures during construction to reduce impacts on aquatic species that inhabit the campus streams.

Environmental Consequences – No-Action Alternative

The No-Action Alternative would not result in any impacts on wildlife or habitat. The potential to improve the campus by enhancing habitats for native wildlife and pollinators, however, would also not be realized under the No-Action Alternative.

4.3 Topography, Geology, and Soils

4.3.1 Topography

Affected Environment

Topography indicates the relative position and elevation of natural and man-made features within an area. Changes to the topography of an area can affect surface and subsurface water pathways and quantities, result in increased sedimentation, impact stormwater runoff, and ultimately affect water quality in nearby waterways and wetlands. Topography can also influence viewscape, landscape, noise trespass, and land use.

The eastern edge of the DoC Boulder Laboratories Campus is located at an elevation of 5,405 feet, with two low points at the northeast and southeast

corners of the campus along Broadway where the elevation is 5,400 feet. The slope increases rapidly to the west of Skunk Creek, rising along Kohler Mesa to an elevation of 5,910 feet (DoC, 2017). The Flatirons formations are approximately 1.5 miles west of the central area of development at the campus.

Although the developed portion of the campus is generally gently sloping, there is a slight change in topography to the west of Curie Circle where the proposed Childcare Center would be constructed under the Master Plan. A portion of this site has a steep rising slope of approximately 20 to 30%. The site of the proposed NOAA expansion is in an area where the ground drops away from the site at a slope of approximately 10 to 20%, leading down to a densely vegetated swale.

Figure 4-4 illustrates the topographic contours in the vicinity of the campus. Refer to Exhibit 112 in the Master Plan for an illustration of the percent slope.

Environmental Consequences – Proposed Action

Implementation of the Master Plan would result in localized changes to the site topography. These impacts would be minor, since construction would predominantly occur in developed areas. However, grading and excavating for the construction of new facilities including the new Childcare Center may be necessary, and fill may be required to stabilize the site for the NOAA expansion under the Master Plan. Implementation of the Master Plan may cause minor changes in drainage patterns in the immediate vicinity of the new facilities and may trigger an application for, and coverage by, a city-issued grading permit. The Master Plan would result in no impacts on Kohler Mesa. For a discussion on the impacts of the Master Plan on viewscapes, refer to Section 4.12.1 (Viewscapes).

Environmental Consequences – No-Action Alternative

The No-Action Alternative would not involve grading activities, and therefore, would not impact topography at the campus.

4.3.2 Geology and Soils

Affected Environment

The geology of an area encompasses characteristic rocks, sediments, and land features and the forces affecting them. These geologic features provide the parent material for overlying soils through weathering and supplying of minerals and nutrients. Assessing the soil resources in an area can provide insight on environmental impacts of potential actions on that area and its surroundings. Alterations to the physical makeup of an area can lead to soil contamination, soil erosion, and detrimental impacts on water bodies in or near the area.

The physical characteristics of soil can affect the suitability of the site for development and can present various pollution and safety concerns upon disturbance, such as high water erosion rates, wind-thrown hazards, and emissions of particulate matter. These concerns may require the establishment of mitigation and precautionary measures.

The predominant soil type on the campus is Nederland (NdD), which covers over 80% of the site including all of the campus area east of Skunk Creek outside the MOA Protected Area. NdD soils are deep, well-drained, moderately permeable soils formed in very cobbly and gravely alluvium, derived principally from granite. Rock fragments within the soil typically range from 35 to 75%, and are mostly fine or very fine angular granite gravel (USDA, 1975). These soils, which allow slow to medium runoff, are generally conducive to development although the presence of stones and cobbles can impede some excavations. According to the National Cooperative Soil Survey, urban housing and development projects often take place on NdD soil and the principal native vegetation is blue grama, needle-and-thread grass, and western wheatgrass. The moist bulk density of the soil is between 1.25 and 1.50 grams/cm^3 generally, a bulk density of more than 1.4 grams/cm^3 or higher (depending on soil texture) can restrict vegetative growth (NRCS, 2015).

The soils typically occur on 1 to 12% slopes, are said to be “hard setting” when dry, and have a slight erosion hazard (USDA, 1975). In terms of erosion, NRCS has assigned an erodibility rating to the soil of 0.05 on a scale from 0.02 to 0.69, where higher values indicate greater susceptibility to sheet and rill erosion by water (NRCS, 2015). NdD also has an assigned wind erodibility of 6 on a scale of 1 to 8, where lower values indicate greater susceptibility to wind erosion (NRCS, 2015). Wind erodibility groups are defined as groups made up of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas.

Another type of soil, Terrace Escarpments (Te), is located along the south boundary east of Skunk Creek. Te soil is unconsolidated in nature and typically features steep slopes. The presence of silts and clays in Te soil can easily make them unstable when development activities occur on or near this landform. Under the Master Plan, construction activities would not occur in the area of the campus where Te soil is present.

The Farmland Protection Policy Act of 1981 (7 U.S.C. §§ 4201 et seq.) aims to minimize the impact of federal actions on farmland and its conversion to nonagricultural uses. Accordingly, federal actions affecting soils with high agricultural potential would require consultation with the NRCS. However, none of the soil types within the campus are characterized as prime or unique farmland. Additionally, the Master Plan is located within an urbanized area and is therefore not subject to the Farmland Protection Policy Act (see NRCS correspondence in Appendix A).

Figure 4-4. Topographic Contours at the DoC Boulder Laboratories Campus

Environmental Consequences – Proposed Action

The Master Plan would result in moderate soil disturbance associated with construction, demolition, and renovation projects that would impact previously disturbed soil. Soil surface and subsurface compaction may result from heavy machinery traffic around the campus as a result of Master Plan implementation. As noted in Section 4.3.1 (Topography), the Master Plan would require minimal grading since construction primarily occurs in previously developed areas. However, construction of the Childcare Center, NOAA expansion facility, and stormwater arroyo would be expected to require soil relocation due to excavation and construction activities in undeveloped areas.

As mentioned in Section 4.5.3 (Stormwater Management), construction activities under the Master Plan would need to ensure coverage under the National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges for Construction Activity in Colorado (COR10000F). This requires the development of a Stormwater Management Plan (SWMP) for construction activities disturbing one or more acres of land, whether individually or as part of a larger common plan of development. DoC would implement erosion and sediment control (ESC) measures during earth disturbance to minimize impacts on soil and water resources. Coverage under the campus' Municipal Separate Storm Sewer Permit (COR042002) also requires the installation of post-construction BMPs for projects that disturb 1 acre or greater of land. Due to the permeable nature of the soil and associated infiltration rates, post-construction BMPs that focus on capturing and emphasizing stormwater infiltration should be assessed at the campus and deployed where feasible. Due to the lack of extensive grading, the soil characteristics (e.g., relatively low susceptibility to erosion by water and wind), and the use of ESC measures, the potential for extensive soil erosion under the Master Plan would be minimal.

Environmental Consequences – No-Action Alternative

The No-Action Alternative would not result in construction or demolition activities and thus would not result in additional soil disturbance or potential soil contamination, erosion, or compaction.

4.4 Water Resources

4.4.1 Surface Water

Affected Environment

Natural conditions (e.g., interactions with soil, sediments, rocks, groundwater, and the atmosphere) and human activities can impact the quality of surface water by affecting its chemical, physical, and biological characteristics. Human actions that may affect surface water quality include agricultural, industrial, and urban activities. Stormwater runoff from surrounding watersheds directly impacts surface water quality.

Federal surface water regulations, including the Clean Water Act (CWA), Safe Drinking Water Act (SDWA), and the Rivers and Harbors Act (RHA), focus on rights to water usage and the protection of water quality. The City of Boulder Municipal Code, Chapter 3, Item 9-3-9 includes regulations for development within streams, wetlands, and water bodies. The Colorado Division of Water Resources has authority for administration of the water rights in the state.

Water rights in the state of Colorado are governed by "prior appropriation doctrine," which controls who uses water, the amount that can be used, and types of uses allowed. This approach is also referred to as "first in time, first in right" meaning that the first person to take water from a source for beneficial use (industrial, agricultural, etc.) has the right to continue to use that quantity of water for that purpose. Water rights holders depend upon snowmelt and rainfall to supply beneficial uses of the water supply. Captured precipitation that is consumed "out of priority" may deprive water right holders of their right to use water from the natural stream. The Colorado Division of Water Resources is empowered to administer the water rights in the state according to said doctrine (Cabot et al., 2016).

The campus is located within the 440-square mile Boulder Creek Watershed. Skunk Creek and Anderson Ditch both enter Bear Canyon Creek and flow to Boulder Creek. Boulder Creek empties into Saint Vrain Creek and ultimately discharges to the South Platte River (Murphy, 2006). Boulder Creek and its tributaries include diversions that remove water from streams for various uses including industrial, agricultural, and municipal purposes. Reservoirs are also used to store water since streamflow in Boulder Creek is primarily supplied by snowmelt and varies seasonally depending on snowpack (Murphy, 2006).

Sections of Skunk Creek and Anderson Ditch, both of which are intermittent waterbodies, run through the campus. Skunk Creek extends in a northeasterly direction through the middle of the campus. The stream channel varies in width from 5 to 15 feet (1.5 to 4.6 meters), contains a gravel and cobble bed, and follows a riffle and pool sequence (GSA, 1996). Anderson Ditch is an irrigation ditch, located near the eastern border of the site, and extends to Bear Canyon Creek at Table Mesa Drive and Broadway and flows generally southerly (GSA, 1996). The ditch proper is approximately 5 feet (1.5 meters) wide, and its southern half flows parallel to Broadway. The campus also encompasses a portion of a freshwater forested/shrub wetland; refer to Section 4.4.3 (Wetlands) for additional information.

The CDPHE 303(d) list of impaired waters defines segments of streams and rivers within the Boulder Creek Watershed as impaired for E. *coli* and selenium. Stream segments within and immediately downstream of the campus, however, are not identified as impaired water bodies (USEPA, 2016a).

As discussed in Section 4.5.3 (Stormwater Management), stormwater on the campus is ideally managed using natural detention areas to encourage infiltration or by using traditional structural BMPs, when necessary. Rainwater collection is not permitted on the campus.

Environmental Consequences – Proposed Action

Implementation of the Master Plan would have the potential to impact surface waters due to runoff from construction activities and changes in the quality and quantity of post-construction stormwater runoff. DoC would implement ESC measures during all construction activities to prevent sediment transport to Skunk Creek and Anderson Ditch. The renovation and construction activities under the Master Plan would provide an opportunity for the design and implementation of post-construction BMPs and improved stormwater management techniques. This opportunity creates the potential to improve the overall quality of surface waters, groundwater, and stormwater at the campus.

The increased campus population under the Master Plan could result in an overall increase in the volume of wastewater discharged to the City of Boulder sanitary sewer system, which ultimately discharges to Boulder Creek following treatment by the city. This potential increase should not affect water quality within Boulder Creek as the city would continue treating the sanitary wastewater in accordance with the applicable CDPHE permit. Also, increased cooling loads under the Master Plan could result in an increased volume of wastewater discharged to the campus stormwater system, portions of which discharge to Skunk Creek and Anderson Ditch. DoC would continue to comply with the applicable Municipal Separate Storm Sewer System (MS4) permit for these discharges.

Refer to Sections 4.5.2 (Wastewater) and 4.5.3 (Stormwater Management) for additional discussion of discharges to surface waters.

Environmental Consequences – No-Action Alternative

The No-Action Alternative would have no impact on surface waters. However, the No-Action Alternative would also not implement Low Impact Development (LID) or improve existing stormwater management practices to meet the intent of local, state, and federal rules and regulations.

4.4.2 Groundwater

Affected Environment

Groundwater is the most prevalent source of available freshwater that supports potable, agricultural, and industrial uses, especially in areas that lack access to surface water resources. Groundwater quality is impacted by interactions with soil, sediments, rocks, surface waters, and the atmosphere. Groundwater quality may also be significantly affected by agricultural, industrial urban, and other human actions.

The campus does not receive its domestic water from onsite wells and is not located within 1,000 meters of a designated sole source aquifer (USEPA, 2016a). Sources for the City of Boulder's potable water include Barker Reservoir, Lakewood Reservoir, Boulder Reservoir, and Carter Lake. Boulder's potable water is not supplied by a groundwater source (City of Boulder, 2016d). For more information regarding potable water at the campus, refer to Section 4.5.1 (Potable Water Supply).

In general, groundwater under the campus may be encountered from 20 to 40 feet beneath the natural ground surface and is highest during the spring and summer due to snowmelt and runoff from the Flatirons. Building 1 (Wing 5) and the CUP each have a sump pump that runs year-round to eliminate groundwater intrusion into the buildings. The site utility tunnel also has sump pits. Groundwater from Building 81 drains to a stormwater detention basin near the northern pedestrian entrance of the campus.

Surface topography is typically an indicator of groundwater flow, with groundwater flowing from higher to lower elevations. Based on the topography of the campus, groundwater is generally expected to flow from the southwestern area of the campus to the northeastern and southeastern corner of the campus, towards Broadway.

Environmental Consequences – Proposed Action

Implementation of the Master Plan would not impact groundwater consumption.

Construction and demolition activities associated with implementation of the Master Plan have the potential to impact groundwater. DoC would implement appropriate pollution prevention and erosion and sediment control measures during the execution of the Master Plan to avoid spills and exposure of groundwater to contamination.

Renovation and construction activities under the Master Plan provide an opportunity for the installation of BMPs and the implementation of advanced stormwater management techniques, including the vegetated arroyo and post-construction BMPs near the parking areas, which may contribute to enhanced groundwater recharge during storm events.

Environmental Consequences – No-Action Alternative

Under the No-Action Alternative, there would be no change in groundwater consumption and no potential for impacts during construction. Stormwater management improvements and subsequent enhanced groundwater recharge on the campus would also not be realized under the No-Action Alternative.

4.4.3 Wetlands

Affected Environment

Wetlands provide important ecological services, including the following:

- Filtering nutrients, sediment, and pollutants from surface and groundwater;
- Absorbing excess floodwater and rainwater;
- Protecting shorelines from erosion; and
- Providing habitat for numerous plants and animals.

Wetlands are federally protected by Section 404 of the CWA, EO 11990 (*Wetland Protection*), RHA, and applicable local regulations and permit programs such as Chapter 9-3-9: Stream, Wetland & Water Body Protection of the City of Boulder Municipal Code. EO 11990, implemented in 1977, also protects wetlands and their associated ecosystem services. Though the state of Colorado does not have specific laws or regulations to protect wetland resources, it does recognize wetlands under the definition of "state waters" which are subject to the standards for water quality, 5 CCR 1002-31 (Colorado Natural Heritage Program, 2013). To afford additional protection, Section 9-3-9 of the City of Boulder Municipal Code requires that a Stream, Wetland and Water Body Permit be obtained from the city prior to the commencement of construction and replacement activities within a wetland or wetland buffer area. According to the City of Boulder municipal code, the term "buffer area" is defined as an area around a wetland within which activities are likely to have an adverse impact upon wetland functions. The inner buffer area width is 25 feet from each point on the wetland or water body boundary; and the outer buffer area width shall be 25 feet from each point on the wetland. The outer buffer shall also be 25 feet from each point on the inner buffer area boundary. The municipal code encourages avoidance of activities that destroy water resources and adjacent buffers to ensure no net loss of wetlands.

The USFWS developed the National Wetlands Inventory (NWI), a wetland classification system used to identify wetlands throughout the U.S. The NWI is a very useful system for obtaining a large-scale understanding of approximate wetland locations. Since aerial photography forms the basis for the NWI, instead of field surveys, the data may include omission errors depending on seasonal and climatic variability. According to NWI data, a 7.72-acre freshwater forested/shrub wetland is located in the southwestern portion of the campus, surrounding Skunk Creek (USFWS, 2016b). Skunk Creek enters the site at the base of the Mesa and extends in the northeasterly direction through the middle of the NIST campus (GSA, 1996). According to a third-party evaluation, the wetland embodies a narrow creek that flows through a ravine lined with dense shrubs and trees (Carpenter and Browne, 2004). The primary water source for the Skunk Creek and the associated wetland is groundwater and approximately 95% of the wetland area is vegetated with hackberry, chokecherry, box elder, and mixed herbaceous shrubs (Carpenter and Browne, 2004).

Three small areas (less than 0.1 acre/0.04 hectare) located in the protection zone on the northeast face of the Mesa also appear to meet the characteristics associated with palustrine wetland classification, but are not included in NWI data (GSA, 1996).

Several stormwater management features throughout the site also contain wetland vegetation, but are not considered jurisdictional under the U.S. Army Corps of Engineers (USACE). During a 1996 consultation, the USACE stated that it had no jurisdiction regarding Anderson Ditch according to Section 404 of the CWA (GSA, 1996).

Wetland delineations were not conducted as part of this EA.

Environmental Consequences – Proposed Action

Construction, demolition, and renovation activities under the Master Plan would not occur within wetlands or wetland buffers.

Construction of the new Childcare Center and parking garage could result in long-term changes in the quantity of stormwater runoff discharged to the wetland surrounding Skunk Creek and stormwater runoff could carry pollutants to the wetland. As discussed in Section 4.5.3 (Stormwater Management), DoC would employ stormwater BMPs to comply with federal requirements and EOs for sustainable stormwater management and reduce the potential for discharge of sediment or contaminant-laden stormwater to the wetland.

The small palustrine wetlands at the northeast face of the Mesa would not be impacted under the Master Plan.

Environmental Consequences – No-Action Alternative

The No-Action Alternative would not impact wetlands.

4.4.4 Floodplains

Affected Environment

Floodplains perform important natural functions, including moderating peak flows, maintaining water quality, recharging groundwater, and preventing erosion. In addition, floodplains provide wildlife habitat, recreational opportunities, and aesthetic benefits. The 100-year floodplain is defined as an area that is subject to a 1% or greater chance of flooding in any given year.

To protect floodplains and minimize future flood damage, the federal regulations at 44 CFR 9 and EO 11988 (as amended by EO 12148) restrict development within the 100-year floodplain. Under EO 11988, all federal agencies must 1) determine if any of their actions would occur within a floodplain, 2) evaluate the potential effects of these actions, and 3) analyze

alternatives to these actions. EO 13690 strengthens the previously established requirements by amending EO 11988 to ensure that federal agencies expand restrictions on development of the 100-year floodplain to a higher elevation and corresponding horizontal floodplain to address current and future flood risk. EO 13690 amends EO 11988 to require that federal agencies establish floodplains as one of the following:

- The elevation and flood hazard area that results from using a climate-informed science approach that uses the best-available actionable hydrologic and hydraulic data and methods that integrate current and future changes in flooding based on climate science;
- The elevation and flood hazard area that results from using the freeboard value, reached by adding an additional two feet to the base flood elevation for non-critical actions; or
- The area subject to flooding by the 0.2 percent annual chance flood (i.e., the 500-year flood).

The City of Boulder developed local floodplain regulations in accordance with the Colorado Department of Natural Resources Water Conservation Board's Rules and Regulations for Regulatory Floodplains. These rules and regulations intend to reduce the risk of damage in areas along the 15 major drainage ways that are prone to flooding within the city (City of Boulder, 2016e). Boulder County is also considered a local authority regarding floodplain development and is involved with conducting floodplain management and floodplain assessments, but does not oversee floodplain regulation for the area.

During September 2013, the City of Boulder and surrounding areas received an unprecedented volume of rainfall (more than 18 inches of rainfall over an eight-day period), causing flooding throughout the area, including at the campus (City of Boulder, 2016e). The city is in the process of updating the Skunk Creek floodplain maps based on updated topographic data, updated floodplain and high-hazard zone boundaries, and city improvements to help reduce flooding along Boulder Creek (City of Boulder, 2016e). The city is also updating maps delineating conveyance zones and high hazard zones within the floodplain. A conveyance zone is defined as an area equivalent to a 0.5-foot rise floodway. A high hazard zone is defined as the portion of the 100-year floodplain where flood depths equal or exceed four feet (City of Boulder, 2013).

The currently effective boundaries of the 100-year floodplain within the campus include the northern corner of Building 81, a portion of Anderson Ditch and Compton Road north of Building 81, and the northern portion of Curie Circle (Figure 4-5). No portions of the campus are located within the current 500-year floodplain (Figure 4-6), and no structures on the campus are located within the current conveyance zone or high hazard zone (Figure 4-7, Figure 4-8). However, the most recently proposed updates to these floodplain boundaries by the City of Boulder would result in the following revisions:

- The updated 100-year floodplain would no longer include any buildings or portions of Anderson Ditch or Compton Road within the campus, but would be expanded immediately outside of the campus boundary to include several private residences along King Avenue; and
- The updated 500-year floodplain would be expanded to cover portions of the campus, including Buildings 1C, 1D, and 1E; a portion of Wings 1, 3, and 5 of Building 1; and the parking lot to the north of Building 1 (City of Boulder, 2017).

The ongoing Skunk Creek study does not evaluate potential floodplain revisions upstream of Green Mountain Cemetery; therefore, it is unclear whether the currently effective floodplain boundaries would remain in effect in the southwest portion of the developed campus (e.g., in the vicinity of Curie Circle).

Floodplain concerns also apply to Anderson Ditch. During their review of the Draft Master Plan and Draft EA, the City of Boulder commented that Anderson Ditch has been identified as being over capacity during two-year and five-year storm events, based on recent stormwater modeling and master planning efforts.

Environmental Consequences – Proposed Action

Implementation of the Master Plan would involve the reconfiguration of Curie Circle within the existing 100-year floodplain and may trigger permitting or consultation with Boulder Planning and Development Services Center, specifically requiring coverage under a Floodplain Development Permit issued by the City. No other new construction proposed under the Master Plan would occur within the current 100-year floodplain. No construction proposed under the Master Plan would occur within the current conveyance zone or high hazard zone.

According to the city's proposed floodplain mapping, during a 100-year flood event, a small corner of the campus to the northeast of the parking lot north of Building 1 would flood. No new construction or renovation is proposed under the Master Plan in this area. Under the proposed floodplain mapping, a 500-year flood event would flood portions of Building 1 proposed for renovation under the Master Plan. However, no new facilities would be constructed within this revised 500-year floodplain or the conveyance zone or high hazard zone.

As discussed in Section 4.5.3 (Stormwater Management), the Master Plan would result in an overall reduction in impervious surfaces within the campus; would provide a central arroyo to improve runoff storage capacity; and would incorporate a stormwater drainage system that can be designed to ensure no net increase in runoff from the campus to Skunk Creek or Anderson Ditch. Therefore, the Master Plan would not contribute to flooding concerns in the Skunk Creek floodplain or elsewhere near the campus.

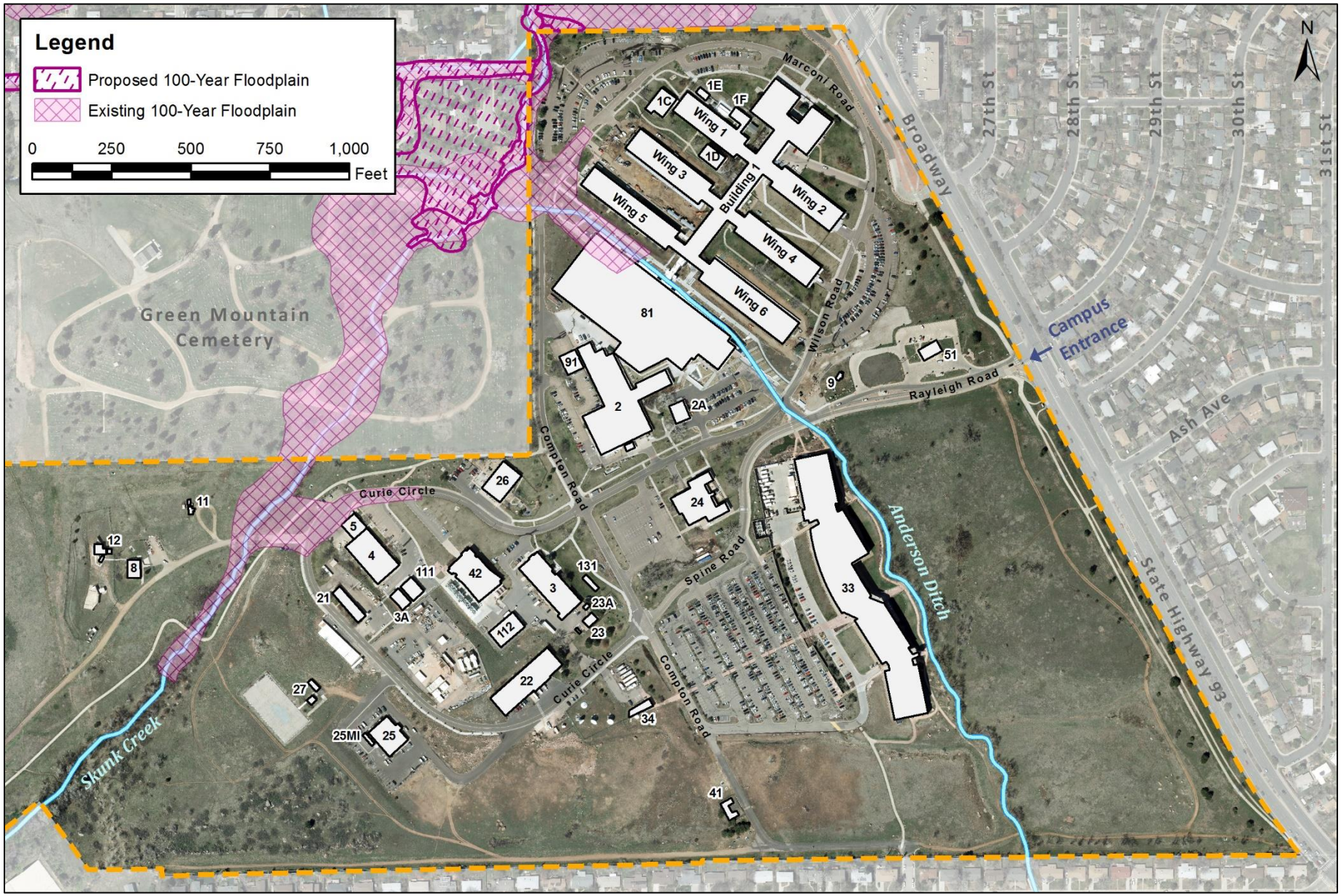

Figure 4-5. Current and Proposed 100-Year Floodplains on the Campus

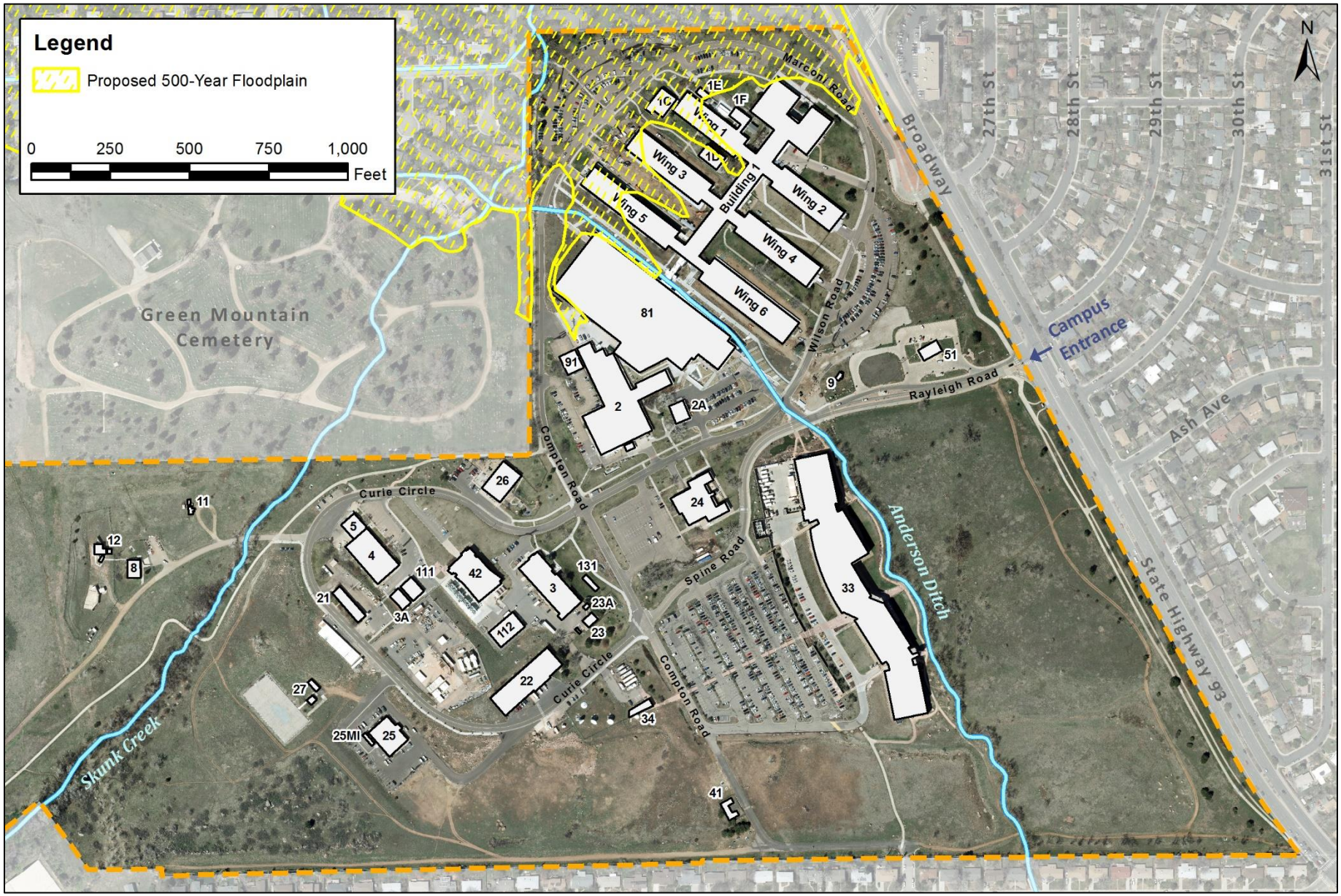

Figure 4-6. Proposed 500-Year Floodplain on the Campus

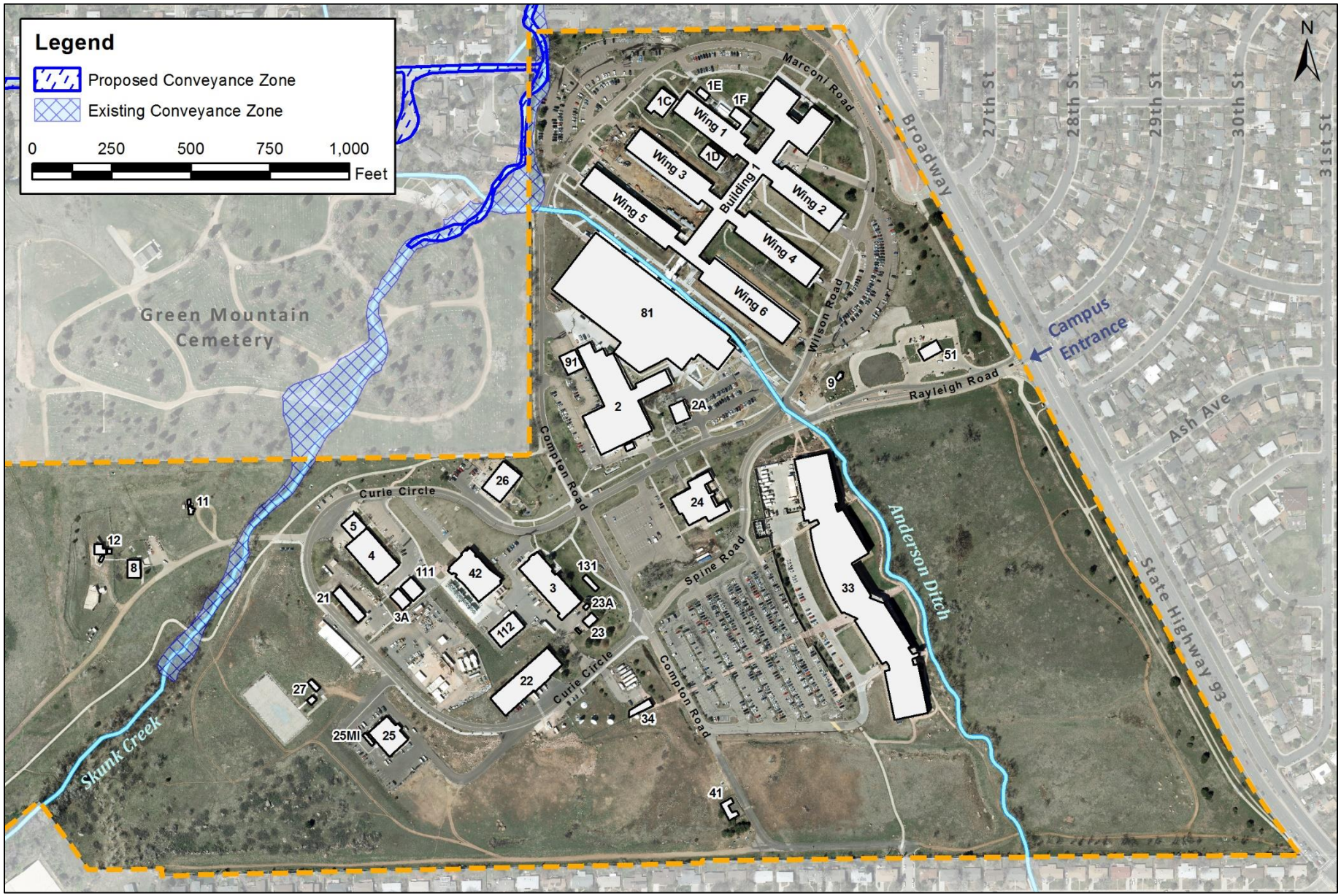

Figure 4-7. Current and Proposed Conveyance Zones on the Campus

Figure 4-8. Current and Proposed High Hazard Zones on the Campus

As noted previously, it is unclear whether the currently effective floodplain boundaries in the southwest portion of the developed campus will be affected by the recent Skunk Creek floodplain mapping updates. DoC will continue to coordinate with the city regarding floodplain updates and would ensure that new facilities constructed under the Master Plan are sited properly to avoid impacts to floodplains and to ensure consistency with federal regulations and EOs.

Environmental Consequences – No-Action Alternative

The No-Action Alternative would not involve any impacts or changes in activities within the current or proposed 100-year floodplain, 500-year floodplain, conveyance zone, or high hazard zone. Existing infrastructure and facilities within the floodplain would remain subject to flood risk.

4.5 Utilities and Infrastructure

4.5.1 Potable Water Supply

Affected Environment

Potable water is supplied to the DoC Boulder Laboratories Campus by the City of Boulder. In fiscal year (FY) 2014, the total water consumption at the campus was approximately 41.2 million gallons. The following are the primary drivers of potable water consumption at the campus (NIST, 2015):

- Domestic water use by occupants (111,000 gpd);
- Cooling tower make-up water (35,000 gpd);
- Boiler feed water (10,000 to 33,000 gpd); and
- Process/laboratory water (22,000 gpd).

In laboratories that are not served by the campus chilled water system, personnel use a constant flow of domestic water for chilling.

EO 13693 mandates federal agencies to reduce potable water use intensity by 2% annually through FY 2025 as compared to the FY 2007 baseline year. This translates to agency-wide reductions of 16%, 26%, and 36% by FY 2015, FY 2020, and FY 2025, respectively. In FY 2015, DoC achieved a department-wide 31.2% reduction in potable water use intensity compared to 2007, surpassing both the FY 2015 and 2020 targets (DoC, 2016). Water use at the DoC Boulder Laboratories Campus, while it has declined over recent years, has not experienced the same magnitude of reductions as seen at the department level.

The total use for the campus remains significantly higher than the FY 2020 goal of approximately 23.2 million gallons (a 26% reduction from the FY 2007 baseline usage) (DoC, 2017).

The existing potable water piping system is approximately 50% loaded and is in a loop configuration which adds capacity and provides an adequate level of system redundancy (DoC, 2017). However, portions of the potable water system are nearing or at the end of their useful life, and, as a result, there is a high probability of leaks occurring in the system.

Environmental Consequences – Proposed Action

The Master Plan is expected to generate an overall minor increase or potential decrease in potable water demand. Increased potable water consumption associated with the construction of new facilities and corresponding increases in campus population, steam load, and cooling load, would be offset by the installation of water-efficient fixtures in new and renovated buildings. Furthermore, eliminating all single pass cooling for equipment, including consolidating laboratory space and connecting the laboratories to the chilled water system, would reduce the use of domestic water for chilling purposes. The Master Plan would also implement water conservation practices from the *Guidebook of Best Practices for Municipal Water Conservation in Colorado*, where appropriate (CWWA, 2010). These measures would help the DoC Boulder Laboratories Campus meet its goal of reducing water use intensity at the campus.

New potable water lines would need to be installed to connect new facilities with the existing potable water infrastructure. The potable water piping in Building 1 would be replaced during renovations. The Master Plan also recommends that DoC repair and line all underground piping to minimize leaks.

Environmental Consequences – No-Action Alternative

The No-Action Alternative would not increase potable water consumption and would not result in any water efficiency improvements within the campus. Under the No-Action Alternative, DoC would not repair and line underground piping; therefore, the likelihood of water leaks along the old lines would increase over time as the existing infrastructure continues to age.

4.5.2 Wastewater

Affected Environment

Sanitary, industrial, and other wastewater generated at the DoC Boulder Laboratories Campus is primarily discharged to the City of Boulder sanitary sewer system for treatment. DoC has been issued an industrial discharge permit (Permit No. 2017-2) by the City of Boulder that limits the allowable discharge of pollutants from research laboratories, offices, and support facilities. The CUP discharges wastewater associated with equipment washdown (7,000 to 15,000 gpd), blowdown from boilers (up to 2,700 gpd) and cooling tower maintenance and cleaning associated with the closed-loop chilled water system (16,700-gallon total volume discharged twice per year). The laboratories in Building 81 dispose of inorganic acids and bases to a waste neutralization system, which

then discharges to the sanitary sewer system. There is also a scrubber that treats gases from the chemical vapor deposition processes in Building 81 (approximately 3,600 gpd) (NIST, 2015).

As discussed in Section 4.5.3 (Stormwater Management), the campus has also been issued a NPDES permit by the U.S. Environmental Protection Agency (USEPA), which allows the discharge of air conditioning condensate and irrigation water to the stormwater system but does not allow discharges associated with industrial or construction activity.

According to 2014 metered outfall data, the campus discharged approximately 195,000 gallons per day of wastewater to the sanitary sewer system. Based on these data and an assessment of topographical features, the existing sanitary sewer system has spare capacity (DoC, 2017).

Environmental Consequences – Proposed Action

The Master Plan is expected to result in an overall increase in wastewater generation due to increased campus population and increased cooling loads. Increased wastewater generation associated with more occupants would be offset somewhat by the installation of water-efficient fixtures in new and renovated buildings. The generation of wastewater would increase in conjunction with the increases in potable water use described in Section 4.5.1 (Potable Water Supply). DoC would evaluate wastewater generation associated with new or modified laboratory activities to determine if the industrial discharge permit needs to be modified.

Under the Master Plan, DoC would install new sanitary sewer lines to connect new facilities with the existing sanitary sewer infrastructure.

Environmental Consequences – No-Action Alternative

The No-Action Alternative would not increase wastewater discharge at the DoC Boulder Laboratories Campus and would not impact the existing wastewater infrastructure.

4.5.3 Stormwater Management

Affected Environment

Stormwater runoff is generated when precipitation flows off land and impervious areas such as paved streets, parking lots, and building rooftops. Stormwater runoff can collect and transport pollutants such as oil and grease, chemicals, nutrients, metals, sediment, and bacteria as it travels across these surfaces. Soil erosion occurs when stormwater travels at velocities sufficient to transport sediment particles. Excessive stormwater runoff may also lead to flooding and infrastructure damage. Stormwater is typically managed on site by using conventional practices such as infiltration devices, filters, and sustainable practices such as LID techniques (USEPA, 2004). LID practices aim to maintain and restore the hydrologic and ecological functions of watersheds by managing stormwater as close to its source as possible.

Impervious surfaces collect and accumulate pollutants and during high storm events, these pollutants are quickly washed off and rapidly delivered to aquatic systems. Monitoring and modeling studies have consistently indicated that urban pollutant loads are directly related to watershed imperviousness. Pervious surfaces allow for the absorption of stormwater, and ultimately allows for recharging of the groundwater table.

The campus has several existing stormwater features to detain stormwater and promote its infiltration into the ground. Two detention basins are located in the southeastern corner of the campus and collect stormwater in series. Specifically, stormwater from the western basin overflows to the eastern basin if the water level reaches a sufficient height, and overflow from the eastern basin is piped off campus to Bear Canyon Creek to the east. These basins provide extensive infiltration capacity and rarely exhibit standing water. The campus has several smaller stormwater detention areas including two along Broadway and one by the northern pedestrian gate. DoC strives to minimize the presence of standing water in these basins due to nuisance and health concerns associated with mosquitos and geese.

Stormwater generally flows from southwest to northeast across the campus. Stormwater that does not infiltrate on site is collected and transported via underground piping to the MS4 outfalls, which then discharge to Skunk Creek just north of the campus where the creek flows under Broadway. Stormwater collected on the campus is also conveyed offsite by Anderson Ditch and Skunk Creek to Bear Canyon Creek. Refer to Exhibit 113 of the Master Plan for an illustration of the hydrology and existing stormwater management features at the campus.

The USEPA retains NPDES permitting and enforcement authority for federal facilities located in the State of Colorado. In accordance with the authority under the CWA, the USEPA issued DoC a permit (Permit No. COR042002) authorizing the discharge from all MS4 outfalls to receiving waters including Skunk Creek and Anderson Ditch and other associated waters of the United States within the exterior boundaries of the campus.

The MS4 permit requires that the permittee design for and provide funding for the installation of permanent post-construction stormwater control measures designed to retain, detain, infiltrate or treat stormwater discharge from newly developed and redeveloped sites that disturb greater than or equal to one acre of land (whether individually or as part of a larger common plan of development) in a manner that is consistent with Control Measure Design Standards. The Control Measure Design Standards are composed of two main elements: the Water Quality Capture Volume (WQCV) Standard and the Infiltration Standard, developed by the State's Urban Drainage and Flood Control District. The WQCV standard requires that a control measure be installed that is designed to provide treatment and/or infiltration of 0.6 inches of runoff while the Infiltration

Standard requires the BMP to infiltrate, through practices such as LID, 0.5 inches of runoff.

DoC must comply with Section 438 of the Energy Independence and Security Act of 2007 (EISA 2007). Under EISA 2007, federal agencies must "use site planning, design, construction, and maintenance strategies for the property to maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to the temperature, rate, volume, and duration of flow" for any project with a footprint greater than 5,000 SF. Guidance on how to meet EISA 2007 is provided in the *Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act* (USEPA, 2009).

EO 13693 section 3(f) requires that, beginning in FY 2016, agencies shall improve water use efficiency and management (including stormwater management) where life-cycle cost-effective. Specifically, the EO prescribes the installation of appropriate green infrastructure features on federally owned property to help with stormwater management. DoC's *Handbook for Strategic Sustainability Performance Plan*, August 2013, provides additional guidance for complying with EO 13693. Although EO 13693 encourages rainwater harvesting, Colorado Water Rights prohibit the collection of rainwater at the campus. Refer to Section 4.4.1 (Surface Water) for additional information regarding Colorado's Water Rights.

Environmental Consequences – Proposed Action

Temporary Construction Impacts

Under the Master Plan, construction and demolition activities at the campus would disturb land, creating the potential for erosion and sediment-laden discharges to Skunk Creek, Anderson Ditch, and the MS4 outfalls. DoC would develop all appropriate ESC and stormwater plans, and obtain all necessary permits, to ensure that these potential impacts are minimized during earth disturbance.

The MS4 permit requires that both DoC and the construction contractor obtain appropriate permit coverage for regulated construction activities under the NPDES General Permit for Stormwater Discharges for Construction Activity in Colorado, COR10000F (Construction General Permit or CGP). The MS4 permit defines "regulated construction activities" as development and re-development that results in a land disturbance of greater than or equal to one acre, whether individually or as part of a larger common plan of development. Demolition and construction projects identified in the Master Plan meet this definition and would be subject to permitting under the CGP. Per the requirements of the CGP, the construction contractor would develop a stormwater pollution prevention plan, including BMPs in accordance with good engineering practice such as the methods described in the Urban Drainage and Flood Control District's *Urban Storm Drainage Criteria Manual, Volume 3*. The permit also requires the permittee to consult with appropriate city, county, and/or drainage district staff regarding the redevelopment or development project. Additionally, DoC would prepare a SWMP detailing how development under the Master Plan would meet the requirements of the campus MS4 permit.

Long-Term Stormwater Management

The implementation of the Master Plan would replace impervious surfaces throughout the campus with the installation of post-construction BMPs including LID, green infrastructure, and other stormwater control measures. Under the Master Plan, DoC would install a stormwater arroyo west of Building 1, paralleling the central pedestrian promenade. Stormwater runoff from the developed portion of the campus would continue to flow to Anderson Ditch, Skunk Creek (both directly and via the MS4), and Bear Canyon Creek (via the detention basins in the southeastern corner of the campus). Figure 4-9 illustrates the stormwater conveyance network proposed under the Master Plan. Relative flow volumes of stormwater discharged to each receiving body would change depending on which phases of the Master Plan get constructed. Throughout implementation of the Master Plan, the efficacy of the stormwater detention basins, smaller detention features, vegetative swales, and piping conveying stormwater to the MS4 may need to be assessed and upgraded to support modifications to the campus, as needed.

When designing the proposed parking garage adjacent to Building 81 (a site where stormwater runoff currently flows to Skunk Creek), DoC would ensure that the selected stormwater management approach does not result in a net increase the amount of runoff to Skunk Creek. This could be accomplished by primarily directing runoff from the garage to the central arroyo and by incorporating additional BMPs as necessary. Additionally, DoC would ensure the central arroyo would be designed not only to manage the potential for increased stormwater flows from proposed development, but also to allow for control of the discharge rate to Anderson Ditch through design features such as check dams. The proposed stormwater conveyance network also emphasizes the use of the two large detention basins to manage runoff from new development located south of the proposed arroyo. The goal of this approach is to decrease the overall flow rate of stormwater runoff into Anderson Ditch from developed areas within the campus.

Under the Master Plan, various BMPs would be installed at the parking lot near the proposed Security Center. Installation of the arroyo and the incorporation of various BMPs would have minor net improvements to stormwater quality. In order to comply with federal requirements and EOs for sustainable stormwater management, the proposed Master Plan would likely need to incorporate additional stormwater management BMPs, control measures, and LID technologies beyond those currently identified in the Master Plan. These BMPs may include a combination of infiltration technologies in addition to LID features such as raingardens, bioswales, and infiltration trenches installed throughout the facility. Regardless of the combination of BMPs chosen for

Figure 4-9. Proposed Stormwater Conveyance Network under the Master Plan

implementation under the Master Plan, DoC would ensure that these BMPs are properly designed and maintained to mitigate the potential health and nuisance concerns associated with the detention of standing water. Stormwater plans and designs would specifically document compliance with the design requirements identified in the campus MS4 permit.

Completion of the full Master Plan would reduce impervious areas within the campus by approximately 4.8% (from 2,242,700 SF to 2,135,200 SF). In addition, the Master Plan suggests replacing the large parking lot near Building 33 with a parking garage, which would further reduce impervious surfaces within the campus. The reduction and replacement of impervious surfaces provides many benefits for stormwater management, including impeding stormwater flow, reducing soil erosion during rain events, improving runoff water quality, and increasing groundwater recharge.

As described in Section 3.1 (Proposed Action) and illustrated in Appendix B, development under the Master Plan is conceptualized as five independent and interchangeable phases, and the possibility exists that only certain phases could become realized through development. Depending on which phases are completed, the net change in impervious areas within the campus could range anywhere from a 7.4% reduction (if only the Childcare, Management Resources Center, and Research Building phasing packages are completed) to a 1.5% increase (if only the NOAA expansion and Visitor Center phase packages are completed). Table 4-2 summarizes the impact of the implementation of each phasing package on the overall impervious footprint of the campus.

Table 4-2. Change in Impervious Areas by Master Plan Phasing Package

Phasing Package	Impervious Areas within Phasing Package Areas (SF)		
	Existing	Proposed	Net Change
Management Resources Center	343,600	219,000	-124,600
Childcare Center	119,000	94,700	-24,300
NIST Research Buildings and Campus Center	391,600	373,900	-17,700
NOAA Research Building	15,700	22,300	+6,600
Visitor Center, Parking and Vehicle Screening	257,300	284,600	+27,300
Total	**1,127,200**	**994,500**	**-132,700**

Environmental Consequences – No-Action Alternative

Implementation of the No-Action Alternative would not involve construction, renovation, or demolition; therefore, no additional stormwater impact would occur at the campus. The No-Action Alternative would not improve existing stormwater management practices to meet the intent of local and federal rules and regulations regarding sustainable management of stormwater.

4.5.4 Energy Systems

The electrical infrastructure at the DoC Boulder Laboratories Campus provides the energy needed to operate the facilities on campus, while heating and cooling systems consume energy sources in the form of electricity and fossil fuels. EO 13693 establishes a target to reduce energy-use intensity by 25% by FY 2025 from an FY 2015 baseline. DoC Departmental Administrative Order 217-16: *Sustainability and Environmental Management* establishes this target as DoC policy.

4.5.4.1 Electricity

Affected Environment

The primary uses of electricity at the DoC Boulder Laboratories Campus are to operate the lighting systems; laboratory equipment; heating, ventilation, and air conditioning (HVAC) systems; and cooling towers and chillers at the CUP. Building 41 houses the automatic source transfer switch for two incoming medium voltage feeds from Xcel Energy, which provides electricity service to the entire campus. The existing onsite infrastructure, including the utility feeders and switchgears, is sized to support a peak load significantly larger than the peak load of 5,462 kilowatts (6,828 kilovolt amperes) recorded in July 2016. DoC is currently evaluating different concepts for replacement of the existing switchgear at Building 41.

Backup power is provided by 21 individual generators that provide limited life safety and standby power supply for specific programmatic needs. These generators are fueled by natural gas or diesel and range in size from 7.5 kW to 1,656 kW. Certain sensitive pieces of equipment are served by uninterruptible power supplies.

Many buildings within the campus were constructed in the 1950s and 1960s. These, as well as the numerous temporary buildings and structures around campus, lack energy efficiency in their infrastructure systems and building envelopes.

Environmental Consequences – Proposed Action

Under the Master Plan, the DoC Boulder Laboratories Campus electrical demand would be expected to increase by 1-2% due to the operation of lighting systems, laboratory equipment, and HVAC systems associated with the new

buildings. The existing electrical infrastructure has sufficient capacity to support this growth. However, the Master Plan recommends that building load densities be monitored closely as buildings are renovated and new buildings are added to ensure that the feeder capacity and redundancy are maintained. New emergency generators would be installed to support operations in the new buildings. Four emergency generators at buildings to be demolished under the Master Plan (Buildings 2, 4, 5, and 25) would be either removed or relocated to support new operations.

The Master Plan recommends that site-wide projects incorporate energy conserving and solar technologies that will continue to evolve over the life of the Master Plan. Despite the increase in electrical demand, inefficient small and temporary buildings would be replaced by new and renovated buildings featuring improved energy efficiency. This consolidation of small inefficient buildings would help DoC meet its agency-wide goal of reducing energy intensity at facilities. DoC would target net-zero energy use for both the Childcare Center and the Management Resources Center. Furthermore, the Master Plan includes solar photovoltaic energy systems on selected building roofs (Management Resources Center, Childcare Center, and Campus Center) and over parking areas, as well as a solar panel field on the former site of Building 25 after it is demolished. The solar energy systems would reduce the quantity of electricity consumed from the grid and help the planned consolidated support facility achieve net-zero energy consumption. Refer to Section 4.6 (Sustainable Development) for additional information regarding sustainable design strategies.

Environmental Consequences – No-Action Alternative

The No-Action Alternative would not impact electrical infrastructure or demand. Under the No-Action Alternative, DoC would continue to operate energy inefficient facilities and, therefore, would not improve energy efficiency throughout the campus.

4.5.4.2 Heating and Cooling

Affected Environment

The CUP (Building 42) provides chilled water and steam to support the HVAC systems at most of NIST's laboratory buildings, specifically Buildings 1, 2, 3, 24 and 81 (only steam to Building 1). Laboratories in other buildings are supplied with these services locally, as needed. The chilled water and steam are delivered via an underground piping system located in tunnels. The CUP and utility tunnels were constructed in several phases with the first phase being put into service in 2005.

The CUP contains four 1,500-ton chillers and three boilers rated at 900 boiler horsepower (BHP). *[Note: One ton of refrigeration is equivalent to the energy removal rate that will freeze one ton of water at 32 degrees Fahrenheit in one day, or approximately 12,000 Btu/hr.]* Typically, DoC operates only two of these three boilers in cooler months and fuel consumption slows significantly in warmer months. The CUP also contains two 350-BHP boilers, but these boilers are not actively used and are not considered in the analysis of the CUP steam generation capacity. A project is under consideration to remove these boilers and install a new deaerator in their location to improve the reliability of the feed water system and the plant. The CUP and utility tunnels are consistent with current technology and have significant remaining life.

The current peak cooling load is approximately 2,200 tons of refrigeration (tons), but this does not include Building 1 loads since the building is not connected to the campus chilled water system. The existing steam and chilled water production and distribution systems have significant additional capacity, as indicated by their firm capacities of 62,000 pph (1,800 BHP) and 4,500 tons, respectively. The firm capacity represents the system output without the availability of the largest single generation unit (e.g., with three of the four chillers in operation).

As discussed in Section 4.5.1 (Potable Water Supply), potable water is used for make-up water in the steam production and cooling tower systems.

Environmental Consequences – Proposed Action

Under the Master Plan, the existing CUP would supply the new and renovated NIST laboratory facilities with chilled water and steam. The Childcare Center and the Management Resources Center would be either provided with dedicated heating and cooling systems (with consideration given to geothermal systems) or connected to the campus steam and chilled water system because of their close proximity to the CUP. As discussed in Section 4.5.4.1 (Electricity), the Master Plan would be expected to increase the electrical (including cooling) demand on the campus by 1-2% and to increase the heating demand on the campus by 1-3%. No upgrades to CUP infrastructure are needed to support the planned heating and cooling loads.

Increases in heating and cooling demand would be offset somewhat by replacement of inefficient and under-insulated small and temporary buildings with new buildings featuring improved insulation and HVAC efficiency. DoC would use natural and passive ventilation, heat recovery systems, and decoupled ventilation/cooling, where feasible, to improve HVAC energy efficiency. This would help DoC meet its agency-wide goal of reducing energy intensity at facilities.

Impacts on potable water demands due to increased heating and cooling loads are discussed in Section 4.5.1 (Potable Water Supply). Impacts on air emissions and greenhouse gases (GHGs) are discussed in Sections 4.9 (Air Quality) and 4.10 (Climate Change).

The existing buildings to be retained in the rest of the campus would continue to have dedicated HVAC systems.

Environmental Consequences – No-Action Alternative

The No-Action Alternative would not implement the facility space expansion associated with the Proposed Action and therefore would not impact heating and cooling demand or systems. However, the DoC Boulder Laboratories Campus would continue to operate facilities with energy inefficient HVAC systems.

4.6 Sustainable Development

Affected Environment

Sustainable development is the practice of modifying or creating structures and processes that are environmentally responsible and resource-efficient throughout their lifecycles. Environmental stewardship and sustainable development are crucial to DoC's ability to fulfill its mission of creating conditions for economic growth and opportunity by promoting innovation, entrepreneurship, competitiveness, and stewardship (DoC, 2013).

EO 13693, issued March 19, 2015, requires that 15% of existing buildings greater than 5,000 SF meet the revised Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings (Guiding Principles) by FY 2025 and that federal agencies continue towards 100% compliance for the complete building inventory. The Guiding Principles require buildings to implement or achieve a combination of sustainable requirements such as optimizing energy performance, protecting and conserving water, enhancing the indoor environmental quality, and reducing the environmental impacts of materials. As discussed in Section 4.5.1 (Potable Water Supply), EO 13693 requires federal agencies to reduce their potable water consumption.

According to the draft document, *Boulder's Climate Commitment*, the City of Boulder has established a goal of reducing its energy-related emissions by 80% or more from 2005 to 2050 (City of Boulder, 2015b). In order to reach this goal, the city has compiled a Climate Action Plan (CAP) that emphasizes the need to diversify the city's energy supply by switching to no and low carbon renewable energy sources (City of Boulder, 2015b).

The City of Boulder Water Conservation Program aims to work with residents and businesses to conserve water, both indoors and outdoors. As part of this effort, the city works with Partners for a Clean Environment (PACE), which provides free expert advice, incentives, and certification programs to assist businesses in gaining recognition and measuring their progress in energy, waste, water, and transportation efficiency efforts (PACE, 2015). PACE conducts indoor water audits, provides rebate opportunities, and disseminates information regarding water conservation throughout the County (PACE, 2015). According to the Boulder County Comprehensive Plan, the city and county will promote conservation of various water resources through water quality protection, public involvement and education, monitoring, and policies that promote applicable water usage (City of Boulder, 2010).

DoC strives to achieve sustainable development by installing high-performance facilities and utilizing low-impact development principles (DoC, 2013). DoC annually updates its Strategic Sustainability Performance Plan (SSPP) in accordance with EO 13693. The SSPP identifies how DoC incorporates sustainability into its goal of growing the national economy, furthering energy security, and protecting the health of the environment (DoC, 2016). Topics addressed in the SSPP include greenhouse gases, sustainable development and acquisition, water efficiency, pollution prevention and waste elimination, electronics stewardship, and innovation (DoC, 2013).

In order to achieve the potable water consumption reduction targets, DoC strives to initiate low-cost options that reduce water consumption with a short payback period of less than 10 years (DoC, 2013). Between 2007 and 2010, water consumption in DoC facilities nationwide decreased from approximately 42 gallons per square foot to 33.6 gallons per square foot (DoC, 2013). For additional information regarding the DoC Boulder Laboratories Campus water supply, refer to Section 4.5.1 (Potable Water Supply).

Other than the most recent buildings (33, 34, 42, and 81), the campus buildings were not designed or constructed with sustainable goals or features. A significant challenge confronting this Master Plan is moving the campus towards a sustainable future. According to a sustainability study of the campus performed in 2013, the following areas of the campus need improvement: HVAC upgrades; increasing the energy efficiency of several buildings on campus; and mechanical, energy efficiency, and electrical upgrades for Buildings 11, 21, 23, 24, the CUP and the Radio Building (Nelson Engineering Co., 2013). DoC is currently working through the list and has implemented many of the recommendations.

Environmental Consequences – Proposed Action

The Master Plan would result in an overall improvement to campus sustainability. As a core component of the Master Plan, DoC would strive to increase the efficiency of the campus by replacing and consolidating small, inefficient buildings and upgrading outdated equipment. DoC would replace existing inefficient and inadequate facilities with more efficient and comfortable facilities; upgrade equipment; and utilize sustainable systems, such as efficient HVAC systems, exhaust energy recovery, and decoupled ventilation/cooling systems (DoC, 2017). Construction and renovation under the Master Plan would be conducted in compliance with EOs, federal requirements, and DoC-sustainability goals. A goal of the Master Plan is to exceed DoC's baseline requirement of achieving Leadership in Energy and Environmental Design (LEED) Silver certification for each new or renovated building.

The greatest opportunity for the implementation of sustainable and energy efficient design is in association with new construction, specifically, the Childcare Center, Management Resources Center, Campus Center, and NOAA Expansion. DoC would target net-zero energy use for both the Childcare Center and the Management Resources Center, and would design the Campus Center to

meet the highest LEED certification level possible. The Management Resources Center and Childcare Center would include installation of efficient technologies (e.g., ample daylighting and energy-efficient exterior wall and roofing systems). Energy efficient design strategies could include use of natural ventilation, improvement of the building envelope, lighting load reduction, and plug load reduction. To help achieve these green certification goals for new construction, the Master Plan would also include the installation of PV systems throughout the campus, including solar panels on the roofs of selected new buildings, over parking areas, and on the Building 25 site following its demolition. DoC also would consider incorporating more advanced PV systems into project designs as PV technology continues to evolve. For more information regarding updates to the campus energy systems, refer to Section 4.5.4 (Energy Systems).

The Master Plan also promotes sustainable development by proposing adaptive reuse of an aging laboratory building (Building 24) as part of the Campus Center. Benefits of adaptive reuse, as compared to redevelopment, can include reduced generation of construction-related waste via the reuse of structural elements and recycling of building materials.

Stormwater quality and management would be improved under the Master Plan due to the installation of the vegetated arroyo and post-construction BMPs near parking structures. Refer to Section 4.5.3 (Stormwater Management) for additional information.

Under the Master Plan, DoC would reconfigure the parking lot to the north of the campus entrance to allow visitors to park vehicles outside of the secure perimeter and to walk onto the campus, as well as reconfigure the drives around the Security Center. This would reduce vehicle congestion at the Security Center and gate. DoC would also remove the central roadway between Buildings 3 and 81, which would promote the central part of the campus as a more pedestrian and bicycle-oriented space. Additionally, all new parking areas constructed under the Master Plan would include vehicle charging stations to provide electricity for plug-in electric vehicles (PEVs). These changes may reduce overall greenhouse gas emissions and fossil fuel consumption, and could contribute to improved air quality.

Construction activities at the campus would temporarily impact soil and vegetation, and would generate waste. DoC would recycle construction and demolition debris to the extent practicable and ensure that other non-recyclable materials are properly disposed. Construction would require the commitment of a wide range of raw materials, including wood, metal, glass, and fossil fuels. The fabrication and manufacture of construction materials requires large quantities of energy and natural resources. In general, construction materials are readily available, and the construction of new facilities would not have an adverse effect on continued availability of these resources. Operation of the proposed facilities and transportation of additional employees to the campus would also require the commitment of fossil fuels to operate generators, vehicles, and other fuel-burning equipment.

Overall, the long-term improvements in sustainability of the campus associated with implementation of the Master Plan, combined with the continued preservation of open spaces on the campus, are expected to greatly outweigh short-term and continuing commitments of readily available resources.

Environmental Consequences – No-Action Alternative

The No-Action Alternative would not result in any changes to campus infrastructure. The energy demand at the campus would not change. The potential to increase energy efficiency, improve stormwater management, and improve the overall sustainability of the campus in accordance with EO 13693 would not be realized under the No-Action Alternative.

4.7 Solid and Hazardous Waste

Affected Environment

Solid waste is defined as any garbage, refuse, sludge, or other discarded material including solid, liquid, semisolid, or contained gaseous materials resulting from industrial, commercial, agricultural, or community activities. USEPA defines hazardous waste as a solid waste that exhibits a characteristic of ignitability, corrosivity, reactivity, or toxicity, or is specifically listed as a hazardous waste.

Hazardous and nonhazardous solid wastes are regulated by federal, state, and Boulder County laws. The Resource Conservation and Recovery Act (RCRA) authorizes USEPA to control hazardous waste from "cradle to grave." This lifecycle includes the generation, transportation, treatment, storage, and disposal of waste. Subtitle D of RCRA encourages states to initiate and oversee the implementation of solid waste management plans in order to promote recycling practices. USEPA has delegated authority to CDPHE to implement hazardous waste regulations and oversight. As a result, CDPHE has developed solid waste regulations (6 CCR 1007-2) and hazardous waste regulations (6 CCR 1007-3).

EO 13693 (*Planning for Federal Sustainability in the Next Decade*) and EO 12873 (*Federal Acquisition, Recycling, and Waste Prevention*) set goals for the federal government to conduct operations in a manner that is sound in terms of energy efficiency, toxic chemical reduction, recycling, sustainability, and water conservation. In addition, the USEPA's *Guidelines for Thermal Processing of Solid Wastes* (40 CFR 240) and *Guidelines for the Storage and Collection of Residential, Commercial, and Institutional Solid Waste* (40 CFR 243) provide specifications for the treatment and disposal of municipal solid waste.

DoC reviewed available databases for solid and hazardous waste sites in the general area around the DoC Boulder Laboratories Campus. Environmental databases used in this review include the National Priorities List database; Comprehensive Environmental Response, Compensation, and Liability Information System database; Resource Conservation and Recovery Act Information database; and USEPA's NEPAssist mapping tool. This review

revealed that there are no nearby solid or hazardous waste sites with potential to impact the campus.

Facilities at the DoC Boulder Laboratories Campus generate various types of hazardous, non-hazardous, and universal wastes (which are hazardous wastes that are very commonly used and have less stringent disposal requirements). Due to the quantity of hazardous waste generated, the campus meets the definition of a small quantity hazardous waste generator, defined by 40 CFR 262 as a facility that generates between 100 and 1,000 kg of hazardous waste and less than 1 kg of acutely hazardous waste in a month.

According to the cross services agreement, one of NIST's responsibilities at the campus includes hazardous and regulated waste management. As a component of this responsibility, NIST oversees the storage of waste in Building 23, which is a 180-day accumulation site for hazardous waste. This two-room building has secondary containment systems to collect waste in the event of a leak or spill. Hazardous waste is stored in cabinets or in drums, while radioactive materials are stored in a dedicated safe (DoC, 2017).

The NIST Boulder Safety, Health, and Environment Division (BSHED) coordinates requests for the collection and transfer of hazardous and universal wastes to Building 23 by a third-party contractor. The BSHED has developed standard operating procedures and specific criteria for the collection, labeling, and transportation of hazardous and universal waste generated at the campus (NIST, 2009). NIST then transfers the waste to permitted treatment, storage, disposal or recycling facilities and retains proper documentation.

Solid non-hazardous waste from the campus is collected and disposed of at a local landfill. Construction contractors are responsible handling construction debris in accordance with CDPHE regulations for solid and hazardous waste.

Environmental Consequences – Proposed Action

The implementation of the Master Plan would generate construction and demolition waste, which would require collection, staging, and removal from the campus. Wastes would be handled and disposed of in accordance with Colorado Department of Public Health and Environment regulations. Recycling of construction and demolition debris would be implemented to the extent practicable. Demolition of older facilities may involve the removal of materials containing polychlorinated biphenyls (PCBs), lead, or asbestos. Disposal methods would be addressed under the construction permit, including the cost of sampling, transporting, and discharging of said wastes to an appropriate facility in compliance with CDPHE regulations (DoC, 2016).

The Master Plan would retain Building 23 as the hazardous waste storage building. Operations in the various proposed administrative, support, and laboratory facilities would be expected to generate similar types of wastes as existing operations within the campus; however, the quantity of these wastes could increase slightly, given the projected increase in staff and operational space. In this scenario, DoC would evaluate the capacity and continued suitability of Building 23 as a hazardous waste storage building and could consider improvements to the building in an action separate from the Master Plan.

Environmental Consequences – No-Action Alternative

The No-Action Alternative would result in no changes in the generation, storage, or disposal of solid or hazardous waste. The No-Action Alternative would not involve the removal of hazardous building materials including asbestos, lead, and PCBs.

4.8 Transportation

4.8.1 Vehicle Circulation and Parking

Affected Environment

The DoC Boulder Laboratories Campus has a single vehicular entrance located on Broadway (Colorado State Highway 93). This entrance is used by all employees, visitors, and deliveries arriving by automobile and truck. Two loop roads branch off from the entrance to form the primary circulation pattern for the campus. One loop, consisting of Compton Road and Marconi Road, circles the majority of the laboratory buildings. The second loop, defined by Curie Circle, provides access to the NOAA building parking area and to the western portion of the campus, where the CUP and most of the administrative and support facilities are located. Parking areas are distributed throughout the campus near each building and are easily accessible from the loop roads. There are currently 1,430 parking spaces on campus. Per agreements with the City of Boulder and a collective of Native American tribes, the total number of parking spaces allowed on campus is restricted to 1,802.

Visitors and their vehicles are screened at the Security Center, which is located at the entrance to the campus. Congestion is a problem in this area and space and maneuvering room are limited. Congestion can also occur at Building 22 when trucks are making deliveries, because the parking lot is narrow and the trucks can extend into the roadway. There are several intersections on campus that lack directional signage, which can lead to confusion for visitors. The exit from the Childcare Center is also potentially dangerous due to a blind spot at a curve on Curie Circle.

The City of Boulder has an effective public transportation system and robust bicycle path network. Both of these serve the DoC Boulder Laboratories Campus and many DoC employees use public transportation or the bicycle paths to commute to work. DoC provides subsidies and incentives to encourage employees to commute using public transit, vanpool, or bicycles.

Environmental Consequences – Proposed Action

Under the Master Plan, DoC would reconfigure the parking lot to the north of the entrance to allow visitors to park their vehicles outside of the security perimeter and to walk into the campus. This would reduce vehicle congestion and queuing at the entrance and the Security Center, especially during conferences. DoC would also reconfigure the Security Center and its drives to streamline the screening process and allow for improved vehicle circulation and maneuvering. The Master Plan includes widening the road at Building 22 to eliminate congestion associated with trucks blocking the road. The relocation of the Childcare Center would eliminate hazards associated with exiting the current parking area.

A key feature of the Master Plan is the removal of the central roadway between Building 3 and Building 81, and vehicle traffic limitations on a portion Compton Road. These changes would promote the central part of the campus as a more pedestrian and bicycle oriented space.

Due to an increase of approximately 202 DoC personnel over the course of the Master Plan, there would be a slight increase in privately owned vehicles (POVs) entering and exiting the campus during peak hours. While the Master Plan anticipates an increase in personnel, there would be a potential reduction in intra-campus POV use due to consolidation of facilities within the campus, construction of the new parking area by the Security Center (which, for occupants of Building 1, would require less driving through the campus as compared to the current parking lot), and improved pedestrian connectivity. DoC would construct a multi-level parking structure to support the new laboratory buildings and reduce the impervious surface on the campus (as compared to constructing a surface lot). DoC would limit the total number of parking spaces to comply with the City of Boulder and tribal agreements. The Master Plan would encourage the use of PEVs instead of fossil fuel vehicles by including vehicle charging stations in all new parking areas.

The Master Plan would also result in temporary increases in traffic during construction and demolition activities. Construction activities could also temporarily affect parking availability by closing off lots or occupying lots with construction vehicles and equipment. As described in Section 3.1.2, DoC would coordinate construction activities and create temporary parking and staging areas to ensure that vehicles are not forced to park off campus, park in grassy areas, or cause other impacts due to a temporary lack of parking capacity.

Environmental Consequences – No-Action Alternative

The No-Action Alternative would not impact the local transportation network or traffic levels and would not change vehicle use or parking availability within the campus. There would be no improvement, however, to campus ingress or vehicle circulation within the campus.

4.8.2 Public and Alternative Transportation

Affected Environment

The City of Boulder and surrounding region has a strong public transportation network. The Regional Transportation District (RTD) operates four separate bus and light rail route systems within 8 of the 12 counties in the Denver-Aurora-Boulder Combined Statistical Area. The SkyRide system connects the Denver International Airport to regional population centers; the Local/Limited routes provide service to local areas; the Express Routes link commuter corridors; and the Regional Routes connect population centers (DoC, 2017).

FasTracks, administered by the RTD, is a public transportation expansion program currently under construction. The new commuter rail, light rail, and express bus services will add 122 miles of new light and commuter rail, 18 miles of bus rapid transit, new transit stations, enhanced bus/rail connections and additional routes, new Park-n-Ride locations, and 21,000 new parking spaces at rail and bus stations (RTD, 2016a). The longest of the FasTrack projects, the Northwest Rail Line, is planned to be a 41-mile fixed-guideway transit line to Longmont from Denver passing through Boulder. The first segment of this line operating from Westminster to Denver Union Station opened in July 2016 (RTD, 2017).

The Department of Transportation's Mass Transit Subsidy Program, known as EcoPass, is a program designed to increase the use of public transportation among federal employees. EcoPass provides incentives for employees to choose public transportation by allowing payment of the pass through pre-taxed dollars, thereby reducing payroll taxes (RTD, 2016b).

According to a 2015 survey, 9% of employees at the DoC Boulder Laboratories Campus commute to work by bus. There are six RTD bus lines with routes along Broadway and along 27th Way, each stopping at the two sheltered bus stops along Broadway: one is located towards the northeast corner of the campus near Building 1, and the other is immediately south of the main campus entrance. From the bus stops, there are no direct walkways or paths onto the campus. Refer to Exhibit 120 in the Master Plan for an illustration of circulation features at the campus, including the bus stops.

Bicycle commuting is a popular mode of transportation in the Boulder area. Approximately 18% of campus employees commute to work by bicycle. As discussed in Section 4.1.4 (Trails), the campus has a strong network of bicycle routes. However, the campus currently does not provide adequate protected bicycle storage such as bicycle racks, lockers, and bike rooms, and the local bike sharing program B-Cycle recently chose to remove the bike sharing station located near the campus entrance (DoC, 2017). Pedestrian circulation is also an important mode of transportation, both between facilities on campus and commuting from off campus. Commuters who enter by foot from Broadway, either as pedestrians or bus riders who get off at one of the two bus stops, have an approximately one-quarter mile walk (roughly five minutes) to the farthest

buildings in the Laboratory District. The Support District is an approximately one-half mile walk, roughly 10 minutes from Broadway. Most of this walk is slightly uphill.

Environmental Consequences – Proposed Action

The Master Plan would increase the number of campus employees by approximately 200 people over the course of 20 years. This increase would be expected to only slightly increase commuting and public transportation ridership to and from the campus. With the inception of commuter incentive programs, such as EcoPass, and the expansion of FasTracks, public transportation to the campus could see an increase in ridership. The Master Plan would provide easier access from the bus stops to the campus by providing additional paved pedestrian access points near Building 1 and north of the new Visitor Center parking lot, shortening the walking distance for many campus employees who commute by bus.

The Master Plan would support and enhance the already established bicycle commuting system by preserving bicycle routes and paths on campus; promoting features such as bicycle parking, secure and integrated bicycle storage, and shower and locker facilities to improve convenience of access and promote bicycle commuting; and recommending improvements to the bicycle path near the campus entrance to improve safety.

Under the Master Plan, the majority of campus employees would continue to work within a five-to-ten-minute walk of the bus stops or the campus entrance on Broadway. Some buildings, such as the Childcare Center, would be relocated farther from Broadway. Walking to this building from Broadway would take approximately three minutes longer than the walk to the existing Childcare Center.

Environmental Consequences – No-Action Alternative

The No-Action Alternative would not impact public transportation facilities or ridership and would not affect commuters who bike or walk to the campus.

4.9 Air Quality

Affected Environment

Air quality refers to the degree of pollution in the air, often assessed by measuring concentrations of pollutants and comparing them to health-based limits set by the USEPA. Airborne pollutants originate from a variety of sources including anthropogenic (man-made) or natural (e.g., forest fires). Most anthropogenic emissions arise from fossil fuel combustion.

National Ambient Air Quality Standards

The Clean Air Act (CAA) designated USEPA the authority to set National Ambient Air Quality Standards (NAAQS) to limit the concentration of pollutants considered harmful to public health and the environment (40 Code of Federal Regulations [CFR] Part 50). The NAAQS regulate six specific pollutants, commonly referred to as "criteria pollutants" that include ozone (O_3), particulate matter (PM), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and lead (Pb) (USEPA, 2016b). The NAAQS limit PM levels according to particle size, with separate standards for coarse (PM_{10}) and fine ($PM_{2.5}$) particulate matter. Refer to Appendix C, Table C-1 for the current NAAQS as of July 2016 (USEPA, 2016c).

If a region's air pollutant concentrations are not in violation of the NAAQS, USEPA designates the area to be in *attainment.* For areas USEPA designates as *nonattainment*, there are several categories from *marginal* to *severe* that USEPA could assign depending on the severity of the exceedance. A *nonattainment* designation requires that a region submit a State Implementation Plan (SIP) that addresses how the NAAQS will be met in a future year. USEPA later determines whether the region has met the SIP goals, and if so, USEPA changes the designation from nonattainment area to *maintenance area*. Boulder County is an 8-hr ozone (2008) nonattainment area and a CO and PM_{10} maintenance area (USEPA, 2016d). The Colorado Air Quality Control Commission has approved a SIP for ozone for the Denver Metro Area, which includes Boulder County, as well maintenance plans for CO and PM_{10}. Boulder County is an attainment area for $PM_{2.5}$, SO_2, NO_2, and lead (40 CFR 81.306).

The CAA General Conformity Rule (GCR) requires that federal actions taking place in nonattainment areas must conform to the region's SIP for reducing airborne concentrations of the nonattainment pollutant(s). Because the campus is located in an ozone nonattainment area and a CO and PM_{10} maintenance area, this EA includes a review of the emissions that would be expected from the construction and operational activities under the Proposed Action to determine whether they would exceed *de minimis* levels and trigger a SIP conformity determination. The *de minimis* level for each of Boulder County's nonattainment or maintenance criteria pollutants and their precursors [nitrogen oxides (NOx), volatile organic compound (VOC), CO, and PM_{10}] is 100 tons per year.

Under Regulation No. 3, "Stationary Source Permitting and Air Pollutant Emission Notice Requirements," the CDPHE Air Pollution Control Division requires that facilities submit an Air Pollutant Emission Notice (APEN) when there is a significant change in emissions. Since Boulder County is an ozone nonattainment area, a change in VOC or NOx emissions of one ton or 5%, whichever is greater, above the level reported on the last APEN submission would be considered a significant change (CDPHE, 2015). The APEN form also serves as the Application for Construction Permit for applicable emission units. Land development activities of at least 25 contiguous acres or more than six months in duration also would require an APEN and may be required to obtain

an air permit depending on estimated emissions. In addition, a start-up notice must be submitted thirty days prior to beginning a land development project.

Emission Sources

Operations at the DoC Boulder Laboratories Campus generate air emissions from multiple sources, including onsite stationary sources (boilers, generators, fume hoods) and mobile sources (vehicles). The CDPHE Air Pollution Control Division has issued NIST a construction permit (Permit No. 09BO0159) that covers five boilers and one emergency generator. The construction permit serves as a minor source operating permit and establishes emission limits for CO and NOx for the six permitted emission sources. This is the only air permit that currently applies to operations at the campus.

The largest onsite stationary emission sources include five natural gas-fired boilers at the CUP (Building 42) for steam generation. Three boilers have heat input ratings of 38 million Btu (MMBtu) per hour and the other two boilers have heat input ratings of 14.65 MMBtu per hour. The boilers produce emissions of NOx, CO, VOCs, SO_2, and PM during regular operation. All five boilers at the CUP are subject to opacity standards and SO_2 limitations under the NSPS for Small Industrial-Commercial-Institutional Steam Generating Units (40 CFR Part 60 Subpart Dc). The operating permit includes limits on the annual natural gas consumption for each of the five boilers. In 2015, the CUP boilers consumed 141 million standard cubic feet (MM scf) of natural gas, less than 20% of the combined limits for the five boilers, while servicing 800,272 GSF of facility space. Multiple smaller boilers are located at individual facilities throughout the campus, including Buildings 2, 3, 21, 22, and 25.

The permitted emergency generator has a 2,200-horsepower (hp) engine and is located adjacent to Building 81. The permit limits the annual operation of the generator to 300 hours. The emergency generator is subject to "Tier 2" USEPA emission standards for nonroad engines above 750 hp. The Tier 2 emission standards establish emission limits for multiple pollutants, including CO, PM, and NOx. Another generator is located adjacent to Building 81 with a 1,005 hp engine. A total of 19 other emergency generators with engines ranging from 10 hp to 134 hp support operations in individual buildings throughout the rest of the campus and are fueled by either natural gas or diesel.

Other minor stationary emissions sources include fuel storage tanks and fume hoods. The diesel-fueled emergency generator systems are supported by five aboveground fuel oil tanks, ranging in size from 145 gal to 6,000 gal. Two 1,000-gal aboveground tanks, one containing diesel and one containing gasoline, are located at the north end of Building 21 and are attached to fuel dispensers. Fume hoods provide ventilation for laboratory spaces in multiple buildings, including a clean lab in Building 81 that uses acetone.

Mobile emission sources associated with DoC Boulder Laboratories Campus activities include personal vehicles for ongoing employee commuting to and from work, as well as intra-campus travel, and grounds maintenance equipment and vehicles.

Environmental Consequences – Proposed Action

The Master Plan would have the potential to directly and indirectly affect air quality at the DoC Boulder Laboratories Campus as a result of the following activities:

- Onsite stationary sources: Changes in operation of boilers and emergency generators, and new or relocated laboratory activities.
- Mobile sources: Changes in employee commuting.
- Temporary activities: Construction, demolition, and renovation activities.

The following subsections describe these air quality impacts in more detail.

Onsite Stationary Sources

Under the Master Plan, there is expected to be a minor increase in air emissions of NOx, CO, VOCs, SO_2, and PM from boilers at the CUP if utility service from the CUP is expanded to new facilities. The existing boilers have adequate capacity to service a potential increase in steam load from the new facilities. The CUP boiler output and fuel consumption are expected to increase proportionally with the steam load changes. Operation of the boilers would comply with the existing (or subsequent) operating permit. Increased air emissions from the CUP boilers or boilers associated with newly constructed buildings would be partially offset by removal of multiple boilers from facilities that would be demolished and the construction of more energy efficient facilities. The boilers would continue to use low-NOx burners in compliance with Reasonably Available Control Technology requirements. A summary of projected criteria pollutant emissions from operation of the boilers under the Master Plan is presented in Appendix C, Table C-11.

The Master Plan would install new generators at each proposed facility to provide redundant backup power during emergencies. Emissions associated with these new generators would be offset by the elimination of emissions from emergency generators at facilities that would be demolished under the Master Plan. Thus, it is expected that changes in emergency generator fuel consumption and the associated emissions would be negligible. The existing emergency generators would continue to comply with USEPA Tier 2 emission standards. The permitted emission units at the DoC Boulder Laboratories Campus are not expected to exceed the operational or emission limits established in the permit. DoC would submit an APEN for the applicable emission units or for applicable changes in operations of existing equipment.

The cooling towers and chillers associated with chilled water production are electric powered, and DoC estimates that the Master Plan would increase

campus-wide electrical demand by approximately 1-2%. This could potentially result in increased fuel consumption by the sources that supply electricity to the regional network and lead to off-site increases in air emissions.

It is expected that changes in VOC emissions due to the installation of additional fume hoods in various labs would be negligible.

Mobile Sources

The Master Plan would increase the number of personnel commuting to and working at the DoC Boulder Laboratories Campus by approximately 12% (from 1,761 to 1,973) over the course of a 20-year period (DoC, 2017). Emissions from vehicle use are expected to increase by approximately this same percentage, or potentially by a lower percentage, assuming a continued growth in the adoption of low-emission vehicles. Refer to Section 4.8 (Transportation) for details regarding the expected changes in vehicular use resulting from the Master Plan. A summary of projected criteria pollutant emissions from mobile sources under the Master Plan is presented in Appendix C, Table C-13.

Temporary Activities

Construction, demolition, and renovation (CDR) activities required for the Master Plan would result in temporary minor emissions of NOx, VOC, CO, PM, and SO_2 from the use of on-road vehicles, such as delivery vehicles, tractor trailers, and dump trucks, as well as nonroad construction vehicles, such as excavators, cranes, track loaders, backhoes, and bulldozers over the course of an approximately 20-year period. The maximum annual projected NOx, VOC, CO, PM, and SO_2 emissions from construction activities and the methodology used to calculate these emissions can be found in Appendix C.

CDR activities often cause fugitive dust (PM) emissions that could have a temporary impact on local air quality. Dust emissions during building construction are associated with land clearing, ground excavation, grading, and the construction of the building itself. Emissions may vary substantially from day to day, depending upon the level of activity, specific type of activity, and weather conditions. The quantity of dust emissions from construction operations is proportional to the area of land where the activity is taking place, as well as the level of construction activity.

DoC is required to use all practical measures or operating procedures necessary to minimize fugitive dust, per Section III.D of Colorado Air Quality Control Commission's Regulation No. 1, "Particulate Matter, Smoke, Carbon Monoxide, and Sulfur Oxides." DoC would use the recommended best practices outlined in the *Fugitive Dust Best Management Practices* guide developed by Boulder County Public Health, where appropriate (BCPH, 2016). DoC may be required to obtain an APEN from CDPHE depending on the size of the construction/demolition site and duration of activity. DoC would follow dust suppression guidelines included in permit requirements.

If any lead-containing materials, asbestos-containing materials, or equipment that contains ozone-depleting substances are encountered during construction, DoC would remove and dispose of these materials and equipment in accordance with all applicable regulations to ensure air quality is not impacted.

GCR Analysis and Emissions Summary

DoC has prepared a GCR Applicability Analysis for the Master Plan (Appendix C). This analysis conservatively estimates the emissions of nonattainment criteria pollutants during construction and operation of the affected facilities for each calendar year affected by the Master Plan. This analysis demonstrates that the Master Plan would result in emissions well below the *de minimis* thresholds each calendar year for nonattainment criteria pollutants and their precursors (NOx, VOC, PM_{10}, and CO). The Master Plan is therefore not subject to GCR requirements and a conformity determination is not required. The air quality effects of criteria pollutants at the DoC Boulder Laboratories Campus and beyond the campus boundary would be minimal under the Master Plan and would not interfere with regional efforts to meet the NAAQS.

Table 4-3 summarizes the net changes in emissions of nonattainment criteria pollutants and their precursors under the Master Plan.

Environmental Consequences – No-Action Alternative

The No-Action Alternative would result in no changes in campus air quality compared to the baseline. The existing emissions-producing operations would continue at their current locations in accordance with the installation's minor source operating permit and applicable standards.

Table 4-3. Summary of Changes in Criteria Pollutant Emissions under the Master Plan

Activity	Emissions (Tons) [a]			
	NOx	VOC	CO	PM_{10}
Increase in operating and mobile source emissions (annual, recurring) [b]	0.9	0.3	3.8	0.2
CDR activities (non-recurring) [c]	20.1	11.2	14.0	132

Notes:
a – This table includes only those criteria pollutants covered by the GCR Applicability Analysis. See Appendix C.
b – This represents a conservative estimate of the annual increase in emissions that would occur following full implementation of the Master Plan. See Appendix C.
c – This represents emissions from all CDR activities, including fuel consumption, surface disturbance, and painting activities. See Appendix C.

4.10 Climate Change

Affected Environment

Climate change refers to any significant change in the measures of climate lasting for an extended period of time. In other words, climate change includes major changes in temperature, precipitation, or wind patterns, among others, that occur over several decades or longer. This occurs naturally over time, but evidence has shown that climate change is occurring at an accelerated rate due to the increase of the average global surface temperature, also known as global warming. The evidence for rapid climate change includes the rate of sea level rise, global temperature rise, warming oceans, shrinking ice sheets, declining Arctic sea ice, glacial retreat, extreme weather events, ocean acidification, and decreased snow cover (NASA, 2016).

Greenhouse Gas Emissions

The recent and ongoing warming of Earth's atmosphere is largely caused by human activities. The burning of fossil fuels and other industrial processes release significant amounts of carbon dioxide (CO_2) and other GHGs into the lower atmosphere. GHGs contribute to global warming by absorbing infrared radiation emitted from the earth's surface and then radiating much of this energy back to the earth's surface.

USEPA classifies GHG emissions and reduction targets as Scope 1 (direct emissions), Scope 2 (indirect emissions from purchased energy), or Scope 3 (other indirect emissions). Scope 1 emissions include emissions from direct fossil fuel combustion such as in the operation of boilers, generators, incinerators, and vehicles operated by the organization, as well as fugitive emissions of refrigerants and other GHGs (e.g., fire suppressants). Scope 2 emissions include upstream emissions from purchased electricity, steam, heating, and cooling. Scope 3 emissions include all other indirect emissions not included in Scope 2, such as emissions from employee commuting, employee business travel, transmission and distribution losses associated with purchased electricity, methane emissions from contracted solid waste disposal, methane and nitrous oxide emissions from contracted wastewater treatment, and upstream emissions associated with purchased products and services.

In accordance with EO 13514, DoC established a 21% reduction target for agency-wide Scope 1 and 2 GHG emissions and a 6% reduction target for agency-wide Scope 3 GHG emissions in absolute terms by FY 2020, relative to the FY 2008 baseline. DoC also has proposed GHG reduction targets through FY 2025 in accordance with EO 13693; these targets are pending approval by CEQ and the Office of Management and Budget.

Operations at the DoC Boulder Laboratories Campus generate GHG emissions from multiple sources, including operation of boilers, emergency generators, and DoC fleet vehicles (Scope 1); purchase of electricity (Scope 2); and employee commuting and business travel, transmission and distribution losses from purchased electricity, and methane emissions from contracted solid waste disposal (Scope 3). DoC purchases electricity for the campus from the Xcel Energy Public Service Company of Colorado (PSCo), which has a power supply portfolio consisting of a mix of coal-fired and natural gas-fired generation (78%) and carbon-free generation (22%) (Xcel Energy, 2016).

Effects of Climate Change

General climate change effects that have been observed and are projected in the future include more frequent and heavier rains and storms, increased flooding and drought, more severe and frequent heat waves, worsened air quality, sea-level rise, and negative impacts on ecosystems and wildlife (CEQ, 2016). Colorado is currently being affected by climate change in the following ways: warmer winters that result in a thinner snowpack and earlier snowmelt and runoff in the spring; a decrease in precipitation and water supply; longer droughts; increases in wildfires; insect infestations in pine forests and aspen stands; and health problems with the increase of ozone (Boulder County, 2016). While current and future emission control measures should help to reduce future impacts on climate change, GHGs already in the atmosphere will continue to cause climate change for many years to come (CEQ, 2016). In Colorado, this is expected to result in progressively hotter and drier conditions, further exacerbating the effects described above and straining both the natural environment and urban areas (USGCRP, 2016).

Accordingly, climate change adaptation and resilience, which are defined as adjustments to natural or human systems in response to actual or expected climate changes, are important considerations when planning an action (CEQ, 2016). Climate change impacts of particular relevance to the DoC Boulder Laboratories Campus include reductions in snowmelt and precipitation, which could reduce water availability in Skunk Creek, Anderson Ditch, and the City of Boulder potable water system; prolonged droughts, which could affect vegetation on campus; more severe and frequent heat waves, which could affect cooling demand on the CUP; and increased risk of wildfires, given the expansive forested areas in Boulder Mountain Park immediately west of the campus. DoC considers these climate change factors when planning future actions at the campus.

Environmental Consequences – Proposed Action

Greenhouse Gas Emissions

Under the Master Plan, steam generation activities and operation of the new facilities, including increased electricity consumption and periodic emergency generator use, would generate recurring direct and indirect (Scope 1, 2, and 3) GHG emissions. The overall increase in climate-controlled floor space would require a minor increase (approximately 1-3%) in the campus steam load, emergency generator capacity, and purchases of electricity. This would result in increased fuel consumption by boilers and generators throughout the campus, and potentially could result in increased fuel consumption by the sources that

supply electricity to the PSCo regional network, leading to increases in direct and indirect GHG emissions. These increases would be mitigated by the construction of more energy efficient facilities and the potential reduction in the overall energy intensity of campus facilities. Installation of the solar field following demolition of Building 25 would further offset GHG emissions from the campus. NIST would also continue to procure Renewable Energy Credits each year to mitigate impacts from GHG emissions on global climate change.

Construction, renovation, and demolition activities under the Master Plan would temporarily generate direct (Scope 1) GHG emissions from construction equipment. DoC estimates that construction, renovation, and demolition activities would release approximately 9,200 tons of CO_2-equivalent emissions over the duration of the Master Plan. These activities also would generate indirect (Scope 3) GHG emissions from contracted solid waste disposal.

While the Master Plan would increase the number of personnel commuting to and working at the campus, DoC assumes that this represents a relocation of existing commuter-related GHG emissions (i.e., the Master Plan would not "create" new commuters). Details regarding the current and future commuting methods and routes of these new campus personnel do not exist, and the increase or decrease in associated GHG emissions cannot be calculated. Also, Scope 1 GHG emissions associated with the travel of DoC fleet vehicles between facilities throughout the campus are anticipated to be approximately equal to or less than the current emissions, due to the improved consolidation of campus facilities under the Master Plan.

Effects of Climate Change

As discussed in Section 4.5.1 (Potable Water Supply) and Section 4.2.1 (Vegetation), the Master Plan would incorporate various water efficiency improvements throughout the campus and would reduce irrigation demand by replacing existing water-intensive plants with low-maintenance grasses and other native vegetation. While the goal of these efforts is to reduce dependency on the City of Boulder potable water system and Anderson Ditch, full implementation of the Master Plan could result in a minor increase in overall potable water demand. Given the continued effects of climate change on water availability, this would potentially contribute to an increasing strain on regional public water sources. However, the use of drought-resistant landscaping would improve the resilience of the campus vegetation during prolonged droughts, thus reducing localized climate change effects within the campus.

As discussed in Section 4.5.4.2 (Heating and Cooling), the Master Plan could result in an increased demand for chilled water from the CUP. More severe and frequent heat waves due to continued climate change could further increase this projected cooling need, leading to additional electrical demand and the associated GHG emissions and potentially contributing to further climate change.

Under the Master Plan, new construction would be located in the existing developed eastern portion of the campus. This area is separated from the forested areas west of campus by expansive grassy vegetated areas, thus reducing the risk associated with climate change-driven wildfires.

Environmental Consequences – No-Action Alternative

The No-Action Alternative would result in no changes in GHG emissions at the campus and would not increase contributions to climate change. However, the No-Action Alternative would not achieve the potential improvements in energy and water efficiency described under the Master Plan and would not reduce the potential impacts of climate change-driven flooding within the campus.

Localized climate change effects within the campus are expected to increase over time. Under the No-Action Alternative, the existing drought-prone non-native landscape vegetation would become less resilient as droughts associated with climate change become more prolonged and severe.

4.11 Cultural and Historic Resources

4.11.1 Architectural Resources

Affected Environment

Historic properties include prehistoric or historic districts, sites, buildings, structures, or objects that are significant in American history, architecture, archeology, engineering, and culture. Historic properties serve as resources, as they provide valuable information about the history of human life and cultures.

To ensure the protection of historic resources, the U.S. Congress passed the National Historic Preservation Act (NHPA) in 1966 and then amended the NHPA in 1976, 1980, and 1992. The NHPA established the Advisory Council on Historic Preservation (ACHP) and authorized the creation and maintenance of the National Register of Historic Places ("the National Register"). The National Register is composed of districts, sites, buildings, structures, and objects that are significant in American history, architecture, archeology, engineering, and culture.

Typically, properties considered eligible for inclusion in the National Register are at least 50 years old. A property is eligible for inclusion in the National Register if it 1) possesses the integrity of location, design, setting, materials, workmanship, feeling, and association, and 2) meets at least one of the following National Register Criteria for Evaluation (NPS, 2002):

1. It is associated with events that have made a significant contribution to the broad pattern of U.S. history (Criterion A).

2. It is associated with the lives of persons significant in our past (Criterion B).

3. It embodies the distinctive characteristics of a type, period, or method of construction; it represents the work of a master; it possesses high artistic values; or it represents a significant and distinguishable entity whose components may lack individual distinction (Criterion C).

4. It has yielded or may be likely to yield important information in prehistory or history (Criterion D).

Section 106 of the NHPA, which is implemented under 36 CFR 800, requires federal agencies to consider the effects of undertakings (i.e., actions) on any historic property, and to afford the ACHP a reasonable opportunity to comment on such undertakings. An adverse effect is anything that could alter the historic fabric (i.e., characteristics) that makes the property eligible. Examples of adverse effects may include changes to the property or alterations to landscape, noise levels, visual characteristics, traffic patterns, or land use near the property, depending on how these changes specifically impact the property.

The NHPA also authorized the creation of a State Historic Preservation Officer (SHPO) for each state. The SHPO participates in statewide historic preservation planning and surveying activities; nominates properties for the National Register; provides advice, assistance, training, and public outreach; and participates in Section 106 undertaking reviews. In Colorado, the Office of Archaeology and Historic Preservation (OAHP, a division of History Colorado) serves as the SHPO.

Additionally, the OAHP administers its own program for properties that are of significance to American history and culture. The Colorado State Register of Historic Properties ("the Colorado State Register") includes all properties from the National Register that are located in Colorado, plus additional properties that are considered significant in Colorado history and culture. Properties listed in the Colorado State Register are afforded certain regulatory protections.

The City of Boulder Historic Preservation program has also identified local landmarks and historic districts that have been determined to have a special character and historic, architectural, or aesthetic interest or value to the city. There are currently 10 historic districts and 175 individual landmarks, totaling over 1,300 designated properties. All exterior changes to a designated property require design review and approval through a Landmark Alteration Certificate (City of Boulder, 2016f).

The majority of buildings at the DoC Boulder Laboratories Campus were constructed between 1989 and 2013 and thus are less than 50 years old. The following features at the campus are more than 50 years old: Building 1, Building 2, Building 3, Building 4/5, Building 8, Building 9, Building 11, Building 21, Building 22, and Anderson Ditch. Anderson Ditch has been determined eligible for listing in the National Register for its representation of early irrigation efforts in Boulder County. DoC and the OAHP agree that Building 1 is eligible for listing in the National Register under Criterion A and possibly for Criterion C. Although Buildings 2, 3, and 4 were previously recommended potentially eligible for their association with the Atomic Energy Commission, in September 2015 the OAHP concluded that these buildings were not eligible. None of the other buildings on the campus that are more than 50 years old were determined to be eligible for the National Register. In addition, none of the buildings on the campus that are less than 50 years old appear to satisfy the National Register criterion for exceptional significance (NIST, 2016).

Additional historic properties are found in the vicinity of the DoC Boulder Laboratories campus. The Mount St. Gertrude Academy, Chautauqua Auditorium, and Colorado Chautauqua Park are all located northwest of campus within a mile of the campus boundary and are listed in both the National Register and Colorado State Register. The Nelson House, which is listed on the Colorado State Register, and the University Place, 16th Street, and Floral Park local historic districts are also within a mile of the campus boundary to the northwest.

Environmental Consequences – Proposed Action

Renovation and demolition activities under the Master Plan would affect historic Building 1. In accordance with Section 106 of the NHPA, DoC is currently in consultations with OAHP to determine if renovations to Building 1 under the Master Plan would cause adverse effects. DoC acknowledges that future renovations to Building 1 will be governed by NHPA and the *Secretary of the Interior's Standards for Rehabilitation* (36 CFR 67).

No impacts on Anderson Ditch or historic properties outside of the campus are anticipated.

Environmental Consequences – No-Action Alternative

The No-Action Alternative would not involve direct or indirect impacts on potentially historic properties at NIST or in the surrounding area. Therefore, there would be no adverse effect to historic resources.

4.11.2 Archeological Resources

Affected Environment

Archeological resources are material remains of past life or activities. Some examples include pottery, bottles, weapons, tools, rock carvings, gravesites, and other evidence of prior inhabitation. Archeological sites that retain sufficient integrity may be eligible for the National Register under Criterion D.

In 1993, GSA sponsored a cultural resource survey conducted by the National Park Service's Interagency Archeological Services at the 55-acre project site for the planned NOAA facilities and associated fiber optic cable corridor in the southern portion of the campus. The survey identified the Anderson Ditch as the only cultural resource in the project area. Another cultural resources survey in 1989 identified two prehistoric sites along the planned fiber optic cable corridor to the southwest of the current NOAA facilities area; these sites are now a tribal

protected area. The surveys also identified several boulders and rock piles, but concluded that these rock piles were of recent origin and the result of early agricultural endeavors and field clearing activities that occurred after the campus was dedicated in 1954 (Butler, 1993).

Extensive development and fill throughout the central core of the campus have extensively altered the ground surface and significantly reduced the potential for encountering archeological resources during earthwork. The planned sites of the Childcare Center and NOAA Research Building are not currently developed but are adjacent to previously developed areas and may be composed of fill from previous construction activities.

Environmental Consequences – Proposed Action

The Proposed Action would not involve any earth disturbance within tribal protected areas, archeologically sensitive areas, or any previously identified archeological sites. The Proposed Action would not adversely affect any archeological sites listed or eligible for listing on the National Register.

Environmental Consequences – No-Action Alternative

Under the No-Action Alternative, DoC would not perform any earth disturbance. The No-Action Alternative would not adversely affect any archeological sites listed or eligible for listing on the National Register.

4.12 Visual Impacts

4.12.1 Viewscapes

Affected Environment

Viewscapes are affected by physical characteristics including the following:

- Vegetation, which may conceal or complement views;
- Building characteristics, such as height and architectural features; and
- Topography.

Development projects have the potential to modify viewscapes by changing one or more of these physical characteristics.

The viewscape of the campus is characterized by the stunning backdrop of Kohler Mesa and the Flatirons and as such is of great interest to members of adjacent communities, and to occupants of vehicles travelling by on Broadway. To ensure preservation of the treasured viewscape, DoC and the City of Boulder established an MOA in May 1998 to formalize an understanding that no DoC buildings may exceed a height of 55 feet above ground level and that new construction will not obstruct views of the top one-third of Kohler Mesa (formerly known as Long Mesa) for a person standing on Broadway. The top one-third of the mesa is defined as the mesa visibility line at an elevation of 5,704.4 feet above sea level. Under the MOA, buildings shall not intrude on the view protection plane from Broadway and 27th Street assuming the eye level at 5,400 feet above sea level. Figure 4-10 demonstrates the view of the campus, Flatirons, and Kohler Mesa from Broadway.

Figure 4-10. View of the Campus, Flatirons, and Kohler Mesa from Broadway

Environmental Consequences – Proposed Action

The MOA described above reduces the potential for visual impacts on adjacent residential neighborhoods by ensuring that views of the Flatirons and Kohler Mesa will remain largely unobstructed. Construction of new, replaced, or renovated buildings and structures under the Master Plan would comply with the MOA and therefore minimize the impact of the Master Plan on the viewscape. Buildings would not exceed 55 feet and would not obstruct visibility of the top one-third of Kohler Mesa when viewed from Broadway and 27th Street.

Construction equipment may temporarily impact the viewscape from surrounding areas.

The Proposed Action would improve the viewscape on the campus by replacing dated buildings with new buildings designed to incorporate the natural aesthetic of the surroundings. While the placement and orientation of the research buildings may not allow full views of the Flatirons by spectators within, the design and locations of shared-use facilities (e.g., conference rooms and cafeterias) would strive to facilitate views of the Flatirons as well as aesthetically pleasing landscaped green areas. The construction of the campus green would allow sweeping views towards the Flatirons from within the campus.

Environmental Consequences – No-Action Alternative

The No-Action Alternative would not impact viewscapes. The No-Action Alternative would also not enhance the viewscape on the campus and its surroundings. Older, dated buildings would remain and would not be replaced with newer, more aesthetically pleasing architecture.

4.12.2 Light Pollution

Affected Environment

Exterior lighting of parking lots, roads, buildings, and pathways is often used to enhance the safety and security of persons and property. Exterior lighting may also be used to emphasize features of architectural and historic significance and enhance the enjoyment of outdoor areas.

Excessive and inappropriate exterior lighting, however, can generate light pollution. The International Dark Sky Association (IDA) identifies four main elements of light pollution (IDA, 2016):

- Urban Sky Glow – the brightening of night sky over inhabited areas, reducing the visibility of stars;
- Light Trespass – light falling where it is not intended, wanted, or needed, such as light from a streetlight entering a residential window;
- Glare – excessive brightness that can cause visual discomfort and decreased visibility; and
- Clutter – bright, confusing, and excessive groupings of light sources. Clutter contributes to urban sky glow, light trespass, and glare.

Furthermore, light pollution associated with over-illumination or inefficient fixtures can contribute to excess energy consumption.

Several standards and guidelines exist for designing effective and appropriate exterior lighting systems, as follows: The IDA *Outdoor Lighting Code Handbook* (version 1.14, December 2000/September 2002), The Illuminating Engineering Society (IES) *Lighting Handbook* (tenth edition, 2011), The United States Green Building Council (USGBC), and *LEED Reference Guide for Green Building Design and Construction* (2009).

In 2003, the City of Boulder codified outdoor lighting standards that are designed to reduce light pollution, promote energy conservation, and improve safety and security (City of Boulder, 2016g). Objectives of the ordinance include the following:

- Establishing maximum allowable lighting levels based on zoning and use;
- Minimizing light/dark contrast by requiring uniform lighting; and
- Requiring all light in excess of 2,400 lumens to be “white light;" and
- Requiring full cut-off light fixtures and shielding to reduce glare, light pollution, and light trespass.

All new multi-unit dwellings and non-residential projects must comply with the ordinance. Property owners with existing outdoor lighting must comply with the ordinance by 2018.

There are overhead streetlights installed on the campus along streets, pathways and parking lots for safety and security purposes. This lighting is directed downward and complies with the City of Boulder outdoor lighting ordinance.

Environmental Consequences – Proposed Action

The Master Plan is not expected to generate any substantial changes in light trespass outside the campus boundary from new exterior lighting. The Proposed Action would incorporate a sustainable design approach. Redesigned lighting features would be energy efficient and would minimize impacts on light pollution.

The Proposed Action could result in minor temporary impacts on light trespass due to use of supplemental lighting (e.g., temporary portable lighting) during construction activities. DoC would conduct construction activities during daylight hours, primarily to limit noise during off hours. Temporary construction

lighting may be used to illuminate work areas in the nighttime to ensure safety and security at unoccupied work sites. If applicable, DoC would mitigate this temporary lighting by ensuring construction contractors direct lighting away from the campus boundary whenever feasible.

The construction, renovation, or replacement of new facilities and parking areas under the Master Plan would require the installation of additional lighting systems for these areas to ensure that the safety and security of the campus is maintained. To minimize light pollution impacts, DoC would ensure that all new exterior lighting systems installed under the Master Plan are directed and sized appropriately, with full cut-off luminaires for streetlights; are designed in accordance with current IES and IDA guidance and the Boulder County Outdoor Lighting Ordinance; and generate light with a color temperature that is appropriate for reducing nighttime light pollution. Some of the new facilities under the Master Plan, such as the NOAA expansion at Building 34 and the new Childcare Center, would be visible from private residences on Dartmouth Avenue along the southern boundary of the campus. When designing these facilities, DoC would evaluate whether additional design and landscaping measures would be necessary to mitigate light trespass into adjacent residential properties. The Master Plan also incorporates strategic tree plantings in areas such as the protected area south of Building 33 to intercept light trespass outside the campus boundary.

Reflected sunlight from solar panels installed under the Master Plan would have the potential to cause glare, creating a potential nuisance in the vicinity of the campus if the panels are not sited and designed appropriately. When designing specific solar panels under the Master Plan, DoC would ensure that the designs incorporate glare reduction measures (e.g., anti-reflective coatings and textured glass) and that the panels are sited in a manner to avoid creating excessive glare within or outside of the campus.

Some new buildings constructed under the Master Plan may feature skylights and windows, thus increasing the potential for light trespass from interior lighting. This potential for light trespass would be mitigated through the continued use of automatic lighting controls for appropriate spaces. Similar to existing operations, interior lighting would be reduced after hours, and would turn off when spaces are not being used (DoC, 2017).

The new lighting would have a minor impact on on-campus users. The lighting characteristics mentioned above would mitigate the potential impacts.

Environmental Consequences – No Action Alternative

The No-Action Alternative would not impact lighting at the campus. The No-Action Alternative would also not incorporate any elements of a sustainable design approach and would therefore not have potential to reduce existing light pollution from the campus. There would be no improvements to existing interior or exterior campus lighting.

4.13 Noise Levels

Affected Environment

High noise levels that occur over a long duration can impact the health of exposed populations and be a nuisance to the surrounding community. The A-weighted decibel scale (dBA) is a logarithmic scale generally used to measure noise levels because it can account for the sensitivity of the human ear across the frequency spectrum. Table 4-4 compares decibel noise levels, common noise sources, and the relative perception of these noise levels.

The Occupational Safety and Health Administration (OSHA) regulates workplace noise with standards for two different types of noise: constant and impulse. The OSHA limit for constant noise is 90 dBA for eight hours; however, the National Institute for Occupational Safety and Health recommends a constant noise limit of 85 dBA for eight hours to minimize occupational noise induced hearing loss. The OSHA maximum sound level for impulse noise is 140 dBA. In areas where workplace noise exceeds these sound levels, employers must provide workers with personal protective equipment to reduce noise exposure.

State and local government agencies regulate noise within the community. Noise standards set by the state under the Colorado Noise Statute 25-12-103 limit the sound levels at 25 feet or further from the property line for residential, commercial, and industrial zones as summarized in Table 4-5. The DoC Boulder Laboratories Campus is primarily surrounded by residential areas with a small commercial area to the northwest.

Between 7:00 am and 7:00 pm, the noise levels permitted in Table 4-5 may be increased by 10 dBA for up to 15 minutes per any one-hour period. Construction projects are subject to the maximum permissible noise levels specified for industrial zones pursuant to any applicable construction permit, or if no time limitation is imposed, then for a reasonable period of time for completion of the project. Boulder County also issued a noise ordinance (Ordinance No. 92-28) that reiterates the maximum permissible noise levels established by the State.

Table 4-4. Perception of Noise

Noise Level (dBA)	Common Noise Source	Subjective Evaluation
70	Outdoors in a commercial area.	Loud
60	Average of normal speech three feet away.	Moderate
50	Open office background noise.	
40	Quiet suburban environment at night.	Faint
30	Quiet rural environment at night.	
20	Concert hall background noise.	Very Faint
10	Human breathing.	
0	Threshold of hearing or audibility.	Inaudible

Source: NIH, 2009.

Table 4-5. Colorado State Maximum Permissible Noise Levels

Levels for Receiving Noise Areas	Daytime (7:00 a.m. – 7:00 p.m.)	Nighttime (7:00 p.m. – 7:00 a.m.)
Residential	55 dBA	50 dBA
Commercial	60 dBA	55 dBA
Light Industrial	70 dBA	65 dBA
Industrial	80 dBA	75 dBA

Ambient noise levels at the campus are affected by noise generated both onsite and offsite. Minor noise associated with vehicular traffic on nearby roads, such as Broadway, is the primary source of noise in the area immediately surrounding the campus. The main sources of noise generated onsite and in proximity to the Proposed Action include the following (in decreasing order of noise level):

- CUP operations (i.e., generators, boilers, cooling towers, and chillers);
- HVAC equipment and emergency generators at individual buildings;
- Grounds maintenance activities (i.e., lawn mowers and leaf blowers); and
- Cars and other vehicles.

DoC received noise complaints from off-campus neighbors in the past and conducted an investigation to identify the source of the noise. Noise sampling was performed, but noise readings did not exceed Boulder County or Colorado State noise limits. However, as noise complaints are identified, DoC works to actively address the concerns.

Environmental Consequences – Proposed Action

Under the Master Plan, the overall change to operational noise levels is expected to be negligible. The upgrade and expansion of facilities would introduce new minor noise sources on campus, including new laboratory activities, air-handling units, exhaust fans, and emergency generators. Increased steam and chilled water output at the CUP is not expected to generate a noticeable increase in noise inside or outside the facility. Workers within the CUP would continue to wear appropriate hearing protection in areas with noise-producing equipment.

While the NOAA expansion at Building 34 would result in development closer to the campus boundary, the activities in this building would be largely administrative in nature with minimal potential for operational noise impacts. As the Building 34 expansion project enters the design phase and additional details become available regarding potential noise-generating activities, DoC would evaluate whether additional design and landscaping measures would be necessary to mitigate noise trespass into adjacent residential properties.

Construction activities associated with the Master Plan would temporarily increase environmental noise levels in the vicinity of the project sites, primarily due to the use of heavy equipment. Equipment that may be used includes backhoes, bulldozers, and excavators. Construction equipment noise emission levels generally range between 74 to 101 dBA at a distance of 50 feet from the source, depending on the type of equipment (FHWA, 2014). The construction noise would be temporary and would dissipate as the distance from the source increases. Thus, it is expected that residents in surrounding neighborhoods and visitors to the adjoining cemetery would not experience noise louder than the applicable noise limit. To further limit impacts on nearby residences, DoC would limit construction activities to normal daytime working hours (beginning no earlier than 7:00 a.m.).

Construction personnel would take the necessary precautions (e.g., hearing protection) to ensure that they would not be exposed to noise louder than the OSHA standard of 90 dBA for 8 hours.

Under the Master Plan, the ambient noise levels at DoC Boulder Laboratories Campus would remain within Colorado and Boulder County noise thresholds. Furthermore, any minor change in noise levels is not expected to affect the character of the site.

Environmental Consequences – No-Action Alternative

The No-Action Alternative would not affect ambient or interior noise levels associated with routine activities. The No-Action Alternative would not generate any temporary noise associated with construction activities.

5 Cumulative Effects

The Master Plan, in combination with the other past, present, or reasonably foreseeable actions at or near the campus, could contribute to cumulative improvements and impacts on certain environmental resources. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.

5.1 Evaluated Actions

The following list identifies the other past, present, or reasonably foreseeable actions at or near the campus that were considered and evaluated in this cumulative improvements and impacts analysis. Each of these actions will precede implementation of any Master Plan elements.

- Building 3 Renovation – Building 3 (Liquefier Building) is a one-story, concrete masonry structure of approximately 24,000 GSF that was constructed in 1952 to provide laboratory and support space. The building will be expanded to become the headquarters of the CTL. The expanded building will include three stories of offices and computer labs in approximately 25,000 usable square feet, corresponding to 41,000-43,000 GSF. The renovation will remain primarily on the existing building footprint; however, slight deviation will be needed for an entrance/lobby, infrastructure, or a small addition. The deviation from the footprint should not exceed 1,000 SF. The current height of the building is 46.5 feet, which may be increased to no higher than 55 feet under the renovation. The renovated building is planned to meet LEED Silver certification or higher. Renovation is underway and expected to be completed in late 2017. The Master Plan, under a later separate effort, would construct an addition to Building 3 to support antenna laboratories (DoC, 2017).
- Building 131 Relocation – Building 131 (Office Building) is a modular 1,440-SF structure situated on a concrete slab-on-grade adjacent to Building 3. The building contains six enclosed office spaces, meeting rooms, and restrooms. Heating and cooling are provided by exterior wall-mounted package units. During the Building 3 renovations described above, Building 131 will be relocated to the grassy area in front of the CUP to provide temporary office space. The Master Plan, under a later separate effort, would demolish Building 131 (DoC, 2017).
- Building 1, Wing 3 and 6 Renovation – Building 1 (Radio Building), completed in 1954, is a concrete and stone panel building with six wings linked by a multi-story spine. Renovation of Wings 3 and 6 was recently completed with occupancy in 2017. Improvements included interior renovation, utility system replacement, exterior recladding and window replacement, and the addition of utility galley space with seismic reinforcements. The Master Plan, under a later separate effort, would renovate other wings of Building 1 (DoC, 2017).
- Temporary Central Computing Center Construction – The Central Computing Facility (CCF) is currently located in Wing 5 of Building 1. This function will be relocated into a temporary modular building in the grass in front of the CUP in 2016 to allow for future renovation of Wing 5 under the Master Plan. The relocated CCF will be called the Boulder Computing Center (BCC) (DoC, 2017).

Figure 5-1 illustrates the locations of each of these evaluated actions.

Figure 5-1. Past, Present, and Reasonably Foreseeable Actions Evaluated in Cumulative Effects Analysis

5.2 Potential Actions Considered but Excluded from Analysis

The following list identifies potential actions at or near the campus that were considered but not evaluated in this cumulative effects analysis because there is not enough certainty at this time regarding the scope and whether the projects could actually occur to conduct a meaningful analysis.

- Security Improvements – DoC is currently conducting a security study of the campus. A NEPA analysis will be undertaken as part of this study, separate from this Master Plan and EA.
- Baseline Zero Project – The Baseline Zero project called for redeveloping a 3.1-acre parcel near the intersection of Baseline Road and 27th Way (currently occupied by a gas station and liquor store) with a four-story office building and a 100-room hotel. This site is approximately a quarter mile from the campus. Due to public opposition and the potential for the city to pass a height moratorium ordinance, the developers have abandoned their plan to move forward on the Baseline Zero project (Biz West, 2015).
- Medical Center Property – 385 Broadway is a medical office building adjacent to the campus. In October 2016, the City of Boulder Planning Board and the City Council approved a land use designation change for this property from *Transitional Business* to *Low Density Residential*. Currently, however, there are no known plans to redevelop this property (City of Boulder, 2016h).

5.3 Cumulative Improvements and Impacts Analysis

Several resource areas could experience continuing environmental effects following completion of the actions described in Section 5.1 (Evaluated Actions). This analysis considers whether the Master Plan, when viewed in combination with the potential impacts or improvements under these other evaluated actions, could contribute to cumulative effects that result in the degradation or enhancement of important resources.

Sustainable Development

The other evaluated actions are consistent with the Master Plan goal of improving campus sustainability. As discussed in Section 4.6 (Sustainable Development), the Master Plan would replace existing inefficient and inadequate facilities with more efficient and comfortable facilities; upgrade equipment; and utilize sustainable systems, such as efficient HVAC systems, exhaust energy recovery, and decoupled ventilation/cooling systems (DoC, 2017). Temporary relocation of the CCF and Building 131 would allow for sustainability-enhancing renovations to Buildings 1 and 3, respectively. Building 1 and 3 renovations would modernize the facilities and provide improved services and environmental stability to the laboratories.

Construction activities at the campus under other evaluated actions and the Master Plan would generate waste. DoC would, however, recycle construction and demolition debris to the extent practicable and ensure that other non-recyclable materials are properly disposed to offset these impacts. Construction would also require the commitment of a wide range of raw materials. The fabrication and manufacture of construction materials requires large quantities of energy and natural resources. In general, construction materials are readily available, and the construction of new facilities and renovation of existing facilities would not have an adverse effect on continued availability of these resources. Operation of the proposed facilities and transportation of additional employees to the campus under the Master Plan would also require the commitment of fossil fuels for generators and other fuel-burning equipment.

Overall, the long-term improvements in sustainability of the campus associated with implementation of the other evaluated actions combined with those of the Master Plan are expected to greatly outweigh commitments of readily available resources.

Economic Resources

The other evaluated actions are consistent with the Master Plan goal of improving productivity and available resources at the DoC Boulder Laboratories Campus, potentially leading to minor economic benefits as discussed in Section 4.1.2 (Social and Economic Resources). Incidental procurement by construction workers temporarily visiting Boulder in association with implementation of the Master Plan and other evaluated actions would combine to add to the local economy.

Vegetation

Renovation of Building 3 (depending on the footprint modification) and construction of the temporary BCC would result in the removal of some grassy vegetation, and the vegetation impacts described in Section 4.2.1 (Vegetation) for the Master Plan would contribute to these impacts. DoC would, however, offset this reduction in grassy vegetation by the eventual removal of the temporary BCC and by planting native vegetation under the Master Plan, resulting in an overall minor cumulative impact on vegetation.

Stormwater Management

Renovation of Building 3 (depending on the footprint modification) and construction of the temporary BCC would slightly increase impervious area within the campus and thus impact stormwater runoff. While the impervious surface changes discussed in Section 4.5.3 (Stormwater Management) for the Master Plan would contribute to these impacts, most of the Master Plan phases

would result in a net decrease in impervious surfaces on the campus and provide benefits for stormwater management. Benefits include impeding stormwater flow, reducing soil erosion during rain events, improving runoff water quality, and increasing groundwater recharge. DoC would install post-construction BMPs including LID, green infrastructure, and other stormwater control measures under the Master Plan, which would help to mitigate any cumulative impacts associated with increased impervious surfaces. Also, any increase in impervious surfaces would be offset by the eventual removal of the temporary BCC.

Surface Water and Wildlife

Stormwater runoff from the BCC and Building 131 could transfer sediment and contaminants to Anderson Ditch. Though these structures would be temporary, sediment and contaminants may persist in the water body thus creating potential for long-term impacts on water quality and aquatic habitat that could combine with impacts discussed in Section 4.4.1 (Surface Water) associated with Master Plan development. DoC would, however, minimize these impacts on surface waters and wildlife by implementing ESC measures to prevent sediment transport from construction and renovation sites. Implementation of the Master Plan has the potential to further improve surface water quality and aquatic habitat through post-construction BMPs and stormwater management techniques.

Potable Water Supply and Wastewater

Construction of the Building 3 expansion and the temporary BCC would result in an increase in the total climate-controlled square-footage on the campus, which would marginally increase steam and cooling loads, the associated use of potable water, and the associated generation of condensate wastewater. The increases in potable water demand and wastewater generation described in Section 4.5.1 (Potable Water Supply) and Section 4.5.2 (Wastewater), respectively, for the Master Plan would combine with these impacts. DoC would, however, minimize this increase in potable water demand and wastewater generation by installing water-efficient fixtures in new and renovated buildings and implementing other water conservation and efficiency measures.

Electricity Demand

Implementation of the other evaluated actions in combination with the Master Plan would increase electricity usage due to operation of lighting systems, laboratory equipment, and HVAC systems associated with the new and renovated buildings. DoC would, however, minimize this increase in electricity demand by implementing energy-efficient elements described in Section 4.5.4.1 (Electricity).

Solid and Hazardous Waste

Construction of the other evaluated actions along with the Master Plan would generate solid and hazardous waste, resulting in a cumulative impact on landfills. DoC would, however, minimize this increase in solid and hazardous waste disposal by recycling construction and demolition debris to the extent practicable and ensuring that other non-recyclable materials are properly disposed.

Architectural Resources

Renovation activities under the other evaluated actions and the Master Plan would affect historic Building 1. DoC is in consultation with OAHP to develop an MOA that addresses the phased renovations of Building 1. DoC would ensure that all renovations to Building 1 comply with the *Secretary of the Interior's Standards for Rehabilitation* (36 CFR 67), thereby minimizing potential for cumulative impacts on architectural resources.

Viewscapes

Renovation of Building 3 could involve increasing the height of the building from 46.5 feet to no higher than 55 feet. As discussed in Section 4.12.1 (Viewscapes), an MOA between the City of Boulder and DoC requires that buildings not exceed a height of 55 feet above ground level and that new construction not obstruct views of the top one-third of Kohler Mesa for a person standing on Broadway. The Building 3 renovation and construction of new, replaced, or renovated buildings and structures under the Master Plan would comply with the MOA and thereby ensure that views of the Flatirons and Kohler Mesa from adjacent residential neighborhoods would remain largely unobstructed.

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Position:	Environmental Scientist
Firm:	Eastern Research Group, Inc.
Items:	Overall EA coordination, analysis, review, and documentation
Experience:	M.S. Biological Sciences/B.S. Biological Sciences; 9 years of experience in environmental impact analysis and natural resources management

Name:	JJ Johnson
Position:	Environmental Engineer
Firm:	Eastern Research Group, Inc.
Items:	Utilities and infrastructure, wastewater, vehicle circulation and parking, air quality, cultural and historic resources, noise levels
Experience:	M.E.M. Engineering Management/B.E. Environmental Engineering; 8 years of experience in environmental engineering, environmental impact analysis, planning, and air emissions analysis

Name:	Allison DenBleyker
Position:	Environmental Engineer
Firm:	Eastern Research Group, Inc.
Items:	Air quality, climate change
Experience:	M.S. Environmental and Water Resources Engineering/B.S. Civil Engineering; 9 years of experience in emissions modeling and air quality planning support

Name:	Kettie Holland Rupnik
Position:	Environmental Scientist
Firm:	PG Environmental
Items:	Biological resources; topography, geology, and soils; water resources; stormwater management; sustainable development; solid and hazardous waste
Experience:	B.S. Integrated Science and Technology; 6 years of experience in environmental compliance and enforcement tasks, focus on stormwater and wastewater management

Name:	Leah Koch
Position:	Environmental Analyst
Firm:	Independent Consultant
Items:	Land use and socioeconomics, public transportation, climate change, visual impacts, cumulative effects
Experience:	M.E.M. Environmental Management/B.A. Environmental Studies; 8 years of experience in natural resource assessments, environmental impact analysis, and environmental compliance

Name:	Jared McGrath
Position:	GIS Analyst
Firm:	Eastern Research Group, Inc.
Items:	GIS analysis, map development
Experience:	M.S. Environmental Engineering/B.S. Civil Engineering; 2 years of experience in GIS and environmental analysis

Name:	Sumayal Shrestha
Position:	Graphics Design and Production Manager
Firm:	Eastern Research Group, Inc.
Items:	Graphic design, production
Experience:	M.A. in Environmental Science and Policy, B.A. in Fine Arts and Economics; 6 years of experience in visual communication and functional design

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8 List of Agencies and Persons Consulted

Agency: U.S. Fish and Wildlife Service, Colorado Ecological Services Field Office

Reason: Potential presence of rare, threatened, or endangered species on the campus.

Agency: History Colorado, Office of Archaeology and Historic Preservation

Reason: Potential impacts on historic resources.

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9 Distribution List

Tribes

Norma Gourneau, Superintendent
Wind River Agency, BIA (Medicine Wheel Coalition)
PO Box 158
Fort Washakie, Wyoming 82514

Amber Toppah, Chairperson
Kiowa Indian Tribe of Oklahoma
100 Kiowa Way, P.O. Box 369
Carnegie, Oklahoma 73015

Clement J. Frost, Chairman
Southern Ute Indian Tribe of the Southern Ute Reservation, Colorado
356 Ouray Drive, P.O. Box 737
Ignacio, Colorado 81137

Darwin St. Clair Jr., Chairman
Eastern Shoshone Tribe
P.O. Box 538
Fort Washakie, Wyoming 82514

Eddie Hamilton, Governor
Cheyenne and Arapaho Tribes, Oklahoma
P.O. Box 38, 100 Red Moon Circle
Concho, Oklahoma 73022

John Yellow Bird Steele, President
Oglala Sioux Tribe
P.O. Box 2070
Pine Ridge, South Dakota 57770

Llevando Fisher, President
Northern Cheyenne Agency, BIA
Hwy 39 N. Cheyenne Ave, PO Box 128
Lame Deer, Montana 59043

Lyman Guy, Chairman
Apache Tribe of Oklahoma
511 E. Colorado, PO Box 1330
Anadarko, Oklahoma 73005

Manuel Heart, Chairman
Ute Mountain Ute Tribe of the Ute Mountain Reservation
P.O. Box 248
Towaoc, Colorado 81334

Misty Nuttle, President
Pawnee Nation of Oklahoma
881 Little Dee Dr, P.O. Box 470
Pawnee, Oklahoma 74058

Shaun Chappoose, Chairman
Ute Indian Tribe of the Uintah & Ouray Reservation, Utah
(Formally NO. UTE TRIBE)
P.O. Box 190
Ft. Duchesne, Utah 84026

Verinda Reval, Superintendent
Jicarilla Agency, BIA
120 Seneca Street, P.O. Box 167
Dulce, New Mexico 87528

Wallace Coffey, Chairman
Comanche Nation, Oklahoma
584 NW Bingo Road, PO Box 908
Lawton, Oklahoma 73502

William Kindle, President
Rosebud Sioux Tribe of the Rosebud Indian Reservation
P.O. Box 430
Rosebud, South Dakota 57570

City of Boulder

Carl Castillo, Policy Advisor
City of Boulder Planning Department
1777 Broadway
Boulder, Colorado 80302

Lesli Ellis, Comprehensive Planning Manager
City of Boulder Planning Department
1777 Broadway
Boulder, Colorado 80302

Holly Opansky, Board Secretary
Boulder Landmarks Board
1777 Broadway – City Council Chambers
Boulder, Colorado 80302

Boulder County

Land Use Planning Division
PO Box 471
Boulder, Colorado 80306

Historic Preservation

Steve Turner, AIA
State Historic Preservation Officer
History Colorado
1200 Broadway
Denver, Colorado 80203

Gail Gray, President
Historic Boulder
1123 Spruce Street
Boulder, Colorado 80302

Regional Transportation District

Susan Wood
Regional Transportation District Planning
1560 Broadway, Suite 700
Denver, Colorado 80202

Colorado Department of Transportation

David Singer
Environmental Policy & Biological Resources Section Manager/NEPA Program Manager
4201 East Arkansas Avenue
Denver, Colorado 80222

Colorado Department of Natural Resources

Dick Wolfe, State Engineer
Colorado Division of Water Resources
1313 Sherman St., Room 818
Denver, Colorado 80203

Colorado Water Conservation Board
1313 Sherman St., Room 718
Denver, Colorado 80203

Colorado Department of Public Health and Environment

Jim DiLeo, Air Pollution Office
Colorado Department of Public Health and Environment
4300 Cherry Creek Drive South
Denver, Colorado 80246-1530

Project Manager
Water Quality Control Division
4300 Cherry Creek Drive South
Denver, Colorado 80246-1530

Natural Resources Conservation Service

Allen Green
Denver Federal Center Building 56
Room 2604
PO Box 25426
Denver, Colorado 80225-0426

U.S. Army Corps of Engineers

Denver Regulatory Office (Omaha District)
9307 South Wadsworth Blvd.
Littleton, Colorado 80128-6901

Colorado Division of Wildlife

Regional Manager
Division of Wildlife - Northeast Regional Service Center
6060 Broadway
Denver, Colorado 80216

U.S. Fish and Wildlife Service

Susan Linner
Ecological Services
Colorado Field Office
P.O. Box 25486, DFC
Denver, Colorado 80225-0486

National Park Service

Sue Masica, Regional Director
National Park Service Intermountain Regional Office
12795 West Alameda Parkway
Denver, Colorado 80225

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APPENDIX A
CORRESPONDENCE

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Colorado Ecological Services Field Office
134 UNION BOULEVARD, SUITE 670
LAKEWOOD, CO 80228
PHONE: (303)236-4773 FAX: (303)236-4005
URL: www.fws.gov/coloradoES; www.fws.gov/platteriver

Consultation Code: 06E24000-2016-SLI-0781 June 10, 2016
Event Code: 06E24000-2016-E-01300
Project Name: EA for DoC Boulder Labs Campus Master Plan

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment

United States Department of Interior
Fish and Wildlife Service

Project name: EA for DoC Boulder Labs Campus Master Plan

Official Species List

Provided by:

Colorado Ecological Services Field Office
DENVER FEDERAL CENTER
P.O. BOX 25486
DENVER, CO 80225
(303) 236-4773
http://www.fws.gov/coloradoES
http://www.fws.gov/platteriver

Consultation Code: 06E24000-2016-SLI-0781
Event Code: 06E24000-2016-E-01300

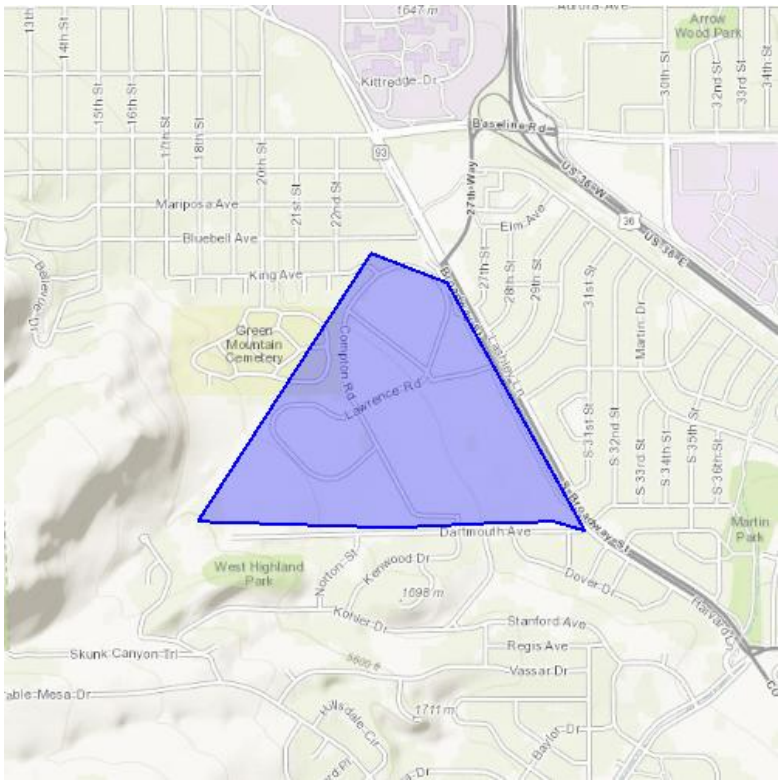
Project Type: ** OTHER **

Project Name: EA for DoC Boulder Labs Campus Master Plan
Project Description: Eastern Research Group (ERG) as a subcontractor to Metropolitan Architects & Planners, Inc. (MAP) is providing support for compiling an Environmental Assessment for the DoC Campus Master Plan in Boulder, CO. The Master Plan will establish a framework for short and long term growth and change within the campus, including consolidation, re-configuring, renovation, and replacement of facilities and other infrastructure. We plan to complete the EA during November 2016 and plan to have the draft report for the biological resources section completed sometime in the upcoming months. We are reviewing a lot of documents for the EA and would like to request an official species list to complete the biological resources portion of the EA.

The Boulder Labs campus includes multiple building, acts as a scientific research center, and is approximately 206 acres in size. Approximately one-half of the land is set aside as a Protected Area, which limits development on the campus. The site rises gently across the campus until it sharply rises to Long Mesa. The campus includes a wetland area at the southwestern portion of the site. Two intermittent streams are located on the property, Skunk Creek and Anderson Ditch.

Please Note: The FWS office may have modified the Project Name and/or Project Description, so it may be different from what was submitted in your previous request. If the Consultation Code matches, the FWS considers this to be the same project. Contact the office in the 'Provided by' section of your previous Official Species list if you have any questions or concerns.

Project Location Map:



Project Coordinates: MULTIPOLYGON (((-105.26103973388672 39.99599409774689, -105.25601863861084 39.9890895809455, -105.25713443756102 39.98935262294526, -105.25936603546143 39.989319742750695, -105.26301383972168 39.989188221814125, -105.270094871521 39.98935262294526, -105.26378631591797 39.996816017539956, -105.26103973388672 39.99599409774689)))

Project Counties: Boulder, CO

Endangered Species Act Species List

There are a total of 11 threatened or endangered species on your species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Note that 5 of these species should be considered only under certain conditions. Critical habitats listed under the **Has Critical Habitat** column may or may not lie within your project area. See the **Critical habitats within your project area** section further below for critical habitat that lies within your project. Please contact the designated FWS office if you have questions.

Birds	Status	Has Critical Habitat	Condition(s)
Least tern *(Sterna antillarum)* Population: interior pop.	Endangered		Water-related activities/use in the N. Platte, S. Platte and Laramie River Basins may affect listed species in Nebraska.
Mexican Spotted owl *(Strix occidentalis lucida)* Population: Entire	Threatened	Final designated	
Piping Plover *(Charadrius melodus)* Population: except Great Lakes watershed	Threatened	Final designated	Water-related activities/use in the N. Platte, S. Platte and Laramie River Basins may affect listed species in Nebraska.
Whooping crane *(Grus americana)* Population: except where EXPN	Endangered	Final designated	Water-related activities/use in the N. Platte, S. Platte and Laramie River Basins may affect listed species in Nebraska.

Fishes			
Greenback Cutthroat trout *(Oncorhynchus clarki stomias)* Population: Entire	Threatened		
Pallid sturgeon *(Scaphirhynchus albus)* Population: Entire	Endangered		Water-related activities/use in the N. Platte, S. Platte and Laramie River Basins may affect listed species in Nebraska.
Flowering Plants			
Colorado Butterfly plant *(Gaura neomexicana var. coloradensis)*	Threatened	Final designated	
Ute ladies'-tresses *(Spiranthes diluvialis)*	Threatened		
Western Prairie Fringed Orchid *(Platanthera praeclara)*	Threatened		Water-related activities/use in the N. Platte, S. Platte and Laramie River Basins may affect listed species in Nebraska.
Mammals			
Canada Lynx *(Lynx canadensis)* Population: Contiguous U.S. DPS	Threatened	Final designated	
Preble's meadow jumping mouse *(Zapus hudsonius preblei)* Population: wherever found	Threatened	Final designated	

Critical habitats that lie within your project area

There are no critical habitats within your project area.

Appendix A: FWS National Wildlife Refuges and Fish Hatcheries

There are no refuges or fish hatcheries within your project area.

Appendix B: FWS Migratory Birds

The protection of birds is regulated by the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA). Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). The MBTA has no otherwise lawful activities. For more information regarding these Acts see:
http://www.fws.gov/birds/policies-and-regulations/laws-legislations/migratory-bird-treaty-act.php
http://www.fws.gov/birds/policies-and-regulations/laws-legislations/bald-and-golden-eagle-protection-act.php

All project proponents are responsible for complying with the appropriate regulations protecting birds when planning and developing a project. To meet these conservation obligations, proponents should identify potential or existing project-related impacts to migratory birds and their habitat and develop and implement conservation measures that avoid, minimize, or compensate for these impacts. The Service's Birds of Conservation Concern (2008) report identifies species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become listed under the Endangered Species Act as amended (16 U.S.C 1531 et seq.).

For information about Birds of Conservation Concern, go to:
http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php

For information about conservation measures that help avoid or minimize impacts to birds, please visit:
http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php

To search and view summaries of year-round bird occurrence data within your project area, go to the Avian Knowledge Network Histogram Tools at:
http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/akn-histogram-tools.php

Migratory birds of concern that may be affected by your project:
There are 25 birds on your Migratory birds of concern list.

Species Name	Bird of Conservation Concern (BCC)	Seasonal Occurrence in Project Area
American bittern *(Botaurus lentiginosus)*	Yes	Breeding

Bald eagle *(Haliaeetus leucocephalus)*	Yes	Year-round
Black Rosy-Finch *(Leucosticte atrata)*	Yes	Year-round
Black Swift *(Cypseloides niger)*	Yes	Breeding
Brewer's Sparrow *(Spizella breweri)*	Yes	Breeding
Brown-capped Rosy-Finch *(Leucosticte australis)*	Yes	Wintering
Burrowing Owl *(Athene cunicularia)*	Yes	Breeding
Cassin's Finch *(Carpodacus cassinii)*	Yes	Year-round
Dickcissel *(Spiza americana)*	Yes	Breeding
Ferruginous hawk *(Buteo regalis)*	Yes	Year-round
Flammulated owl *(Otus flammeolus)*	Yes	Breeding
Golden eagle *(Aquila chrysaetos)*	Yes	Year-round
Lewis's Woodpecker *(Melanerpes lewis)*	Yes	Breeding
Loggerhead Shrike *(Lanius ludovicianus)*	Yes	Breeding
Long-Billed curlew *(Numenius americanus)*	Yes	Breeding

Mountain plover *(Charadrius montanus)*	Yes	Breeding
Peregrine Falcon *(Falco peregrinus)*	Yes	Breeding
Prairie Falcon *(Falco mexicanus)*	Yes	Year-round
Sage Thrasher *(Oreoscoptes montanus)*	Yes	Breeding
Short-eared Owl *(Asio flammeus)*	Yes	Wintering
Swainson's hawk *(Buteo swainsoni)*	Yes	Breeding
Virginia's Warbler *(Vermivora virginiae)*	Yes	Breeding
Western grebe *(aechmophorus occidentalis)*	Yes	Breeding
Williamson's Sapsucker *(Sphyrapicus thyroideus)*	Yes	Breeding
Willow Flycatcher *(Empidonax traillii)*	Yes	Breeding

Appendix C: NWI Wetlands

Wetlands data for your project area was not available at the time of this species list request.

UNITED STATES DEPARTMENT OF COMMERCE
National Institute of Standards and Technology
Gaithersburg, Maryland 20899-

2017-I-0113

U.S. FISH AND WILDLIFE SERVICE
☐ NO CONCERNS
☐ CONCUR NOT LIKELY TO ADVERSELY AFFECT
☒ NO COMMENT
DRUE L. DEBERRY 11/3/16 DATE
ACTING COLORADO FIELD SUPERVISOR

NOV - 7 2016

October 26, 2016

To Distribution List

Re: U.S. Department of Commerce Boulder Laboratories Draft Master Plan and Draft Environmental Assessment

The National Institute of Standards and Technology (NIST) recently completed a Draft Master Plan and a Draft Environmental Assessment for the U.S. Department of Commerce (DOC) Boulder Laboratories campus located at 325 Broadway, Boulder, CO, 80305. At this time, NIST and DOC are requesting comments on these two documents from members of the public as well as local and regional jurisdictional entities. A CD with PDF copies of the Draft Master Plan and Draft Environmental Assessment is enclosed. These documents are also accessible on the web at: https://www.nist.gov/ofpm/boulder-master-plan.

Your organization is invited to submit comments via email to BldrLabsMPcommentsPublic@nist.gov or by mail to the following address:

DOC Boulder Laboratories
Master Plan Comments
National Institute of Standards and Technology (NIST)
325 Broadway, MS-194.00
Boulder CO, 80305-3328

The last date for receiving comments is December 5, 2016. If we do not hear from you by that date, we will assume that you do not wish to comment. We appreciate your time and consideration in the review of these documents.

Sincerely,

Clyde Messerly, RA
Acting Chief Facilities Management Officer
Office of Facilities and Property Management

Enclosures

NIST

From: Kuster - CDPHE, Kent [mailto:kent.kuster@state.co.us]
Sent: Tuesday, November 22, 2016 12:56 PM
To: BldrLabsMPcommentsPublic <bldrlabsmpcommentspublic@nist.gov>
Subject: Master Plans comments

Clyde Messerly,
The Colorado Department of Public Health and Environment has the attached a comment sheet with our comments on the DOC Boulder Laboratories Master Plan. Thank you for the opportunity to comment.
Kent

--

Kent Kuster

Environmental Protection Specialist

Colorado Department of Public Health and Environment

4300 Cherry Creek Drive South

Denver, CO 80246-1530

303-692-3662 | kent.kuster@state.co.us

Chapter	Section	Page Number	Comment
1	Table 1-1	1-9	In the Air Quality section, under mitigation, suggest rephrasing sentence to "Removal and disposal of **lead**, asbestos-containing materials and ozone-depleting substances in accordance with applicable regulations."
4	4.9	4-31	In the final paragraph of the Temporary Activities Section, suggest rephrasing sentence to, "If any **lead**, asbestos-containing materials or equipment that contains ozone-depleting substances are encountered during construction, DOC would remove and dispose of these materials and equipment in accordance with all applicable regulations to ensure air quality is not impacted."
Non-specific comment			Land development construction activities (earth moving) that are greater than 25 acres or more than six months in duration require an Air Pollutant Emissions Notice (APEN) from the Air Pollution Control Division and may be required to obtain an air permit depending on estimated emissions. In addition, a start-up notice must be submitted thirty days prior to beginning a land development project. Depending on the duration of each construction progect, the developer may need to obtain an APEN.

NRCS

Natural Resources Conservation Service
Denver Federal Center
Building 56, Room 2604
P.O. Box 25426
Denver, CO 80225

SUBJECT: Farmland Policy Protection Act December 5th, 2016

Clyde Messerly, RA
Acting Chief Facilities Management Office
Office of Facilities and Property Management
DOC Boulder Laboratories
325 Broadway, MS-194.00
Boulder, CO 80305-3328

RE: US Department of Commerce Boulder laboratories Draft Master Plan and Draft Environmental Assessment

Mr. Messerly,

The Farmland Policy Protection Act is intended to minimize the impact Federal programs have on the unnecessary and irreversible conversion of farmland to non-agricultural use. It assures that to the extent possible federal programs are administered to be compatible with state, local units of government, and private programs and policies to protect farmland.

For the purpose of FPPA, farmland includes prime farmland, unique farmland, and land of statewide or local importance. Farmland subject to FPPA requirements does not have to be currently used as cropland. Projects are subject to FPPA requirements if they may irreversibly convert farmland to non-agriculture use and are completed by a federal agency or with assistance from a federal agency.

Your project occurs within the boundaries of an urbanized area, according to the Urbanized Area Reference Map produced by the United States Census Bureau in 2010, therefore it is not subject to FPPA. NRCS recommends using accepted erosion control practices throughout all phases of the project's construction.

If you have any further questions, please call at (720) 544-2855.

Thank you,

T. Riley Dayberry
Asst. State Soil Scientist, NRCS, Denver CO

cc:
Eugene Backhaus State Resource Conservationist, NRCS, Denver CO
Clinton Evans State Conservationist, NRCS, Denver CO
William Shoup State Soil Scientist, NRCS, Denver CO

CITY OF BOULDER
OFFICE OF THE CITY MANAGER

December 5, 2016

Susan Cantilli, AIA
Team Lead, Facilities Planning
Capital Asset Management & Facilities Planning Group
Office of Facilities & Property Management
National Institute of Standards & Technology (NIST)

Re: Comments on the Draft Master Plan and Environmental Assessment

Dear Ms. Cantilli:

Thank you for providing the City of Boulder the opportunity to submit the attached comments on the Department of Commerce's (DOC) draft Master Plan and Environmental Assessment for its Boulder Laboratories Campus. The city is strongly supportive of the work conducted by DOC and appreciative of the positive economic and social impact it makes in our community. We are consequently encouraged with the farsighted plan to enhance the campus to better support DOC's mission of advancing science and technology.

We appreciate that the Master Plan respect the agreements in place between DOC and the city as well as all the efforts you have made to understand those agreements and to work with us in developing this plan.

Please let me know if you have any questions about the attached comments.

Sincerely,

Carl Castillo
Policy Advisor

Attached

P.O. Box 791 · Boulder, Colorado 80306-0791 · www.bouldercolorado.gov · (303)441-3002 · Fax (303)441-4478

City of Boulder Comments on the draft Master Plan

The DOC draft Master Plan and Environmental Assessment for the Boulder Laboratories Campus outlines many positive elements that align with city goals. The City of Boulder respectfully requests consideration of issues and suggestions identified in the areas listed below. Some of the items are significant concerns around which city staff is happy to work with the DOC to explore changes. Additionally, we have included requests for clarifications in the plan.

Topics of Comments

- Joint Use Utility Corridor
- Transportation and Access
- Wastewater Utility
- Flood and Stormwater
- Open Space & Mountain Parks
- Urban Wildlife
- Facility Design
- Impacts to Nearby Neighbors (lighting, noise, construction)
- Public Access and Tourism
- Public Art
- Regional Analysis

Additional Information for the Plan

- Recent changes to the blue line
- Recent change to Boulder Valley Comprehensive Plan land use designation for 385 Broadway

Comments

Joint Use Utility Corridor

The Master Plan omits an important agreement in the description of agreements listed in Section 2.3. It should include the joint use utility corridor for electrical distribution and telecommunications conduits. This easement contains significant infrastructure and we recommend it be specifically acknowledged.

Transportation

The site includes essential transportation connections and the need to accommodate and improve bike paths is strongly emphasized. The city's Transportation staff raises the following issues regarding access and egress and bicycle safety.

- The proposed alignment includes a separate sidewalk connecting the intersection/crosswalk to the multi-use path just north of the intersection. Due to the indirect design of the proposed multi-use path alignment, cyclists will choose to utilize the sidewalk instead of the multi-use path which will result in conflicts with pedestrians. Additionally, the proposed sharp curves in the multi-use path adjacent to Broadway presents an unsafe condition for north and southbound bicycle commuters (page 112 of the draft plan). Staff previously met with DOC staff

last summer to discuss a variety of intersection design options; however, no single design option was agreed upon at that time. Staff understands the DOC's safety concerns regarding the current intersection design and looks forward to continuing discussions to determine a mutually agreeable and appropriate intersection design alternative.

- The Campus Master Plan map on p.83 shows a "Reject Lane" for trucks around the visitor parking area exiting on to Broadway using the Medical Center Drive. This means additional vehicle traffic crossing the Broadway bike path at this location and making left hand turns, which presents a significant safety issue for cyclists and pedestrians. Large trucks making left hand turns at this unsignalized intersection would likely block the bike path as they wait for a gap in traffic and these turns will be difficult during peak hours, presenting an additional safety issue for traffic on the corridor.

- The plan proposes to add parking and includes structured parking but does not contain any Transportation Demand Management (TDM) efforts to manage the demand for parking. This seems to be a major oversight given the sustainability emphasis in many other areas of the plan and ignores the potential to avoid the significant costs of building structured parking. The parking survey on p. 158 shows an occupancy of 73% and a ratio of occupied spaces/employee of only .59. The report recognizes that a significant number of employees arrive at campus via non-SOV modes but does not discuss any strategies to increase this. Given the single entrance to the campus, a parking cash- out could be relatively easy to implement and is worth considering along with other TDM efforts. City staff respectfully offers assistance to explore potential TDM efforts.

- The Staff supports maintaining the existing curb-cut / driveway that provides access to the 385 Broadway property.

Water

There are five large water transmission lines that cross the NIST site ranging from 14" to 30" in diameter. The existing Grant of Irrevocable Easement in Real Property dated December 8, 1993 appears to cover the majority of these facilities under provision 11 in the easement language. However, there are portions of the 20" PCCP waterline and the 14" steel waterline that are located outside of the 1993 easement area. The city requests clarification that provision 11 applies to city owned waterlines and requests identification of existing or additional agreements, amendments and easements as necessary to cover these lines in their entirety.

Wastewater Utility

Sanitary sewer discharges from this site enter the city's trunk sewer line in 28th St. This trunk sewer line has been identified as a significant source of inflow and infiltration into the sanitary sewer system during wet weather events. This master plan indicates sanitary sewer capacity on the site is estimated at 50% capacity and include no plans to upgrade capacity. In order to determine the

amount in inflow and infiltration that this site may be contributing to the sanitary sewer system the city requests that a flow monitoring analysis be conducted and temporary flow meter be used to verify whether the sewers on the site are contributing to the inflow and infiltration problem. For additional information on this item please contact the city Public Works Department Development Review Division.

Flood and Stormwater

- The NIST property was included in recent flood mapping and analysis of Skunk Creek as most of the site drains to Skunk Creek with some of the southern part of the site draining to Bear Creek. Utilities staff may have concern about changes to stormwater drainage if the redevelopment in some way changed the watershed boundaries. This is the link: https://maps.bouldercolorado.gov/flood-zones/ to the most current flood plain mapping, which is on our website. It can be found under "new mapping".

- The plan states that stormwater from the site is discharged to both Skunk Creek and the Anderson Ditch which crosses the site. The Anderson Ditch has been identified in recent stormwater modeling and master planning efforts as being over capacity during the 2-year and 5-year storm events. To meet the needs of the stormwater system and also the limitations of the Anderson Ditch any increased stormwater discharges should be directed away from the Andersons Ditch. In addition, opportunities to redirect current stormwater discharge to the Anderson Ditch should be explored as a part of implementing this master plan.

Open Space & Mountain Parks

The following revisions to the document are recommended by Open Space and Mountain Parks staff to provide clarification and accuracy about trails, trail system cooperation, and descriptions of the natural environment.

- Page 66; Essential Patterns; 1.; second to last line:
    a. Should be Rocky Mountain juniper
    (not cedars).
    b. At the end of this paragraph add the following statement: Consult with OSMP for recommendations on native plants appropriate for sites adjacent to the Protected Area and open space to create a more natural transition to Zone 1.

- Page 126; 11.11; open space and parks: Amend paragraph to read: The DoC property is integrated into the trail and open space system maintained by the City of Boulder Open Space and Mountain Parks Department (OSMP). OSMP's Kohler Mesa trail system abuts the property to the west, and OSMP's Tippet property and the Four Pines trailhead to the north. Trails from both these areas cross the property, and trail modifications/ upgrades are planned by the City.

- Page 132; first column; last paragraph: Add this sentence to the end of this paragraph: Today, beaver, yellow-bellied marmot and leopard frogs are less common and peregrine falcons, prairie falcons, and golden eagles are known to be nesting in the Flatirons to the west.

- Page 138; Campus Trails; Amend paragraph to read: The City's Open Space and Mountain Parks Department (OSMP) maintains hiking trails on adjacent open space lands. The trail systems through the campus Protected Area make use of DoC's Kusch Road. It links the campus roadways to Long Mesa and OSMP trails to the west. Four Pines trail at the western edge of the property connects from OSMP's Kohler Mesa Trail to the Tippitt Open Space along the north property line.
  NIST is engaged in a collaborative project with OSMP to create a designated physically and environmentally sustainable trail system. The city is responsible for maintaining the Protected Area and is concerned with issues of erosion, landscape protection and safety. Following are recently completed and anticipated actions:

  Completed

  - Constructed 3 new trail connections to Greenways multi-use path to Kusch Road, closing and restoring related undesignated social trails.
  - Worked with the Anderson Ditch Company to design and install a crossing.

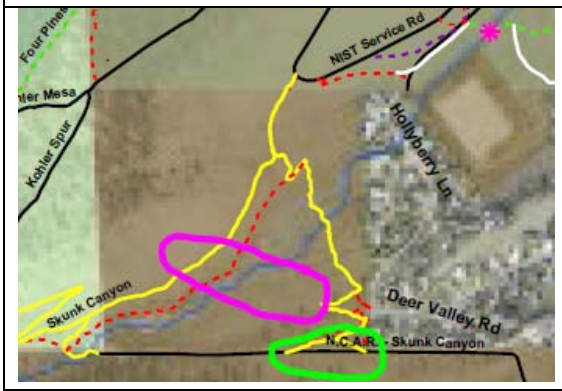
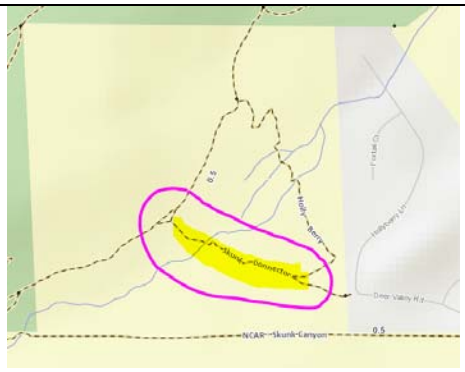
  Anticipated

  - Designate trails between Skunk Creek and Broadway, closing undesignated trails and restoring them to their natural state.
  - Evaluate options to cross Skunk Creek.
  - Designate trail connections to Four Pines and Kohler Mesa.
  - Install appropriate signs at designated trail entry points.

- Page 138; Exhibit 121: City of Boulder Proposed Trails: Note: This map needs updating. OSMP can provide updated/current trail information if desired.
  Map corrections:

  - In the map legend, change "Proposed Bridge" to "Proposed Crossing". Skunk Creek crossing could include options other than a bridge.
  - Add "Completed Crossing" to the legend and show the Anderson Ditch crossing as completed instead of proposed.
  - The yellow "Re-Route" trails west of Deer Valley Rd are not shown correctly. Two connecting trails from Deer Valley Rd to Skunk Canyon have been completed (re-routed) and one remains to be re-routed.

Exhibit 121

• Fuchsia circle shows area of missing "Re-Route" trail. See trail image to the right. • Lime green circle shows trail that has not been designated or re-routed and needs to be shown on the map as "Designate".	Highlight below on map shows a constructed trail connection that is not included on Exhibit 121. This trails needs to be added and shown as a "Re-Route" trail on Exhibit 121.
	

Urban Wildlife

The draft EA notes (page 4-8) "existing prairie dog colonies would not be disturbed." However, prairie dog colonies are dynamic, and colony growth on an annual basis is common. The Master Plan is proposing new construction (NOAA laboratory) *in the area* of the existing prairie dog colony north of Dartmouth Ave. Prairie dog colony boundaries may change through the development and implementation of the Master Plan. Should the colony boundaries change, the city recommends consulting our "six step" decision making process, Urban Wildlife Management Plan, and Wildlife Protection Ordinances. Additional information on the city's approach to managing prairie dogs when they are in conflict with human land uses can be found at: www.urbanwildlifeplan.net

Facility Design

The city recommends including designing building systems to be more resilient in light of temperatures in the region projected to increase 2 to 6 degrees F by 2050; this could include both passive (shading; lower heat island effects) and active (upsizing HVAC systems) design elements.

The plan does not include information on electric vehicle charging systems being provided for both cars and bikes. Increasing the system for EV charging is a city goal. A recommended resource is the DOE's Workplace EV Charging Challenge to promote more electric vehicle use and plan electrical loads for the increase in EV adoption.

Impacts to Nearby Neighbors (Lighting, Noise, Construction)

The city strongly encourages compliance with the outdoor lighting ordinance to minimize impacts to nearby neighbors and minimize overall light pollution. More information about the outdoor lighting ordinance can be found here: https://bouldercolorado.gov/plan-develop/outdoor-lighting-ordinance

The city encourages the DOC to minimize noise impacts that have been identified by neighbors to the north of the site. In addition, the city recommends assessing construction disruptions and minimizing impacts to Broadway and nearby residential neighbors.

Public Access and Tourism

The ability to enter the public area of the campus without vehicle screening will improve accessibility for visitors and community members and may become an additional visitor destination, conference space, and cultural asset. It would be helpful to know how many new visitors would be expected each year and if that increase is at a level that is expected to affect traffic volume or other impacts on the neighborhood. Also, will the conference center and meeting facilities located in the public area be available for use by outside groups such as industry conferences, the city, or local non-profit organizations? The city's Office of Arts and Culture working with Boulder's Convention and Visitors Bureau would be very interested in assisting your staff on this.

Public Art

Public art is mentioned in the plan only in reference to the lighting. We assume, but cannot tell from the master plan, that there will be other Federal public art commissions triggered by the project. It would improve the document to have information on public art such as funding levels, sites, discrete projects, process, and plans for maintenance and interpretation. The city's public art coordinator should be included for consultation or collaboration.

Regional Analysis

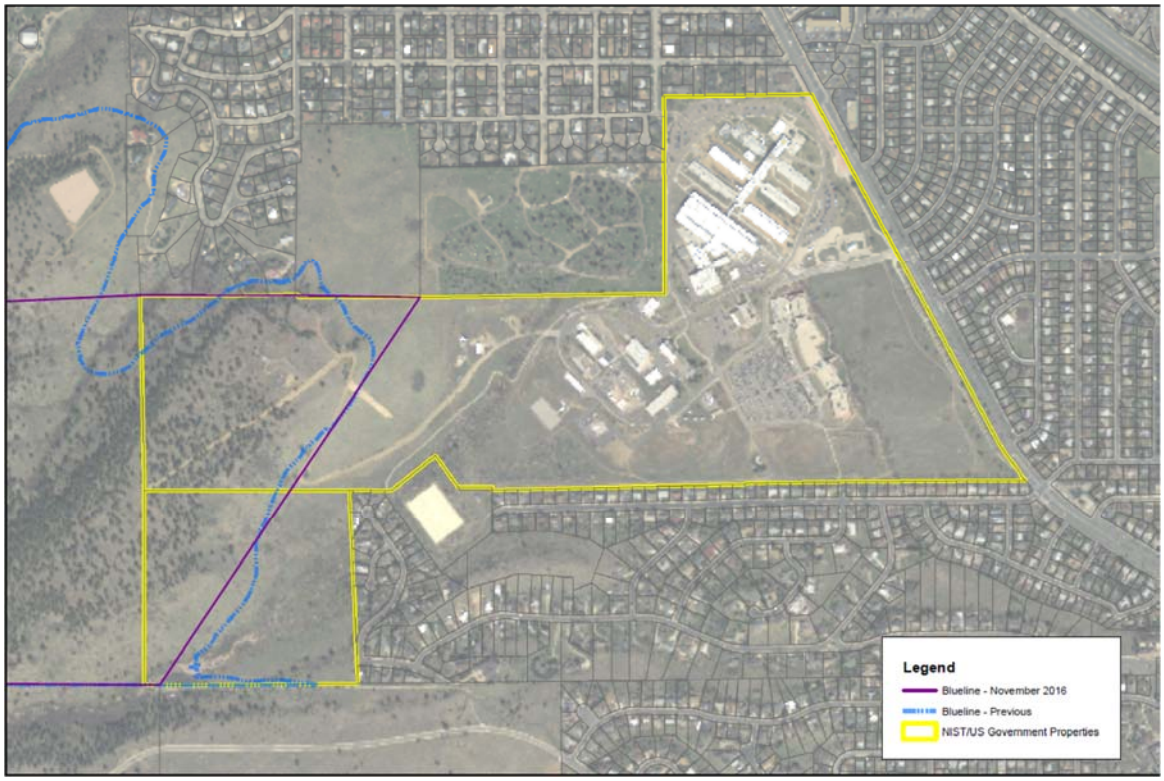
There are a few areas of the Regional Analysis section that could use a bit of editing. Suggestions include more clarity in 11.2 Geopolitical Divisions (CSA vs. MSA), 11.3 Demographics and Socio-economics (population trends, education), 11.4 Institutional Environment (number of labs in city) and 11.5 Business Environment (number of employers).

Additional Information for the Plan

Changes to the Blue Line

In November, city voters approved changes to clarify the location of the blue line, the line indicating the westward boundary where the city will supply water for domestic, commercial, or industrial uses. The

area described in the Master Plan is not in close vicinity of the blue line or near the development area. This information is provided as informational.



Land Use Designation Change to 385 Broadway

A land use designation change from Transitional Business (TB) to Low Density Residential (LR) for 385 was recently approved by the Planning Board and City Council. This change acknowledges the potential loss of existing access through the NIST property and neighborhood's expressed compatibility concerns. The city supports maintaining the existing curb-cut / driveway that provides access to the property.

APPENDIX B
PHASING DIAGRAMS

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Figure B-1. NIST Research Buildings and Campus Center Phase

Figure B-2. Visitor Center, Parking, and Vehicle Screening Phase

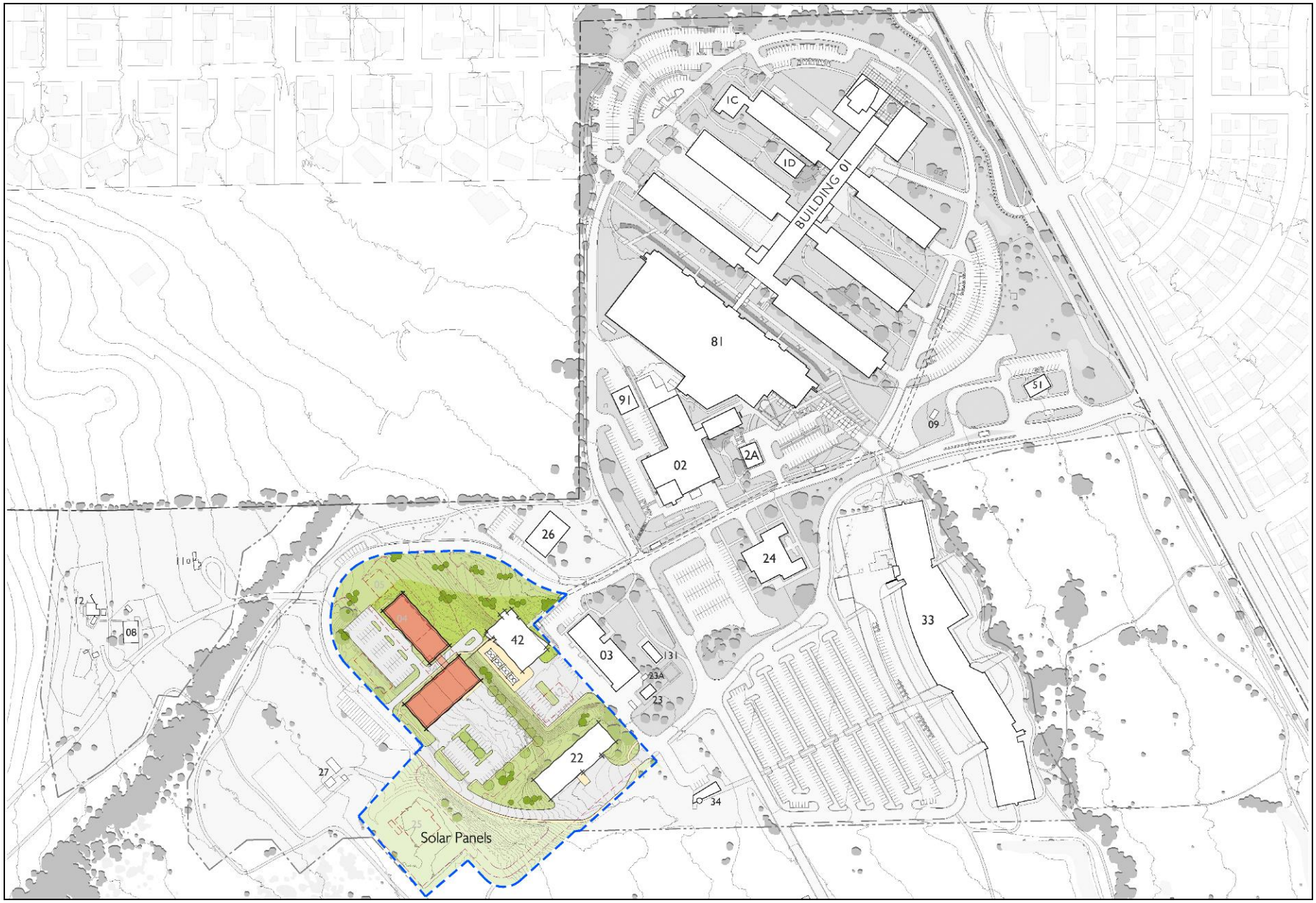

Figure B-3. Management Resources Center Phase

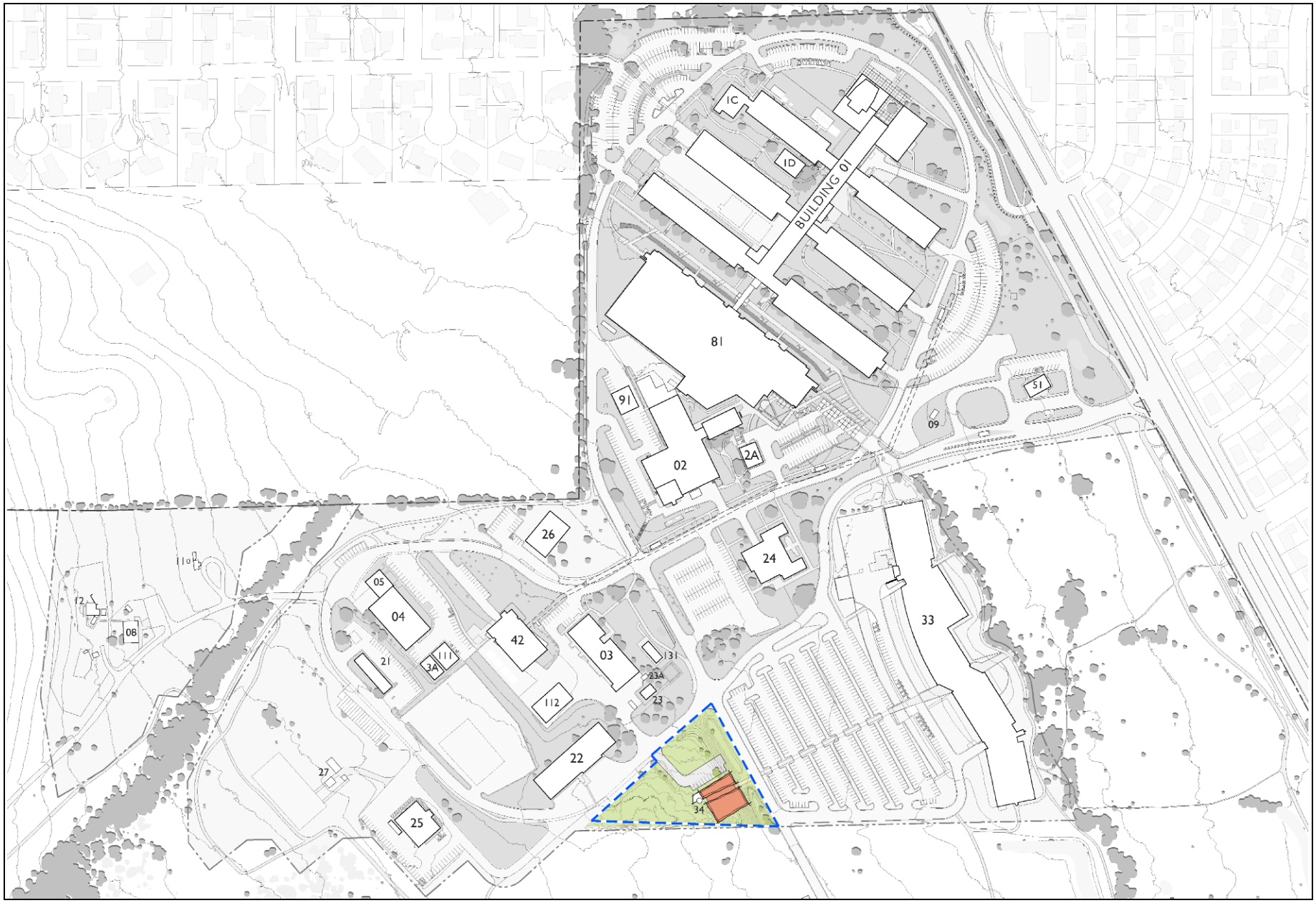

Figure B-4. NOAA Research Building Phase

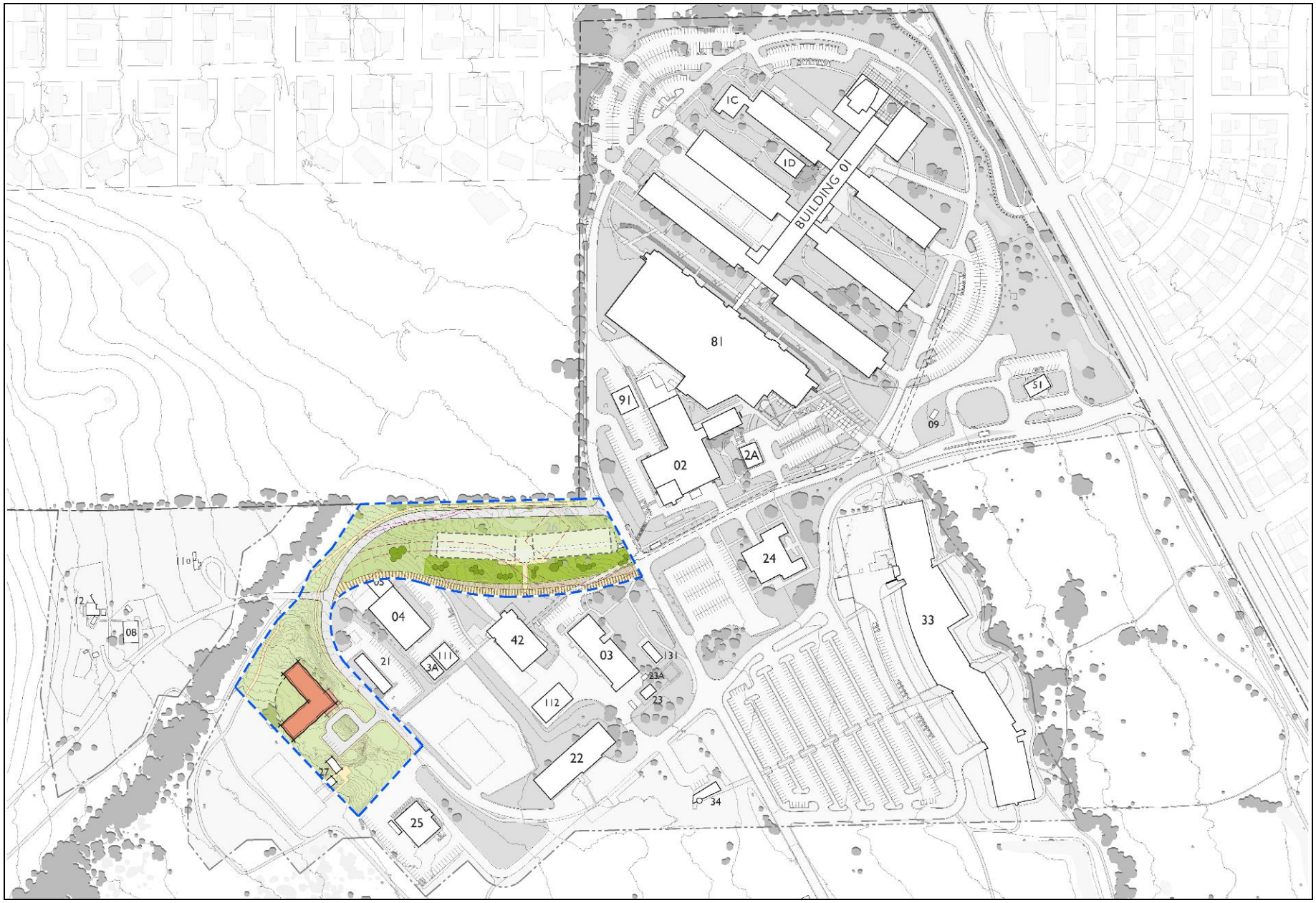

Figure B-5. Childcare Center Phase

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APPENDIX C
GENERAL CONFORMITY RULE APPLICABILITY ANALYSIS

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Executive Summary

The General Conformity Rule (GCR) was established to ensure that federal activities do not hamper local efforts to control air pollution. In particular, the GCR implements Section 176(c) of the Clean Air Act, which prohibits federal agencies, departments, or instrumentalities from engaging in, supporting, licensing, or approving any action that does not conform to an approved state or federal implementation plan. The purpose of the GCR Applicability Analysis is to determine whether the Proposed Action—execution of a Master Plan for the DoC Boulder Laboratories Campus—is subject to the federal GCR.

The Proposed Action would demolish approximately 154,000 GSF of aging and deteriorating facilities, including some temporary buildings. These facilities would be replaced and expanded by the construction of new facilities, totaling approximately 319,000 GSF and the renovation of approximately 226,000 GSF. The Proposed Action would also construct a three-story parking garage and reconfigure pavement and sidewalks throughout the campus to support the new facilities. The Proposed Action would occur in five distinct phasing packages over a 20-year period. These activities would result in emissions due to the use of equipment and vehicles during construction activities and building demolition. In addition, the construction of new facilities that would be serviced by the campus Central Utility Plant (CUP) would result in annual operating emissions from increased heating and cooling demand. Conversely, the demolition of the aging facilities would eliminate emissions from operation of boilers and emergency generators at these facilities. Using USEPA's *Motor Vehicle Emission Simulator*, this analysis estimated the resulting emissions of nitrogen oxides, particulate matter, carbon monoxide, and volatile organic compounds. These calculations demonstrate that the emissions resulting from the Proposed Action would be below the *de minimis* levels defined for those pollutants in the Applicability Section of the GCR for the years 2018 through 2032. Therefore, the GCR is not applicable to the Proposed Action.

Introduction

The purpose of this analysis is to determine whether the Proposed Action—execution of a Master Plan for the Department of Commerce (DoC) Boulder Laboratories Campus in Boulder, Colorado—is subject to the federal General Conformity Rule (GCR) established in 40 Code of Federal Regulations (CFR), Part 51, Subpart W, *Determining Conformity of General Federal Actions to State or Federal Implementation Plans*. The GCR was established to ensure that federal activities do not hamper local efforts to control air pollution. In particular, Section 176(c) of the Clean Air Act (CAA) prohibits federal agencies, departments, or instrumentalities from engaging in, supporting, licensing, or approving any action that does not conform to an approved state or federal implementation plan. This analysis will determine under which of the following areas the Proposed Action will fall:

- Not subject to the rule – The action does not emit criteria pollutants or precursors for which the area is designated as a nonattainment or maintenance area—all procurement actions are excluded from the GCR.
- Exempt or below *de minimis* levels – Emissions from the action are below *de minimis* levels and are not regionally significant, or the action is exempt.
- Does not meet *de minimis* levels or is regionally significant – Emissions from the action exceed *de minimis* levels—a Conformity Determination must be prepared for such actions.

This analysis is organized into the following sections:

- Background – Information on applicable air emission programs and limitations, including *de minimis* levels.
- Proposed Action – A description of the Master Plan at the DoC Boulder Laboratories Campus.
- Emissions Calculation Methods and Results – Procedures and results for estimating emissions associated with the Proposed Action.
- Conclusion – Assessment of whether the GCR is applicable to the Proposed Action.

Background

As part of the implementation of the CAA Amendments, the United States Environmental Protection Agency (USEPA) issued National Ambient Air Quality Standards (NAAQS) for six criteria air pollutants: carbon monoxide (CO), sulfur dioxide (SO_2), particulate matter with an aerodynamic diameter less than or equal to a nominal 10 micrometers (PM_{10}) and 2.5 micrometers ($PM_{2.5}$), ozone (O_3), nitrogen dioxide (NO_2), and lead (Pb) (USEPA, 2016a). USEPA defines ambient air in 40 CFR Part 50.1(e) as "that portion of the atmosphere,

external to buildings, to which the general public has access." Table C-1 shows the current NAAQS concentration limits as of July 2016 (USEPA, 2016c).

Table C-1. National Ambient Air Quality Standards

Criteria Pollutant	Averaging Time	Level [a]
Ozone (O_3)	8-hour	0.070 ppm [b]
Particulate Matter ($PM_{2.5}$)	24-hour	35.0 ug/m^3
	Annual Mean	12.0 ug/m^3
Particulate Matter (PM_{10})	24-hour	150 ug/m^3
Carbon Monoxide (CO)	1-hour	35.0 ppm
	8-hour	9.0 ppm
Lead (Pb)	3-month	0.15 ug/m^3
Nitrogen Dioxide (NO_2)	1-hour	100 ppb
	Annual Mean	53 ppb
Sulfur Dioxide (SO_2)	1-hour	75 ppb
	3-hour	0.5 ppm

Notes:
a – All of the standards are primary standards, which provide public health protection, except for the 3-hour SO_2 limit, which is a secondary standard and provides public welfare protection. Units of measure are parts per million (ppm) by volume, parts per billion (ppb) by volume, and micrograms per cubic meter of air (ug/m^3).
b – A final rule signed October 1, 2015, and effective December 28, 2015 established a more stringent 8-hour standard of 0.070 ppm. The previous (2008) ozone standards of 0.075 ppm remain in effect in some areas.

The CAA divides the U.S. into geographic areas called "air quality control regions" (AQCR). These AQCRs are established areas such as counties, urbanized areas, and consolidated metropolitan statistical areas. An AQCR in which levels of a criteria air pollutant meet the health-based NAAQS is designated an *attainment* area for the pollutant, while an area that does not meet the NAAQS is designated a *nonattainment* area for the pollutant. An area that was once designated a nonattainment area but was later reclassified as an attainment area is known as a *maintenance* area. Nonattainment and maintenance areas can be further classified as extreme, severe, serious, moderate, or marginal. An AQCR may have an acceptable level for one criteria air pollutant but may have unacceptable levels for other criteria air pollutants. Thus, an area could be attainment, maintenance, and/or nonattainment at the same time for different pollutants.

Each nonattainment AQCR is responsible for submitting a State Implementation Plan (SIP), which specifies the manner in which NAAQS will be achieved and maintained. Maintenance areas must adhere to a maintenance plan for the specific pollutant for which the area was initially designated nonattainment.

The DoC Boulder Laboratories Campus is located in Boulder County, Colorado. Boulder County is part of the Denver Metro/North Front Range (DM/NFR) area, which is managed by the Regional Air Quality Council (RAQC). USEPA has designated Boulder County a moderate nonattainment area for 8-hour ozone, a maintenance area for CO and PM_{10} (USEPA, 2016c), and an attainment area for $PM_{2.5}$, SO_2, NO_2, and lead (40 CFR 81.306). Based on a USEPA ruling published May 4, 2016, the DM/NFR area is required to achieve attainment of the NAAQS by July 20, 2018 based on 2015-2017 ozone season data (RAQC, 2016a).

On June 30, 2016, the RAQC approved the *Moderate Area Ozone SIP for the Denver Metro and North Front Range Nonattainment Area*, which addresses how the area will achieve attainment with the 8-hour ozone standard. The SIP was submitted to the Colorado Air Quality Control Commission (AQCC) on July 7, 2016 for public hearing and approval (RAQC, 2016a). The SIP was approved by AQCC on November 17, 2016 (RAQC, 2016b).

The Applicability Analysis Section of the GCR, 40 CFR 93.153, states that Federal actions are required to perform a conformity determination for each nonattainment criteria pollutant (or precursor to those pollutants) if the total of direct and indirect emissions of those pollutants would equal or exceed the *de minimis* levels defined in that section. Table C-2 identifies the *de minimis* levels that would apply to actions in Boulder County, Colorado. This GCR applicability analysis will determine whether the Proposed Action has the potential to result in emissions above the levels listed in Table C-2.

USEPA promulgated revisions to the GCR on March 24, 2010. The revised rule removes requirements for federal agencies to conduct conformity determinations for "regionally significant" actions that have emissions greater than 10 percent of the emissions inventory for a nonattainment area if expected pollutant emissions do not exceed *de minimis* levels. Therefore, this applicability analysis does not evaluate the Proposed Action for "regional significance."

Table C-2. Boulder County Attainment Status and General Conformity Rule *De Minimis* Thresholds

Criteria Pollutant	Classification of Boulder County	Pollutant or Precursor of Concern	*De Minimis* Emission Rate (tons/yr) [a, b]
Ozone (O3)	Nonattainment of the 1997 standard (marginal) Nonattainment of the 2008 standard (moderate)	NOx	100
		VOC	100
Carbon Monoxide (CO)	Attainment (maintenance area)	CO	100
Particulate Matter (PM_{10})	Attainment (maintenance area)	PM_{10}	100
Particulate Matter ($PM_{2.5}$)	Attainment	$PM_{2.5}$	N/A
		NOx	N/A
		SO_2	N/A
Lead (Pb)	Attainment	Pb	N/A
Nitrogen Dioxide (NO_2)	Attainment	NO_2	N/A
Sulfur Dioxide (SO_2)	Attainment	SO_2	N/A

Notes:
a – *De minimis* levels are emission rates specified in 40 CFR 93.153(b), which may not be exceeded by federal actions taking place in nonattainment and maintenance areas. Federal actions in nonattainment areas for $PM_{2.5}$ must also consider the *de minimis* levels for $PM_{2.5}$ precursors, including NOx and SO_2.
b – N/A designates that Boulder County is an attainment area for that pollutant and *de minimis* levels are therefore not applicable for that pollutant.

Proposed Action

The need for the DoC Boulder Laboratories Campus Master Plan, and the campus improvements prescribed therein, is driven by both institutional policy and the inability of existing facilities to support current and projected mission requirements at the campus. New and renovated facilities are necessary to replace aging facilities that do not provide adequate space or appropriate configuration to accommodate the projected research programs at the campus. The Master Plan would demolish approximately 154,000 GSF of insufficient facilities. These facilities would be replaced and expanded by the construction of new facilities, totaling approximately 319,000 GSF, including new research buildings, a Management Resources Center, a new Childcare Center, and a Campus Center. The Master Plan would also construct a 75,000-GSF three-story parking garage and reconfigure pavement and sidewalks throughout the campus to support the new facilities.

The Master Plan would occur in the following five distinct phasing packages over a 20-year period:

- Visitor Center, Parking and Vehicle Screening;
- National Institute of Standards and Technology (NIST) Research Buildings and Campus Center;
- Management Resources Center;
- Childcare Center; and
- National Oceanic and Atmospheric Administration (NOAA) Research Building.

See Table C-3 for a summary of construction and demolition activities, including the associated square footage and assumed construction schedule for each project phase. To ensure a conservative analysis, DoC assumed an aggressive schedule that includes completion of all Master Plan construction activities in a less-than-20-year period.

Table C-3. Phased Construction Schedule under the Master Plan

	Visitor Center, Parking and Vehicle Screening (2018-2019)	NIST Research Buildings and Campus Center (2019-2021)	Management Resources Center (2025-2026)	Childcare Center (2027)	NOAA Research Building (2032)	Total
Construction (SF)						
Buildings (New)	10,800	277,500 [a]	60,000	13,000	32,600	393,900
Buildings (Renovation)	600	192,000	--	32,700	--	225,300
Pavement/ Sidewalks	138,100	115,600	73,400	53,200	8,400	388,700
Demolition (SF)						
Buildings	--	98,121	47,551	7,776	--	153,448
Pavement/ Sidewalks	46,000	143,000	134,000	57,600	5,300	385,900

Notes:
This is an assumed construction schedule, specifically for the purposes of this GCR applicability analysis.
a – The NIST Research Buildings new buildings construction square footage includes the new parking garage (75,000 SF) and the Building 24 addition/renovation (3,000 SF).

Emissions Calculation Methods and Results

Because USEPA has designated the DM/NFR area a moderate nonattainment area for ozone and a maintenance area for CO and PM_{10}, this applicability analysis estimates emissions of ozone precursors (VOCs and NOx), CO, and PM_{10} associated with the Master Plan. This analysis considers the changes in emissions resulting from temporary construction and demolition activities (including equipment and vehicle use, surface disturbance, and painting activities); operation of campus boilers; and relocation of new staff to the DoC Boulder Laboratories Campus.

Construction and Demolition Equipment Emissions

Emissions associated with construction and demolition under the Master Plan would originate from mobile sources such as excavators, bulldozers, loaders, dump trucks, and privately owned vehicles (POVs). Emissions from these vehicles were estimated using USEPA's Motor Vehicle Emission Simulator (MOVES), which models both on-road (e.g., dump trucks and POVs) and nonroad vehicles (e.g., excavators, bulldozers, loaders). USEPA developed MOVES to help states develop estimates of current and future emission inventories for on-road motor vehicles and nonroad equipment. MOVES can calculate emission inventories from the default database or user inputs at the county or sub-county scale. For this analysis, MOVES was used to develop emission factors outside the model in units of either grams of pollutant per mile traveled for on-road vehicles or grams of pollutant per horsepower-hour for nonroad equipment. These emission factors reflect all US mobile source emissions regulations specific to each calendar year in the analysis.

MOVES requires the user to select settings in an input file (termed a "run specification" file) through the following navigation panels of the model's graphical user interface:

- Scale: On-road or Nonroad model; National, County, or Project scale; and Inventory or Emission Rate calculation mode.
- Time Spans: Year(s), month(s), day(s), and hour(s).
- Geographic Bounds: Nation, state(s), and county(ies).
- Vehicles/Equipment: Fuels and source use type (on-road) or sector (nonroad).
- Road Type: Road type(s) for on-road only.
- Pollutants and Processes: Combinations of pollutants and emission processes (e.g., VOC from running exhaust).
- Manage Input Datasets: Optional input database tables to override default data.
- Strategies: Optional checkbox to compute Rate-of-Progress "No Clean Air Act Amendments" Emissions.

- General Output: Create output database name, select units, and choose activity types to report.
- Output Emissions Detail: Choose aggregation options for the output.
- Advanced Performance Features: These options are not needed for most analyses.

The MOVES selections for this GCR analysis are specified in Table C-4.

The activity and emissions corresponding to the on-road and nonroad fleets for the Master Plan are shown in Table C-5 and Table C-6, below. The model year of the vehicles used in construction and demolition was assumed to be five years before the start of each construction phase. The model years of the passenger fleet associated with new employees reflects the national average mix of vehicle ages in each calendar year. The emission standards, technology types, and fleet turnover effects are all built into MOVES and result in reduced emissions on a per unit activity basis in future years. The vehicle types, number of vehicles, mileage, and operating hours were based on information gathered from comparable federal demolition and construction projects. On-road and nonroad input files were created for each year of construction and demolition to model these scenarios.

Total estimated annual temporary emissions from construction and demolition for the Master Plan are shown in Table C-7.

Table C-4. MOVES Input File Selections

MOVES Navigation Panel	Model Parameter	GCR Analysis Setting
Scale	Model	On-road, Nonroad
	Domain/Scale	National
	Calculation Type	Inventory
Time Spans	Time Aggregation Level	Year (on-road) and Day (nonroad)
	Years	2018 through 2032
	Months	All 12
	Days	Weekday and Weekend
	Hours	All 24
Geographic Bounds	Region	County
	States and Counties	Boulder, Colorado
Vehicles/Equipment	Fuels	Gasoline, E85, Diesel, and Nonroad Diesel
	Source Use Types (on-road)	Passenger Car, Passenger Truck, Light Commercial Truck, Single Unit Short-haul Truck, and Combination Unit Short-haul Truck
	Sectors (nonroad)	Industrial, Construction
Road Type	Selected Road Types	All (on-road)
Manage Input Datasets	Database/tables input	N/A
Strategies	Rate-of-Progress	N/A
Output	Units	Grams, Joules, Miles
	Activity (on-road)	Distance Traveled, Population
	Time	Year (on-road), Day (nonroad)
	Location	County
	Aggregation Levels	Model Year, Fuel Type, Source Use Type (on-road), SCC (nonroad), HP class (nonroad)
Advanced Performance Features	N/A	N/A

Acronyms: Horsepower (HP), not applicable (N/A), source classification code (SCC).

Table C-5. On-Road Construction and Demolition Vehicle Activity and Estimated Emissions

Year	MOVES Vehicle Class	Annual Miles	Emissions (Tons/Year)			
			NOx	VOC	CO	PM_{10}
2018	Light Commercial Truck	16,117	0.00	0.00	0.05	0.00
	Single Unit Short-haul Truck	8,684	0.01	0.00	0.03	0.00
	Combination Unit Short-haul Truck	4,568	0.01	0.00	0.00	0.00
	Total 2018	**29,370**	**0.02**	**0.00**	**0.09**	**0.00**
2019	Light Commercial Truck	309,120	0.06	0.05	1.04	0.02
	Single Unit Short-haul Truck	133,437	0.13	0.03	0.46	0.02
	Combination Unit Short-haul Truck	14,468	0.02	0.00	0.01	0.00
	Total 2019	**457,025**	**0.21**	**0.07**	**1.50**	**0.04**
2020	Light Commercial Truck	293,003	0.05	0.04	0.98	0.01
	Single Unit Short-haul Truck	124,752	0.12	0.03	0.43	0.02
	Combination Unit Short-haul Truck	9,900	0.02	0.00	0.01	0.00
	Total 2020	**427,655**	**0.20**	**0.07**	**1.42**	**0.03**
2021	Light Commercial Truck	293,003	0.05	0.04	0.98	0.01
	Single Unit Short-haul Truck	124,752	0.12	0.02	0.44	0.02
	Combination Unit Short-haul Truck	9,900	0.02	0.00	0.01	0.00
	Total 2021	**427,655**	**0.20**	**0.07**	**1.43**	**0.03**
2022	Light Commercial Truck	293,003	0.06	0.04	0.80	0.01
	Single Unit Short-haul Truck	124,752	0.12	0.02	0.44	0.02
	Combination Unit Short-haul Truck	9,900	0.02	0.00	0.01	0.00
	Total 2022	**427,655**	**0.20**	**0.07**	**1.24**	**0.03**
2025	Light Commercial Truck	168,353	0.02	0.02	0.31	0.01
	Single Unit Short-haul Truck	84,974	0.07	0.02	0.29	0.01
	Combination Unit Short-haul Truck	8,964	0.02	0.00	0.01	0.00
	Total 2025	**262,290**	**0.10**	**0.04**	**0.61**	**0.02**
2026	Light Commercial Truck	168,353	0.02	0.02	0.29	0.01
	Single Unit Short-haul Truck	84,974	0.07	0.02	0.29	0.01
	Combination Unit Short-haul Truck	8,964	0.02	0.00	0.01	0.00
	Total 2026	**262,290**	**0.10**	**0.04**	**0.58**	**0.02**
2027	Light Commercial Truck	118,094	0.01	0.01	0.19	0.01
	Single Unit Short-haul Truck	51,012	0.04	0.01	0.17	0.01
	Combination Unit Short-haul Truck	6,379	0.01	0.00	0.00	0.00
	Total 2027	**175,485**	**0.06**	**0.02**	**0.36**	**0.01**
2032	Light Commercial Truck	79,554	0.01	0.01	0.10	0.00
	Single Unit Short-haul Truck	39,270	0.03	0.01	0.13	0.01
	Combination Unit Short-haul Truck	2,704	0.00	0.00	0.00	0.00
	Total 2032	**121,528**	**0.04**	**0.02**	**0.24**	**0.01**

Table C-6. Nonroad Equipment Activity and Estimated Emissions

2018	Air Compressor	2270006015	16	0.43	1,368	0.05	0.01	0.03	0.00
	Asphalt Paver	2270002021	175	0.59	552	0.09	0.01	0.01	0.00
	Backhoe	2270002066	175	0.21	1,038	0.06	0.01	0.01	0.00
	Bulldozer	2270002069	175	0.59	1,406	0.22	0.02	0.02	0.00
	Crane	2270002045	175	0.43	365	0.04	0.00	0.00	0.00
	Excavator	2270002036	600	0.59	108	0.06	0.01	0.01	0.00
	Generator	2270006005	40	0.43	1,368	0.08	0.00	0.00	0.00
	Loader	2270002066	175	0.21	-	-	-	-	-
	Roller	2270002015	100	0.59	108	0.01	0.00	0.00	0.00
	Skid Steer Loader	2270002072	75	0.21	1,038	0.05	0.00	0.01	0.00
	Steel Track Loader	2270002066	50	0.21	368	0.01	0.00	0.00	0.00
	Vibratory Compactor	2270002015	6	0.59	108	0.03	0.00	0.03	0.00
	2018 Totals:				**7,827**	**0.70**	**0.07**	**0.13**	**0.01**
2019	Air Compressor	2270006015	16	0.43	29,538	1.00	0.11	0.55	0.09
	Asphalt Paver	2270002021	175	0.59	784	0.03	0.01	0.01	0.00
	Backhoe	2270002066	175	0.21	2,815	0.03	0.02	0.03	0.00
	Bulldozer	2270002069	175	0.59	3,755	0.12	0.07	0.06	0.00
	Crane	2270002045	175	0.43	4,972	0.12	0.06	0.04	0.00
	Excavator	2270002036	600	0.59	1,496	0.16	0.09	0.08	0.01
	Generator	2270006005	40	0.43	29,538	1.68	0.08	0.09	0.01
	Loader	2270002066	175	0.21	324	0.00	0.00	0.00	0.00
	Roller	2270002015	100	0.59	1,496	0.03	0.02	0.04	0.00
	Skid Steer Loader	2270002072	75	0.21	2,981	0.16	0.01	0.03	0.00
	Steel Track Loader	2270002066	50	0.21	1,921	0.07	0.00	0.01	0.00
	Vibratory Compactor	2270002015	6	0.59	1,496	0.42	0.06	0.46	0.04
	2019 Totals:				**81,113**	**3.82**	**0.54**	**1.40**	**0.16**
2020	Air Compressor	2270006015	16	0.43	28,170	0.95	0.11	0.52	0.08
	Asphalt Paver	2270002021	175	0.59	231	0.01	0.00	0.00	0.00
	Backhoe	2270002066	175	0.21	1,777	0.02	0.01	0.02	0.00
	Bulldozer	2270002069	175	0.59	2,349	0.08	0.04	0.04	0.00
	Crane	2270002045	175	0.43	4,607	0.11	0.06	0.04	0.00
	Excavator	2270002036	600	0.59	1,388	0.15	0.08	0.08	0.01
	Generator	2270006005	40	0.43	28,170	1.61	0.08	0.08	0.01
	Loader	2270002066	175	0.21	324	0.00	0.00	0.00	0.00
	Roller	2270002015	100	0.59	1,388	0.03	0.01	0.04	0.00
	Skid Steer Loader	2270002072	75	0.21	1,943	0.10	0.00	0.02	0.00
	Steel Track Loader	2270002066	50	0.21	1,553	0.05	0.00	0.01	0.00
	Vibratory Compactor	2270002015	6	0.59	1,388	0.39	0.06	0.43	0.04
	2020 Totals:				**73,286**	**3.50**	**0.47**	**1.27**	**0.14**

Table C-6. Nonroad Equipment Activity and Estimated Emissions

2021	Air Compressor	2270006015	16	0.43	28,170	0.95	0.11	0.52	0.08
	Asphalt Paver	2270002021	175	0.59	231	0.01	0.00	0.00	0.00
	Backhoe	2270002066	175	0.21	1,777	0.02	0.01	0.02	0.00
	Bulldozer	2270002069	175	0.59	2,349	0.08	0.04	0.04	0.00
	Crane	2270002045	175	0.43	4,607	0.11	0.06	0.04	0.00
	Excavator	2270002036	600	0.59	1,388	0.15	0.08	0.08	0.01
	Generator	2270006005	40	0.43	28,170	1.61	0.08	0.08	0.01
	Loader	2270002066	175	0.21	324	0.00	0.00	0.00	0.00
	Roller	2270002015	100	0.59	1,388	0.03	0.01	0.04	0.00
	Skid Steer Loader	2270002072	75	0.21	1,943	0.10	0.00	0.02	0.00
	Steel Track Loader	2270002066	50	0.21	1,553	0.05	0.00	0.01	0.00
	Vibratory Compactor	2270002015	6	0.59	1,388	0.39	0.06	0.43	0.04
	2021 Totals:				**73,286**	**3.50**	**0.47**	**1.27**	**0.14**
2022	Air Compressor	2270006015	16	0.43	28,170	0.95	0.11	0.52	0.08
	Asphalt Paver	2270002021	175	0.59	231	0.01	0.00	0.00	0.00
	Backhoe	2270002066	175	0.21	1,777	0.02	0.01	0.02	0.00
	Bulldozer	2270002069	175	0.59	2,349	0.08	0.04	0.04	0.00
	Crane	2270002045	175	0.43	4,607	0.11	0.06	0.04	0.00
	Excavator	2270002036	600	0.59	1,388	0.15	0.08	0.08	0.01
	Generator	2270006005	40	0.43	28,170	1.61	0.08	0.08	0.01
	Loader	2270002066	175	0.21	324	0.00	0.00	0.00	0.00
	Roller	2270002015	100	0.59	1,388	0.03	0.01	0.04	0.00
	Skid Steer Loader	2270002072	75	0.21	1,943	0.10	0.00	0.02	0.00
	Steel Track Loader	2270002066	50	0.21	1,553	0.05	0.00	0.01	0.00
	Vibratory Compactor	2270002015	6	0.59	1,388	0.39	0.06	0.43	0.04
	2022 Totals:				**73,286**	**3.50**	**0.47**	**1.27**	**0.14**
2025	Air Compressor	2270006015	16	0.43	7,200	0.24	0.03	0.13	0.02
	Asphalt Paver	2270002021	175	0.59	294	0.01	0.01	0.00	0.00
	Backhoe	2270002066	175	0.21	1,094	0.01	0.01	0.01	0.00
	Bulldozer	2270002069	175	0.59	2,166	0.07	0.04	0.04	0.00
	Crane	2270002045	175	0.43	2,082	0.05	0.03	0.02	0.00
	Excavator	2270002036	600	0.59	600	0.07	0.04	0.03	0.00
	Generator	2270006005	40	0.43	7,200	0.41	0.02	0.02	0.00
	Loader	2270002066	175	0.21	314	0.00	0.00	0.00	0.00
	Roller	2270002015	100	0.59	600	0.01	0.01	0.02	0.00
	Skid Steer Loader	2270002072	75	0.21	1,256	0.07	0.00	0.01	0.00
	Steel Track Loader	2270002066	50	0.21	2,023	0.07	0.00	0.01	0.00
	Vibratory Compactor	2270002015	6	0.59	600	0.17	0.02	0.18	0.02
	2025 Totals:				**25,429**	**1.18**	**0.20**	**0.48**	**0.05**

Table C-6. Nonroad Equipment Activity and Estimated Emissions

Year	Equipment Type	SCC	Max HP	Load Factor	Annual Hours	Emissions (Tons/Year)			
						NOx	VOC	CO	PM_{10}
2026	Air Compressor	2270006015	16	0.43	7,200	0.24	0.03	0.13	0.02
	Asphalt Paver	2270002021	175	0.59	294	0.01	0.01	0.00	0.00
	Backhoe	2270002066	175	0.21	1,094	0.01	0.01	0.01	0.00
	Bulldozer	2270002069	175	0.59	2,166	0.07	0.04	0.04	0.00
	Crane	2270002045	175	0.43	2,082	0.05	0.03	0.02	0.00
	Excavator	2270002036	600	0.59	600	0.07	0.04	0.03	0.00
	Generator	2270006005	40	0.43	7,200	0.41	0.02	0.02	0.00
	Loader	2270002066	175	0.21	314	0.00	0.00	0.00	0.00
	Roller	2270002015	100	0.59	600	0.01	0.01	0.02	0.00
	Skid Steer Loader	2270002072	75	0.21	1,256	0.07	0.00	0.01	0.00
	Steel Track Loader	2270002066	50	0.21	2,023	0.07	0.00	0.01	0.00
	Vibratory Compactor	2270002015	6	0.59	600	0.17	0.02	0.18	0.02
	2026 Totals:				**25,429**	**1.18**	**0.20**	**0.48**	**0.05**
2027	Air Compressor	2270006015	16	0.43	10,968	0.37	0.04	0.20	0.03
	Asphalt Paver	2270002021	175	0.59	426	0.01	0.01	0.01	0.00
	Backhoe	2270002066	175	0.21	976	0.01	0.01	0.01	0.00
	Bulldozer	2270002069	175	0.59	1,898	0.06	0.03	0.03	0.00
	Crane	2270002045	175	0.43	2,978	0.07	0.04	0.02	0.00
	Excavator	2270002036	600	0.59	260	0.03	0.02	0.01	0.00
	Generator	2270006005	40	0.43	10,968	0.63	0.03	0.03	0.00
	Loader	2270002066	175	0.21	103	0.00	0.00	0.00	0.00
	Roller	2270002015	100	0.59	260	0.00	0.00	0.01	0.00
	Skid Steer Loader	2270002072	75	0.21	1,029	0.05	0.00	0.01	0.00
	Steel Track Loader	2270002066	50	0.21	1,233	0.04	0.00	0.01	0.00
	Vibratory Compactor	2270002015	6	0.59	260	0.07	0.01	0.08	0.01
	2027 Totals:				**31,358**	**1.36**	**0.19**	**0.43**	**0.05**
2032	Air Compressor	2270006015	16	0.43	7,824	0.27	0.03	0.14	0.02
	Asphalt Paver	2270002021	175	0.59	67	0.00	0.00	0.00	0.00
	Backhoe	2270002066	175	0.21	765	0.01	0.00	0.01	0.00
	Bulldozer	2270002069	175	0.59	850	0.03	0.02	0.01	0.00
	Crane	2270002045	175	0.43	2,086	0.05	0.03	0.02	0.00
	Excavator	2270002036	600	0.59	652	0.07	0.04	0.04	0.00
	Generator	2270006005	40	0.43	7,824	0.45	0.02	0.02	0.00
	Loader	2270002066	175	0.21	-	-	-	-	-
	Roller	2270002015	100	0.59	652	0.01	0.01	0.02	0.00
	Skid Steer Loader	2270002072	75	0.21	765	0.04	0.00	0.01	0.00
	Steel Track Loader	2270002066	50	0.21	85	0.00	0.00	0.00	0.00
	Vibratory Compactor	2270002015	6	0.59	652	0.18	0.03	0.20	0.02
	2032 Totals:				**22,223**	**1.11**	**0.17**	**0.47**	**0.05**

Table C-7. Total Estimated Construction and Demolition Equipment Emissions under the Master Plan

		NOx	VOC	CO	PM_{10}
2018	On-road	0.02	0.00	0.09	0.00
	Nonroad	0.70	0.07	0.13	0.01
	2018 Totals:	**0.72**	**0.07**	**0.21**	**0.01**
2019	On-road	0.21	0.07	1.50	0.04
	Nonroad	3.82	0.54	1.40	0.16
	2019 Totals:	**4.03**	**0.61**	**2.90**	**0.19**
2020	On-road	0.20	0.07	1.42	0.03
	Nonroad	3.50	0.47	1.27	0.14
	2020 Totals:	**3.70**	**0.54**	**2.69**	**0.18**
2021	On-road	0.20	0.07	1.43	0.03
	Nonroad	3.50	0.47	1.27	0.14
	2021 Totals:	**3.70**	**0.53**	**2.70**	**0.18**
2022	On-road	0.20	0.07	1.24	0.03
	Nonroad	3.50	0.47	1.27	0.14
	2022 Totals:	**3.70**	**0.53**	**2.51**	**0.18**
2025	On-road	0.10	0.04	0.61	0.02
	Nonroad	1.18	0.20	0.48	0.05
	2025 Totals:	**1.28**	**0.24**	**1.09**	**0.07**
2026	On-road	0.10	0.04	0.58	0.02
	Nonroad	1.18	0.20	0.48	0.05
	2026 Totals:	**1.28**	**0.24**	**1.06**	**0.07**
2027	On-road	0.06	0.02	0.36	0.01
	Nonroad	1.36	0.19	0.43	0.05
	2027 Totals:	**1.42**	**0.21**	**0.79**	**0.06**
2032	On-road	0.04	0.02	0.24	0.01
	Nonroad	1.11	0.17	0.47	0.05
	2032 Totals:	**1.15**	**0.19**	**0.71**	**0.06**

Surface Disturbance (Fugitive PM Emissions)

Construction activities have the potential to generate PM emissions during many operations, including land clearing, ground excavation, site preparation, and, in particular, equipment traffic on unpaved roads. The quantity of PM emissions from construction operations is proportional to the level of activity, duration of activity, and the area of land being worked. Emission factors derived from AP-42 Sections 11.9 and 13.2 were used to calculate PM emissions associated with surface disturbance. Use of these emission factors is likely to overestimate PM emissions because they do not account for dust suppression methods such as those outlined in the *Fugitive Dust Best Management Practices* guide developed by Boulder County Public Health.

PM emissions from surface disturbance due to construction equipment are summarized by phase in Table C-8.

Painting Activities (VOC Emissions)

VOCs are emitted as gases from a variety of construction materials, including paints and coatings. For the purposes of this analysis, it is conservatively assumed that the interior surface area requiring painting is three times the total building footprint, three coats of paint would be applied (one primer and two finish), and the average VOC content of the paint would be 1 pound of VOC per gallon of paint.

VOC emissions from painting activities are summarized by phase in Table C-9.

Operating Emissions

Operating emissions changes were assessed by comparing the total emissions generated from boilers in FY 2015 with the projected annual emissions from the boilers during each phase of the Master Plan.

In 2015, the CUP boilers consumed 141 million standard cubic feet (MM scf) of natural gas while servicing 800,272 gross square feet (GSF) of facility space. For this analysis, DoC assumed that other boilers not associated with the CUP operate at the same energy intensity (fuel consumed per unit of supported space), and that the change in campus-wide boiler emissions for each Master Plan phase would be proportional to the increase or decrease in facility space under that phase. These fuel consumption estimates are shown in Table C-10. This approach likely overestimates fuel consumption under the Master Plan, which would demolish aging facilities with boilers (e.g., Buildings 2 and 25) and incorporate energy efficiency improvements through renovation activities (e.g., Buildings 1, 3, and 24). Total estimated annual emissions from operation of the boilers and the net change in operating emissions as a result of the Master Plan are shown in Table C-11.

Individual emergency generators are located throughout the campus to provide emergency power for life safety and standby power. The emergency generators operate up to one hour per week for regular testing to ensure system functionality. Additional emergency generators would be installed at each new facility constructed under the Master Plan. Emissions associated with these new generators would be offset by the elimination of emissions from emergency generators at facilities that would be demolished under the Master Plan. Thus, for this analysis it is assumed that changes in emergency generator fuel consumption and the associated emissions would be negligible.

The Master Plan could result in a minor increase in VOC emissions due to the installation of additional fume hoods in various labs. Emissions estimates for fume hoods are not available. For this analysis, DoC assumed that any changes in VOC emissions associated with fume hoods would be negligible and would not influence the conclusion of this GCR applicability analysis.

Employee Commuting Emissions

The Master Plan would increase the number of personnel working at and commuting to the DoC Boulder Laboratories Campus by 212 personnel over a 20-year period. The personnel increases are assumed to commence in the year following completion of the associated phasing package; for example, new personnel associated with facilities constructed in 2018 are accounted for in 2019 and subsequent years. Table C-12 summarizes the personnel changes for each phasing package.

Table C-8. Total Estimated Surface Disturbance (Fugitive PM10) Emissions under the Master Plan

Phasing Package (Years)	Total PM_{10} Emissions (tons)	PM_{10} Emissions Per Year (tons)
Visitor Center, Parking and Vehicle Screening (2018-2019)	8.9	4.4
NIST Research Buildings and Campus Center (2019-2022)	58.7	14.7
Management Resources Center (2025-2026)	18.1	9.0
Childcare Center (2027)	7.4	7.4
NOAA Research Building (2032)	5.2	5.2

Table C-9. Total Estimated VOC Emissions from Painting Activities under the Master Plan

Phasing Package (Years)	Total VOC Emissions (tons)	VOC Emissions Per Year (tons)
Visitor Center, Parking and Vehicle Screening (2018-2019)	0.2	0.1
NIST Research Buildings and Campus Center (2019-2022)	5.9	1.5
Management Resources Center (2025-2026)	0.9	0.5
Childcare Center (2027)	0.7	0.7
NOAA Research Building (2032)	0.5	0.5

Table C-10. Summary of Existing and Projected Boiler Fuel Consumption under the Master Plan

Metric	Existing (2015)	Visitor Center, Parking and Vehicle Screening (2018-2019)	NIST Research Buildings and Campus Center (2019-2021)	Management Resources Center (2025-2026)	Childcare Center (2027)	NOAA Research Building (2032)
CUP Boilers						
Proposed Construction (GSF)	N/A	--	202,500	60,000	--	--
Proposed Demolition (GSF)	N/A	--	(98,121)	--	--	--
Area Serviced (GSF)	800,272	800,272	904,651	964,651	964,651	964,651
Annual Fuel Consumption (MM scf)	141	141	159	170	170	170
Independent Boilers						
Proposed Construction (GSF)	N/A	10,800	--	--	13,000	32,600
Proposed Demolition (GSF)	N/A	--	--	(47,551)	(7,776)	--
Area Serviced (GSF)	453,902	464,702	464,702	417,151	422,375	454,975
Annual Fuel Consumption (MM scf)	80	82	82	73	74	80
Total						
Annual Fuel Consumption (MM scf)	221	223	241	243	244	250

Notes:
Area Serviced and Annual Fuel Consumption values reflect the expected area that will be serviced and projected fuel consumption in the year following completion of each phasing package. For example, the NIST Research Buildings and Campus Center phasing package is expected to be completed in 2021; therefore, the projected annual fuel consumption for 2022 is presented under the NIST Research Buildings and Campus Center.
Gross square footage (GSF) data were obtained/extrapolated from the Draft DoC Boulder Laboratories Campus Master Plan, Exhibit 39.

Table C-11. Operating Emissions (Projected and Net Changes) under the Master Plan

Year	Projected Operating Emissions (Tons/year)				Net Change in Operating Emissions (Tons/year)			
	NOx	VOC	CO	PM_{10}	NOx	VOC	CO	PM_{10}
2015 (Actual)	5.5	0.6	9.3	0.8	--	--	--	--
2018	5.5	0.6	9.3	0.8	--	--	--	--
2019	5.5	0.6	9.3	0.8	0.02	0.00	0.04	0.00
2020	5.7	0.6	9.6	0.9	0.16	0.02	0.27	0.02
2021	5.8	0.6	9.7	0.9	0.28	0.03	0.47	0.04
2022	5.9	0.7	9.9	0.9	0.39	0.04	0.66	0.06
2023-2025	6.0	0.7	10.1	0.9	0.51	0.06	0.85	0.08
2026	6.1	0.7	10.2	0.9	0.53	0.06	0.90	0.08
2027	6.1	0.7	10.2	0.9	0.56	0.06	0.94	0.09
2028-2032	6.1	0.7	10.3	0.9	0.59	0.06	0.98	0.09
Post-2032	6.3	0.7	10.5	1.0	0.73	0.08	1.22	0.11

Notes:
Emissions are assumed to commence in the year following completion of the associated phasing package. For example, operating emissions associated with facilities constructed in 2018 are accounted for in 2019 and subsequent years.
Projected changes in operating emissions only reflect changes associated with the operation of boilers. Changes in emissions from emergency generators and other potential emission sources (e.g., VOCs from fume hoods) are expected to be negligible under the Proposed Action; therefore, these emission sources are not included in this table.
Emissions factors from AP-42, Chapter 1.4 (natural gas combustion), a USEPA Compilation of Air Emission Factors, are used to calculate projected emissions: 50 lb NOx/MM scf, 5.5 lb VOC/MM scf, 84 lb CO/MM scf, and 7.6 lb PM_{10}/MM scf.

Table C-12. Personnel Added by Phasing Package under the Master Plan

Phasing Package (Years)	Personnel Added
Visitor Center, Parking and Vehicle Screening (2018-2019)	--
NIST Research Buildings and Campus Center (2019-2022)	134
Management Resources Center (2025-2026)	18
Childcare Center (2027)	--
NOAA Research Building (2032)	60

Notes:
Personnel data were obtained from the Draft DoC Boulder Laboratories Campus Master Plan, Exhibit 6.

The MOVES model was used to estimate the emissions associated with the additional personnel commuting to and from work. Approximately 53% of personnel commute to the DoC Boulder Laboratories Campus via personal vehicles and the remainder of the personnel commute via bicycle, transit bus, carpool/vanpool, or walking. To develop a worst-case scenario emissions estimate, it is assumed that all 212 personnel would relocate to Boulder County from outside the DM/NFR AQCR, and that all 212 personnel would commute via personal vehicles without carpooling.

According to a recent City of Boulder transportation survey, the average commute distance for single occupancy vehicles in 2011 was 13.0 miles (National Research Center, Inc., 2012). Therefore, each new employee is assumed to drive 13.0 miles one-way from their residence in the DM/NFR AQCR to the campus, for a total of 26 miles per weekday, 260 days per year. Using these assumptions, the staff increase of 212 people translates to a total of approximately 1.4 million more vehicle miles traveled (VMT) annually from personnel commuting to work at the campus.

Table C-13 summarizes the VMT and emissions associated with additional employee commuting under the Master Plan.

Table C-13. Vehicle Miles Traveled and Emissions from On-road Vehicles of New Personnel

Year	VMT Added	Emissions (Tons/year)			
		NOx	VOC	CO	PM_{10}
2018	-	-	-	-	-
2019	-	-	-	-	-
2020	226,460	0.07	0.07	0.87	0.01
2021	452,920	0.12	0.14	1.63	0.02
2022	679,380	0.16	0.19	2.30	0.03
2023-2025	905,840	0.15	0.20	2.51	0.04
2026	966,680	0.15	0.20	2.51	0.04
2027	1,027,520	0.14	0.20	2.49	0.05
2028-2032	1,027,520	0.10	0.16	1.83	0.05
Post-2032	1,433,120	0.14	0.22	2.55	0.06

Conclusion

The projected levels of emissions generated by the Master Plan, resulting from construction and demolition activities and boiler operating changes, would be below *de minimis* thresholds for all phases, as summarized in Table C-14. Therefore, the GCR is not applicable to the Master Plan.

References

1. National Research Center, Inc. 2012. *2011 Boulder Valley Employee Survey for Transportation, Report of Results.* June 2012. https://www-static.bouldercolorado.gov/docs/2011-boulder-valley-employee-survey-for-transportation-report-of-results-1-201305291119.pdf. Accessed 12 August 2016.

2. Regional Air Quality Council (RAQC). 2016a. *Moderate Area Ozone SIP for the Denver Metro and North Front Range Nonattainment Area*. 7 July 2016.

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4. USEPA. 2016a. Criteria Air Pollutants. https://www.epa.gov/criteria-air-pollutants. Accessed 6 July 2016.

5. USEPA. 2016b. NAAQS Table. https://www.epa.gov/criteria-air-pollutants/naaqs-table. Accessed 6 July 2016.

6. USEPA. 2016c. Green Book Nonattainment Areas. Colorado Nonattainment/Maintenance Status for Each County by Year for All Criteria Pollutants. https://www3.epa.gov/airquality/greenbook/anayo_co.html. Accessed 15 July 2016.

7. USEPA. 2016d. *De Minimis* Levels. https://www.epa.gov/general-conformity/de-minimis-emission-levels. Accessed 5 August 2016.

Table C-14. Estimated Emissions from the Master Plan Compared to GCR *De Minimis* Thresholds

Year	Pollutant	Construction and Demolition Activities			Net Change in Operating Emissions (tons)	Net Change in Employee Commuting Emissions (tons)	Total Net Change in Emissions under Proposed Action (tons)	*De Minimis* Level (tons)
		Construction and Demolition Equipment Emissions (tons)	Surface Disturbance Emissions (tons)	Painting Activity Emissions (tons)				
2018	NOx	0.7	--	--	--	--	**0.7**	100
	VOC	0.1	--	0.1	--	--	**0.2**	100
	CO	0.2	--	--	--	--	**0.2**	100
	PM_{10}	0.0	4.4	--	--	--	**4.5**	100
2019	NOx	4.0	--	--	0.0	--	**4.1**	100
	VOC	0.6	--	1.6	0.0	--	**2.2**	100
	CO	2.9	--	--	0.0	--	**2.9**	100
	PM_{10}	0.2	19.1	--	0.0	--	**19.3**	100
2020	NOx	3.7	--	--	0.2	0.1	**3.9**	100
	VOC	0.5	--	1.5	0.0	0.1	**2.1**	100
	CO	2.7	--	--	0.3	0.9	**3.8**	100
	PM_{10}	0.2	14.7	--	0.0	0.0	**14.9**	100
2021	NOx	3.7	--	--	0.3	0.1	**4.1**	100
	VOC	0.5	--	1.5	0.0	0.1	**2.2**	100
	CO	2.7	--	--	0.5	1.6	**4.8**	100
	PM_{10}	0.2	14.7	--	0.0	0.0	**14.9**	100
2022	NOx	3.7	--	--	0.4	0.2	**4.3**	100
	VOC	0.5	--	1.5	0.0	0.2	**2.2**	100
	CO	2.5	--	--	0.7	2.3	**5.5**	100
	PM_{10}	0.2	14.7	--	0.1	0.0	**14.9**	100
2023-2024	NOx	--	--	--	0.5	0.2	**0.7**	100
	VOC	--	--	--	0.1	0.2	**0.3**	100
	CO	--	--	--	0.9	2.5	**3.4**	100
	PM_{10}	--	--	--	0.1	0.0	**0.1**	100

Table C-14. Estimated Emissions from the Master Plan Compared to GCR *De Minimis* Thresholds

Year	Pollutant	Construction and Demolition Activities			Net Change in Operating Emissions (tons)	Net Change in Employee Commuting Emissions (tons)	Total Net Change in Emissions under Proposed Action (tons)	*De Minimis* Level (tons)
		Construction and Demolition Equipment Emissions (tons)	Surface Disturbance Emissions (tons)	Painting Activity Emissions (tons)				
2025	NOx	1.3	--	--	0.5	0.2	**1.9**	100
	VOC	0.2	--	0.5	0.1	0.2	**0.9**	100
	CO	1.1	--	--	0.9	2.5	**4.5**	100
	PM_{10}	0.1	9.0	--	0.1	0.0	**9.2**	100
2026	NOx	1.3	--	--	0.5	0.1	**2.0**	100
	VOC	0.2	--	0.5	0.1	0.2	**0.9**	100
	CO	1.1	--	--	0.9	2.5	**4.5**	100
	PM_{10}	0.1	9.0	--	0.1	0.0	**9.2**	100
2027	NOx	1.4	--	--	0.6	0.1	**2.1**	100
	VOC	0.2	--	0.7	0.1	0.2	**1.2**	100
	CO	0.8	--	--	0.9	2.5	**4.2**	100
	PM_{10}	0.1	7.4	--	0.1	0.0	**7.6**	100
2028-2031	NOx	--	--	--	0.6	0.1	**0.7**	100
	VOC	--	--	--	0.1	0.2	**0.2**	100
	CO	--	--	--	1.0	1.8	**2.8**	100
	PM_{10}	--	--	--	0.1	0.0	**0.1**	100
2032	NOx	1.1	--	--	0.6	0.1	**1.8**	100
	VOC	0.2	--	0.5	0.1	0.2	**0.9**	100
	CO	0.7	--	--	1.0	1.8	**3.5**	100
	PM_{10}	0.1	5.2	--	0.1	0.0	**5.4**	100
Post-2032	NOx	--	--	--	0.7	0.1	**0.9**	100
	VOC	--	--	--	0.1	0.2	**0.3**	100
	CO	--	--	--	1.2	2.6	**3.8**	100
	PM_{10}	--	--	--	0.1	0.1	**0.2**	100

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