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4.24 CUMULATIVE EFFECTS SUMMARY

INTRODUCTION

As part of the NEPA process, the environmental impacts of a federally funded project must be identified and analyzed in sufficient detail to make an informed decision. This includes direct, indirect, and cumulative impacts. A federal agency's responsibility to address these impacts in the NEPA process was established by the Council on Environmental Quality (CEQ) regulations.

The CEQ regulations define a cumulative impact as

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

This section addresses the cumulative effects associated with the No Action Alternative and the four build alternatives: the Freeway Alternative, the Tollway Alternative, the Regional Arterial Alternative, and the Combined Alternative (Recommended Alternative). This cumulative effects analysis (CEA) takes into account past, present, and reasonably foreseeable future actions, regardless of responsible party in the study area, to determine the environmental impacts that might result from each alternative. According to CEQ CEA guidance, this analysis was performed using available or reasonably obtainable information.

CEA METHODOLOGY

As part of the study process, a CEA methodology was developed that included the following steps:

- Identifying the important cumulative effects issues through the public and agency scoping process.
- Establishing appropriate geographic boundaries for analysis.
- Establishing an appropriate time frame for analysis.
- Identifying other actions affecting the resources, ecosystems, and human communities of concern (i.e. the important cumulative effects issues) including past, present, and reasonably foreseeable future actions.
- Documenting impacts to resources from past, present, and future projects and determining the magnitude and significance of cumulative effects.

Developing this information for the CEA was accomplished as follows:

Scoping

Local, state, and federal agencies were invited to a scoping meeting on January 21, 2004, to assist in the identification of key/critical environmental, social, economic, and transportation issues in the study area. The following agencies were in attendance:

- City and County of Broomfield
- City of Golden
- City of Lakewood
- Colorado Department of Public Health and Environment
- Colorado Division of Wildlife
- Colorado Historical Society
- Colorado State Land Board
- Congressman Mark Udall's office
- Denver Regional Council of Governments
- Denver Water
- Department of Natural Resources, Division of Minerals and Geology
- Federal Aviation Administration
- Jefferson County
- Natural Resources Conservation Service

- Regional Transportation District
- Sierra Club
- U.S. Department of Energy
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service

A separate scoping meeting was held with the CDOT Environmental Programs Branch (EPB) on February 5, 2004. The purpose was to orient EPB staff to the study area and solicit initial comments on draft methodologies and other material. Following a presentation, a tour of the study area was conducted to familiarize staff and provide an opportunity for the project team to discuss any issues.

Several letters were received providing additional scoping comments. These letters were received from USEPA, the City of Golden, and a private citizen.

The specific areas of concern identified for the CEA were derived from the scoping meetings, the received letters, and the results from the environmental analysis conducted during the study. All social, economic, and environmental resources were considered before identifying the important issues within the Northwest Corridor study area. The identified areas of particular concern within the study area to be analyzed for cumulative effects are:

- Land use (growth)
- Water resources and water quality
- Wetlands
- Wildlife
- Air quality
- Noise
- Traffic and transportation equity

Geographic Boundaries

The geographic boundaries to be used for the CEA were based on the identified resources of concern and the potential impacts that might occur to these resources under a build alternative. In general, the cumulative effects boundaries are the Hogback on the west, Sheridan Boulevard on the east, Baseline Road on the north, and US 285 and Morrison Road on the south. This boundary takes into account the physical barrier of the mountains as well as identified planning area boundaries. Boundaries for analysis varied by resource with some larger and some smaller than the general boundary. For example, water resources were assessed using watersheds only within the study area while air quality was assessed on a regional level.

Time Frame

The time frame used for the CEA is the past 35 years (starting 1970), based on available resource data and data concerning growth in the area. The present to future time frame extends to the year 2030, the planning horizon for this study and for the DRCOG *Metro Vision 2030* plan.

Resource Data

Data was collected for the resources of concern from readily available data sources for the study area. These sources include: study area jurisdictions, DRCOG, CDOT, NWC Technical Reports, data from federal agencies, and other environmental studies completed in the area.

This CEA addresses the "incremental impacts" of the build alternatives when added to other past, present, and reasonably foreseeable future actions related to the resources identified through the scoping process. To determine the cumulative effects to the specific resources, a baseline condition was established. The direct and indirect impacts of the proposed transportation improvements are then added to this baseline to reflect the incremental impacts of the project.

4.24.1 AFFECTED ENVIRONMENT

4.24.1.1 HISTORICAL SETTING

Modern day settlement in the study area first began during the mining rush of the mid-1800s. The Golden and Arvada areas served as mining and supply camps for miners passing through en route to gold claims up Clear Creek Canyon and the surrounding mountains. Gold, silver, and copper-bearing veins were found within Jefferson County. Coal and clay deposits to the north of Golden along Coal Creek and the town of Leyden led to further development and exploration of the area. A record of coal being mined as early as 1861 confirms that coal beds from Golden north were among the first opened in the state. This large influx of settlers spurred the construction of permanent frame buildings and the town of Golden City was established in 1859 and incorporated as Golden in 1871.

In 1861, the Colorado Territory was formed. Two years later, Golden City became the capitol of the Colorado Territory and a hub for a bustling mining and transportation operation. Colorado's first railroad company, the Colorado Central, began operating in 1870 with Golden as a central rail terminus to rival the City of Denver. Rail service also passed through the village of Arvada and provided access between Black Hawk and Denver. In 1873, the Colorado School of Mines was established and the Coors Brewing Co. was founded, both in Golden. Throughout the late 1880s and into the early 1900s, other study area towns were established.

Concurrent to the mining industry, flour mills, paper mills, and pottery works were constructed as the population began to grow. Additionally, the rise and decline of the smelting industry paralleled that of the mines. Smelting was used to separate metals from waste material. According to interviews by Henry Layne from the State Historical Society, the air was filled with smoke and the acrid smell peculiar to smelting.

A *loose* timeline of the progression of mining shows that hard rock mining is what brought settlers to the area. In a general overlapping succession, coal, then gravel, clay and sand mines were constructed.

The last coal mine in the county was shut down in 1950, with the exception of Leyden Mine (which was active until the late 1960s). In Jefferson County, 34 mines had produced 6.7 million tons of coal, of which 5.7 million tons came from the three mines at Leyden. The Schwartzwalder Mine, a uranium mine between Golden and Boulder, was constructed in the 1950s. As recently as 1997 the mine produced about 500,000 pounds of uranium oxide. The mine was closed in 2000.

Aside from the mining and industrial endeavors, agriculture served as a primary industry. Crops were planted and sustained by irrigation ditches off of Clear Creek. Due to these agricultural lands platted in the early 1900s, the study area saw a substantial increase in residential growth. An influx of World War II veterans and their families generated a boom in the development of subdivisions with ranch style houses.

Many transportation and industrial developments in the study area in the latter half of the twentieth century attracted new settlers to the area as well. Following are some of these major developments:

- **1946**–SH 72 paved from SH 93 to the east within the study area.
- **1949**–SH 121/Wadsworth Boulevard completely paved within the study area.
- **1950s**–Construction of the Denver-Boulder Turnpike (US 36) from Boulder to Denver.
- **1952**–Construction began on Rocky Flats Atomic Energy Plant.
- **1960**–Jefferson County Airport dedicated.
- **1963**–Standley Lake enlarged to 42,000 acre-feet.
- **1965-1967**–SH 128 extended from US 36 to SH 93.
- **1971-1973**–Current alignment of SH 58 between SH 93 and I-70 completed.

- **1973**–I-70 through Jefferson County was completed.
- **1984**–SH 93 was extended south to SH 58 in Golden via Washington Avenue.
- **1990**–C-470 was completed through Jefferson County.
- **2003**–Northwest Parkway and E-470 (both tollroads) were completed.

Transportation improvements, along with supportive planning policies and new career and educational opportunities spurred great residential growth throughout the area. Industry and improved technology also contributed to the increase in people migrating to the area. As growth caps were implemented in Boulder, surrounding communities saw increases in development, especially in small towns like Superior. This increase in population, in turn, engendered the building of more schools, churches, and parks, and ultimately, these neighborhoods grew into successful communities present today.

In general, the population growth and rapid development experienced in the Northwest Corridor study area over the past 30+ years has been the greatest influence on the environmental conditions of the study area. Between 1970 and 2000, communities in the study area grew by approximately 124 percent. Developed areas increased by approximately 18,000 acres, or 68 percent.

4.24.1.2 Reasonably Foreseeable Future Projects within the Study Area

Within the study area, transportation, development, and infrastructure projects that are reasonably foreseeable by 2030 and are identified in local, regional, and state plans are described (see **Table 4.24-1**, **Table 4.24-2**, and **Table 4.24-3**). These projects are expected to occur without the proposed transportation improvements in the study area. They include those that have been approved, are under construction, or have recently been completed, as well as those that are known by planners or developers to be reasonably certain but which have not been approved or permitted. Sources for the information presented in the tables include the fiscally constrained 2030 Metro Vision Regional Transportation Plan, the 2005-2010 Transportation Improvement Program (TIP), and Capital Improvement Programs from study area jurisdictions.

Several of these listed transportation projects are undergoing environmental studies including the US 36 Corridor EIS and the Gold Line EIS. The C-470 EA was recently signed, but the project is currently on hold.

Table 4.24-1 Transportation Projects within Study Area

Project Name	Jurisdiction	Description	Use
SH 42/96th Street Extension/Connection	Louisville	Expansion and enhancement	Capacity building
US 36: 96th Street to Interlocken East	Boulder	Add two new lanes	Capacity widening
Wadsworth Pkwy./US 36 Interchange	Broomfield	Interchange improvement	Capacity building
Greenway Park Trail	Broomfield	Trail and traffic signal within Greenway Subdivision	Bike and pedestrian
120th Avenue/SH 128 Connection	Broomfield	Extension of 120th Avenue over US 36	Operational improvement–new six-lane road
96th Street: SH 128 to Eldorado Blvd.	Broomfield	Add two new lanes	Capacity widening
Wadsworth Pkwy: 92nd Avenue to SH 128/120th Avenue	Broomfield	Add two new lanes	Capacity widening
West 72nd Avenue Phase II Upgrade (complete)	Arvada	Road construction	Capacity building
West 86th Parkway: Alkire Street to 88th Avenue	Arvada	Developer-funded widening to four lanes	Capacity building

Project Name	Jurisdiction	Description	Use
West 86th Parkway: Indiana Street to Alkire Street	Arvada	Widen from two to four lanes	Capacity widening
McIntyre Street: SH 58 to 48th Avenue	Arvada	Widen from two to four lanes	Capacity widening
McIntyre Street: 62nd Avenue to 64th Avenue (complete)	Arvada	Widen from two to four lanes; developer funded	Capacity widening
Arvada RTD Call-N-Ride (service implemented)	Arvada	New Call-N-Ride service to enhance mobility	New bus service
72nd Avenue: Pierce Street to Kipling Street (phase I complete)	Arvada	Construct four lanes	Capacity widening
SH 72: Kipling Street to Alkire Street	Arvada	Widen two to four lanes, paid by developer	Capacity widening
SH 72: Alkire Street to Indiana Street	Arvada	Construct four lanes, paid by developer	Capacity widening
72nd Avenue: Wadsworth Blvd. to Kipling Street	Arvada	On street bike/pedestrian path	Bike/pedestrian
86th Avenue: Alkire Street to Indiana Street	Arvada	On street bike/pedestrian path	Bike/pedestrian
McIntyre Street : 62nd Avenue to 64th Aveune	Arvada	Detached bike/pedestrian trail	Bike/pedestrian
56th Avenue and Ward Road	Arvada	Bike/pedestrian underpass	Bike/pedestrian
64th Avenue: Terry Street to Indiana Street	Arvada	Add two new lanes	Capacity widening
19th Street Reconstruction (complete)	Golden	Reconstruct 19th Street	Capacity enhancing
US 6 bike path from C-470 to Clear Creek	Golden	Bike/pedestrian trail	Bike and pedestrian
Clear Creek Trail (complete)	Golden	McIntyre Street crossing, detached trail	Bike/pedestrian
McIntyre Street: Clear Creek to Croke Canal	Golden	Roadway project with sidewalks	Roadway and bike/pedestrian
US 6: C-470 to 19th Street (complete)	Golden	Detached trail	Bike/pedestrian
Kipling Parkway: Morrison Road	Lakewood	Improvements along Kipling Parkway	Intersection improvements
Union Boulevard from Alameda Pkwy. to US 6 (complete)	Lakewood	Reconstruct Union Blvd. from Alameda Pkwy. to US 6	Capacity enhancing
Indiana Street Expansion: 6th Avenue to Colfax (complete)	Lakewood	Expansion from four to six lanes, paid by developer	Capacity widening
Colfax Avenue: Simms Street Improvements	Lakewood	Construction of turn lanes	Operational improvement
Colfax Avenue: Hawthorne Road to Indiana Street (complete)	Lakewood	Widen from four to six lanes, paid by developer	Capacity widening
Union Blvd: 4th Avenue to 6th Avenue Improvements	Lakewood	Deceleration and turn lane construction	Operational improvement
SH 121 (Wadsworth Blvd.)/US 40 (complete)	Lakewood	Add turn lanes	Operational improvement

Project Name	Jurisdiction	Description	Use
8th Avenue: Simms Street to Indiana Street	Lakewood	On street bike/pedestrian path	Bike/pedestrian
Northwest Parkway: Sheridan Parkway	Adams County	New interchange	Operational improvement
C-470: I-70 to US 6 Ramps	Jefferson County	Interchange reconstruction/ramp addition	Intersection improvements
SH 93: 64th Pkwy. to Boulder County Line	Jefferson County	Add two new lanes	Capacity widening
US 36 at Old Wadsworth Bridge Repair	CDOT Region 6	Bridge repair	Intersection improvements
C-470 Trail	CDOT Region 6	Detached and on-street path	Bike/pedestrian
US 36 EIS Corridor Improvements	CDOT Region 6	Improvements to US 36	Capacity widening, operational improvements, BRT
FasTracks	RTD	West Corridor, Gold Line, and Northwest Rail	Light rail and commuter rail transit
SH 170: Superior to SH 93	Superior	Add 5 foot shoulders for bike lane	Bike/pedestrian
McCaslin Boulevard: Coalton Road to Rock Creek Parkway	Superior	Add two new lanes	Capacity widening
McCaslin Boulevard: SH 128 to Coalton Road	Superior	Add two new lanes	Capacity widening
Farmer's Highline Canal	Westminster	Detached bike/pedestrian trail	Bike/pedestrian
Old Wadsworth Boulevard: Big Dry Creek Trail	Westminster	Bridge construction over Big Dry Creek	Bike/pedestrian
Simms Street Widening	Westminster	112th to 120th Ave.: widen from two to four lanes	Capacity enhancing
Simms Street (see widening project)	Westminster	Combined (bike lanes and off-street sidewalk)	Bike/pedestrian
US 36 Underpass at Mandalay Town Center	Westminster	Construct US 36 underpass at Church Ranch Road	Capacity enhancing
Kipling Street: I-70 to 50th Avenue (complete)	Wheat Ridge	Remove islands, extend median	Capacity enhancing
46th Avenue: Estes St. to Carr St.	Wheat Ridge	Improvements	Capacity enhancing
32nd Avenue and Eldridge Street Improvements	Wheat Ridge	Roundabout and intersection improvements	Operational improvement
I-70/SH 58	Wheat Ridge	Add EB SH 58 to WB I-70; EB I-70 to WB SH 58	Capacity widening
32nd Avenue and Eldridge Street Improvements	Wheat Ridge	Roundabout and intersection improvements	Operational improvement
I-70: Kipling Street	Wheat Ridge	Reconstruct Interchange	Interchange improvements

Source: Compiled by Carter & Burgess, 2006.

Table 4.24-2 Land Development Projects within Study Area

Project Name	Jurisdiction	Description	Use
Boulder Transit Village	Boulder	11.2-acre development	Mixed use
Broomfield Urban Transit Village	Broomfield	204-acre development	Mixed use
Discovery Office Park	Superior	McCaslin Boulevard and Rock Creek Parkway	Commercial
Superior Marketplace Expansion	Superior	US 36 and McCaslin Boulevard; 80,000 square foot expansion	Commercial/Retail
Roger's Farm	Superior	McCaslin Boulevard and south of E. Coal Creek Drive; pedestrian mall	Mixed Use
Community Park Development	Louisville	Multi-Use City Park	Park
Police Department and Municipal Building	Louisville	Municipal Building	Municipal
New Library Building	Louisville	New Library	Municipal
Skate Park	Louisville	Skate Park	Park
Rooney Road Athletic Fields	Golden	Building of athletic fields	Park
Table Rock/Grand Quadrille	Golden	SF P.U.D. at SH 93 and W 58th Avenue	Residential
Park View Villas	Golden	111-home, age restricted community at SH 93 and 58th Avenue	Residential
Saddle Brook	Arvada	115-acre development at Indiana Street and 75th Avenue	Residential and open space
Whisper Creek	Arvada	200-acre development at 87th Avenue and Alkire Street	Residential and open space
Water Tower Village	Arvada	700-unit residential village Wadsworth Boulevard and W 55th Avenue	Residential
Hometown North & South	Arvada	373-acre development at 64th Avenue and Kendrick Drive and 64th Avenue and McIntyre Street	Residential
Grandview Plaza and Reno Place	Arvada	Redevelopment of parcel with retail and office/lofts at Grandview Avenue and Wadsworth Boulevard	Mixed Use
Ralston Fields, including Arvada Ridge	Arvada	Arvada Urban Renewal Authority Project	TOD/Mixed Use
Wildgrass Subdivision	Arvada	201-acre development at 87th Avenue and Indiana Street	Residential
Westwoods Villas	Arvada	19-acre development at 63rd Avenue and McIntyre Pkwy.	Multi-family Residential
Village of Five Parks	Arvada	12.5-acre development. at 86th Avenue and Alkire Street	Residential/Parks
Fieldstone	Arvada	P.U.D. south of 64th Avenue at Easley Road	Residential
Cimarron Park	Arvada	426-acre development northwest of SH 72 and Indiana Street	Mixed Use

Project Name	Jurisdiction	Description	Use
Vauxmont Intermountain Communities	Arvada	1095-acre development northeast of SH 93 and SH 72	Mixed Use
Walnut Grove #11	Westminster	108th Avenue and Wadsworth Parkway; SF Detached, 96 units	Residential
Sunstream #9	Westminster	Carr Street and Lark Bunting Drive; SF Detached, 28 units	Residential
Meadow View Development	Westminster	107th Avenue and Simms Street; SF Detached, 20 units	Residential
Walnut Grove #10	Westminster	East of Johnson Drive on 107th Avenue; SF, 63 units	Residential
Countryside	Westminster	Northeast Corner, 9 units	Residential
Village at Standley Lake	Westminster	100th Avenue	Residential/Commercial
Christ Community Covenant Church	Westminster	100th Avenue	Public
Mountain Vista Village	Westminster	86th Avenue and Yukon, 24 units	Residential
Cabela's, Inc.	Wheat Ridge	I-70 and SH 58	Commercial

Source: Compiled by Carter & Burgess, 2006.

In addition to development projects listed above, there are several station area studies underway associated with the FasTracks program. Several jurisdictions are looking at transit oriented development opportunities for stations along the rail corridors.

Table 4.24-3 Infrastructure Projects within Study Area

Project Name	Jurisdiction	Description
Guanella Reservoir Pipeline	Golden	Water retention reservoir west of Empire for Golden municipal use
Reuse Water Pipeline	Louisville	Transfers used water for use on golf course
Van Bibber Drainage Project	Arvada	Improve Van Bibber Creek drainage and flood control
Great Western Reservoir	Broomfield	Expansion of existing reservoir
Arvada-Blunn Reservoir	Arvada	Expansion of existing reservoir
Moffat Collection System EIS	Denver Water (Arvada)	EIS underway for expanding drinking water storage and/or recycling drinking water. One alternative includes creation of a storage reservoir west of SH 93 along Leyden Gulch.

Source: Compiled by Carter & Burgess, 2006.

4.24.2 Environmental Consequences

4.24.2.1 Baseline Condition

The baseline condition starts with existing conditions, which includes the effects of past projects (i.e. uses 2005 conditions as a starting point), and adds potential impacts from projects that are reasonably foreseeable (see **Chapter 2** and **Table 4.24-1**, **Table 4.24-2,** and **Table 4.24-3**).

The impacts associated with the baseline condition include historic impacts since 1970 and impacts from all of the reasonably foreseeable future projects to the year 2030. It does not include completion of the beltway as proposed under any of the build alternatives. The baseline condition has no new direct impacts to resources discussed in this document as a result of the build alternatives.

The reasonably foreseeable future projects would have the same cumulative impacts regardless of which build alternative is selected. Many area jurisdictions expect full build out within the next 20 to 30 years. Build out includes residential, industrial, office, and commercial development as well as open space. These projects would cause conversion of land from a natural state to a developed one resulting in increased impervious surface, a loss of rural and agricultural lands, loss of wetlands and riparian areas, further habitat fragmentation, wildlife displacement, loss of habitat and mortality of wildlife, increase in noise levels, degradation of water quality, and stress on the area's water availability and supply.

4.24.2.2 Land Use (Growth)

The northwest quadrant of the Denver metropolitan area, which includes the study area, has experienced tremendous growth over the past several years and this trend is expected to continue whether or not any transportation improvements related to this project are provided (see **Figure 4.24-1**). By 2030, forecasts prepared by DRCOG show that almost four million people will reside in the Denver metropolitan area and 800,000 new jobs will be created (DRCOG *Metro Vision 2030*). This anticipated growth is considered in city, county, and regional plans.

Historically, the study area was characterized by grasslands (tallgrass prairie, mixed grass prairie, agricultural and pasture lands), shrublands (riparian shrubland, xeric upland shrubland), woodlands (riparian woodland), and wetlands. Since the 1950s, urban development has displaced much of this native vegetation, affecting the species that depend on it. Rocky Flats National Wildlife Refuge is a large open space amenity within the study area that is protected from future development.

Generally, development has occurred from the southeast portion of the study area toward the north and west. Within the study area, natural vegetation communities in the north and west portions are still dominant, while other portions consist of developed urban lands with pockets of open space areas. These urban areas also include disturbed sites composed of bare soil or weedy vegetation.

Over the years, the study area has experienced the conversion of land from traditionally rural uses such as farming and ranching to more suburban and urban uses. Although the area was originally settled by miners, it also emerged as a large agricultural production region. Following World War II, Denver and the surrounding areas saw an increase in population spurring more suburban developments. Since then, new homes, businesses, and infrastructure have been converting vast areas of agriculture and open space land. DRCOG estimates that in 20 years, an additional two million residents will occupy the Denver metropolitan area. With the increase in population, areas of development have spread, continuing to consume agricultural and open space lands. This growth has put a significant strain on the area's natural resources, most notably water supplies. It is also driving up land values, making it increasingly expensive for local and county governments to preserve additional open space and for agricultural landowners to stay in business. Many communities have begun recognizing the importance of open space and are taking steps to preserve open space corridors for residents and wildlife alike.

The cumulative land use impacts would be a result of growth and development already expected to occur in specific areas identified by the cities and counties as shown (see **Section 4.24.1**). According to DRCOG, forecasts show an overall increase of 26 percent in households and 42 percent in employment within the Denver metropolitan area and an increase of 168 percent in households and 64 percent in employment within the study area between 2005 and 2030. Transportation improvements and development projects in the study area would not induce new growth into the region alone; rather they would cause redistribution or a shift in the location of future development. In several locations, the proposed transportation improvements would affect the density, variety, and timing of expected future development.

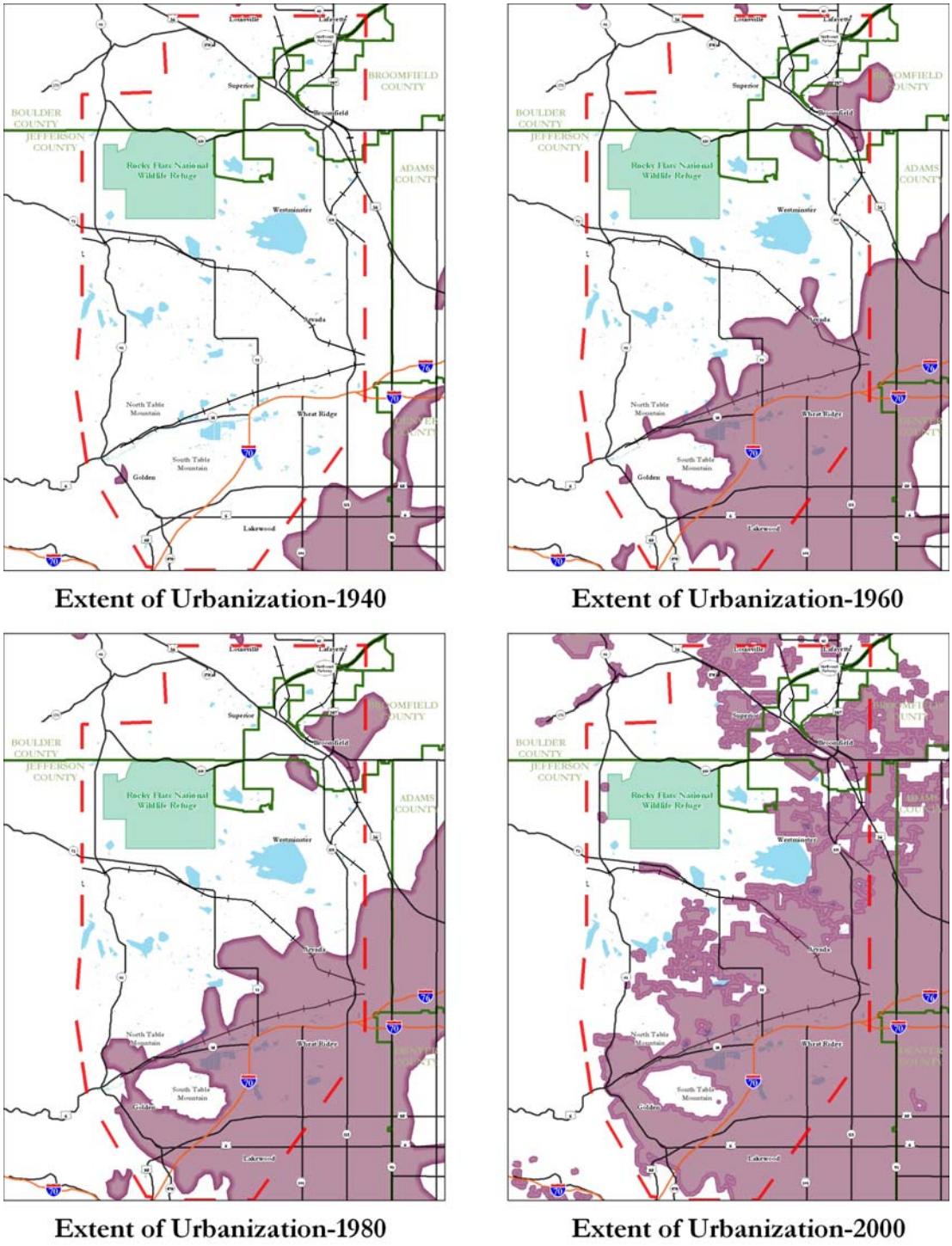
With the No Action Alternative, growth would occur as projected by U.S. Census data, municipalities, and DRCOG. According to the induced growth expert panel (see **Section 4.1.1.3**), development would occur in areas of undeveloped land under the No Action Alternative, but not as quickly or at the same high density as under a build alternative. These locations have been identified in area plans for future urban/suburban development. Under the No Action Alternative, as well as the build alternatives, there are several reasonably foreseeable future transportation improvements within the study area that are identified for funding over the 25-year planning horizon. The fiscally constrained 2030 RTP includes the roadway and rapid transit capital improvement projects identified that could accommodate the expected growth and development, in particular the Gold Line and West Corridor as part of the FasTracks program, and the addition of two lanes on SH 93 from 64th Parkway to the Boulder County line (see **Table 4.24.1**). In general, the projects listed in the tables (that could occur over the next 25 years with the No Action Alternative) would contribute to the incremental environmental impacts of past, present, and reasonably foreseeable future projects.

With the build alternatives, the projects listed in the tables above also are expected to occur. New development is forecasted for the same locations as identified under the No Action Alternative, however, the density, variety, and timing may vary. In the undeveloped area north of SH 72 and east of SH 93, development plans have been approved by the City of Arvada. This area is within DRCOG's 2030 Urban Growth Boundary and the City of Arvada's planning boundary. Overall, the construction of a build alternative is not likely to contribute to cumulative land use impacts in comparison to what is already on the horizon through land development projects and other roadway improvements.

The NRCS Metropolitan Denver and Longmont offices were contacted to determine if any Prime or Unique Farmland, or Farmlands of Statewide or Local Importance exist within the Study Area. The NRCS identified soils that fall under the protected categories. There are no Unique Farmlands identified in the study area. Land that currently has an urban use or that will be developed in the near future is not considered farmland. Recent land development and urbanization of the Broomfield and north Golden areas has removed much area from consideration for Prime Farmlands and Farmlands of State and Local Importance. Continued residential development is expected within the existing SH 93 corridor and Interlocken-Flatiron Crossing mixed-use development areas of Boulder and Broomfield Counties, further reducing the number of farms in the area.

Historical urbanization has caused the greatest impact on farmlands. The No Action Alternative would not impact any category of farmland. The Regional Arterial Alternative will impact the least amount of farmland, followed by the Combined Alternative (Recommended Alternative), the Freeway Alternative, and the Tollway Alternative. The construction of any build alternative is not likely to contribute to cumulative farmland impacts in comparison to what is already on the horizon through land development projects and other roadway improvements (see **Table 4.18.2**).

Figure 4.24-1 Urbanization 1940–2000



Source: Compiled by FHU, 2006.

4.24.2.3 Water Resources and Water Quality

Water resources consist of such systems as aquatic life, aquatic habitat, stream hydraulics, basin hydrology, floodplains, and water quality. Prior to the mining era, the natural ecosystem was largely unaffected by human activity. Mining, agriculture, urbanization, and hydrologic modification placed additional stresses on these crucial resources. These human activities have resulted in the continuous loss of wetlands, aquatic life, riparian habitat, aquatic vegetation, and fauna, which has altered the ecosystem. The cumulative effects of these activities have resulted in changes, not only to the stream corridors, but also to the overall ecosystem.

While water quality in the Platte River Basin is generally good, urbanization, rapid growth, historical mining, and agriculture have created water quality concerns. Urbanization, including the conversion of agricultural lands to new commercial and residential developments, has increased impervious surfaces affecting the natural hydrology of area streams and has contributed to the cumulative effects on water resources and water quality. Development rapidly consumes and converts natural landscapes to impervious surfaces such as parking lots, roads, and rooftops, resulting in a loss of groundwater infiltration. Water runs off these impervious surfaces, carrying pollutants directly into water bodies instead of filtering through the soil into underground aquifers. As growth and development increases, detrimental cumulative effects on the quality of local water resources and water supply can result from individually minor but collectively greater increases in impervious surface area over a period of time.

In addition, the construction of irrigation ditches and reservoirs greatly affects the natural hydrologic conditions of the streams. Irrigation practices have altered the groundwater levels along the South Platte River. Much of the mineral extraction that has taken place in Colorado has occurred in the upper reaches of the South Platte River Basin. The South Platte River Basin and Clear Creek, in particular, have been most affected.

Impacts to study area water resources and water quality could result from increased runoff containing increased amounts of pollutants being carried into receiving waters. The study area will continue to experience commercial and residential development under the No Action Alternative and the build alternatives. The No Action Alternative would have the least increased effect on local hydrological conditions. Of the build alternatives, the Regional Arterial Alternative would have the greatest effect followed by the Combined Alternative (Recommended Alternative), the Freeway Alternative, and the Tollway Alternative. Winter maintenance practices, such as snow plowing, sanding, deicing, and runoff can move sand, salt, and debris into adjacent water bodies, altering the natural biochemical makeup as well as their functions and values. The following indicates the additional acreage of impervious surface by alternative (see **Table 4.24-4**).

Table 4.24-4 Acres of Impervious Surfaces by Alternative

Alternative	Total Impervious Surface (acres)	Impervious Surface Greater than Existing conditions (acres)
No Action	240.8	—
Freeway	388.8	299.0
Tollway	362.5	289.9
Regional Arterial	479.0	348.0
Combined (Recommended)	425.7	325.6

Cumulative water quality impacts are primarily dependent on future changes in the hydrologic conditions adjacent to the roadway in the study area. The most significant changes to the hydrologic conditions are associated with changes in impervious surfaces in the watershed. It is very difficult to accurately predict future changes in impervious surfaces. One way to identify areas of potential cumulative water quality impacts is to compare the DRCOG transportation analysis zones (TAZs) for 2005 and for the 2030. TAZs are classified by area type and are primarily used to project future traffic patterns. Area types with their associated percent impervious surface area are:

- Central Business District (CBD)—95 percent
- Central Business District–Fringe—80 percent
- Urban Areas—75 percent
- Suburban Areas—40 percent
- Rural Areas—2 percent

The percent imperviousness for each TAZ area type were derived from the *Urban Drainage and Flood Control District Drainage Criteria Manual* (UDFCD, 2001).

The largest areas of change in area type from the 2005 to 2030 conditions are in the northern portion of the study area because of plans for the development of a "Tech Center" type of business district. The changes in impervious surfaces are a result of increased urbanization in the study (see **Table 4.24-5** and **Table 4.24-6**).

Table 4.24-5 Estimates of Acres of Impervious Surfaces in 2005 and in 2030, based on DRCOG TAZs.

TAZ Type	Clear Creek			Big Dry Creek			Boulder Creek/ St. Vrain Creek			Upper South Platte		
	2005	2030	Difference	2005	2030	Difference	2005	2030	Difference	2005	2030	Difference
CBD	--	--	--	--	--	--	--	--	--	--	--	--
CBD Fringe	--	531	531	--	36	36	--	600	600	96	365	269
Urban	5,910	7,788	1,878	2,092	4,280	2,188	2,043	2,915	871	2,593	2,341	-252
Suburban	12,213	11,149	-1,064	5,630	6,852	1,222	3,093	2,863	-230	479	479	0
Rural	258	248	-10	147	26	-120	185	159	-27	2.4	2.4	0

Source: DRCOG 2005 and 2030 Traffic Model.

Table 4.24-6 Percent Increase of Impervious Surfaces for Study Area Watersheds

	Clear Creek	Big Dry Creek	Boulder Creek/St. Vrain Creek	Upper South Platte
Net Increase in Impervious Surfaces	1,335	3,326	1,215	17
Total Watershed Area	51,332	24,192	19,719	4,896
Percent of Total Watershed Converted to Impervious Surfaces	**3%**	**14%**	**6%**	**0.3%**

Diminishing quality and quantities of water that recharge water supplies, and increases in the amount of pollution in receiving waters are both possible cumulative effects that can have even further impact on the environment. Impacts to water resources can result in adverse effects on wildlife from diminished water quality and on human water consumption due to both limits of water availability and impacts to water quality. As the population continues to grow, a decrease in water levels due to extraction for domestic use could occur.

4.24.2.4 WETLANDS

The study area is located where the foothills montane shrubland and the grasslands of the Great Plains meet and is part of the Clear Creek and Middle South Platte/Cherry Creek watersheds. According to the Colorado Division of Wildlife (CDOW) riparian data, there are presently 2,142 acres of wetlands in the study area. This constitutes approximately 2 percent of land cover for the study area. Wetlands within the study area are associated with natural drainages, seep areas, ponded sites, and irrigation and roadside ditches. Major drainages within the study area include Rock Creek, Walnut Creek, Woman Creek, Big Dry Creek, Ralston Creek, Van Bibber Creek, Clear Creek, Little Dry Creek, Leyden Gulch, Cressman Gulch, and Tucker Gulch. Major irrigation canals include Community Ditch, South Boulder Diversion Canal, Farmer's Highline Canal, and Croke Canal. Cumulative effects to wetlands and riparian areas have occurred and continue to occur in the study area due to human activities such as construction, land conversion, and agricultural practices.

Prior to the mining era, wetland communities in the study area were largely unaffected by human activity. Mining, agriculture, and urbanization have resulted in the continuous loss of wetlands and riparian habitat. Cumulative effects of development activity have resulted in a reduction in the amount of wetlands as well as a decrease in wetland function and value.

Historical urbanization between 1940 and 2000 caused the greatest impact on wetlands. Development is expected to continue until build out, whether or not a build alternative is constructed. Most of these impacts would occur adjacent to roadways and in undeveloped lands planned for development. However, many of the remaining wetlands in the study area are protected from development by open space, wetland, and floodplain regulations. There are approximately 36,005 acres of protected lands within the study area, 1,043 acres of which are wetlands, showing that almost one half of the total wetland acres in the study area (2,142) are located within protected zones (see **Figure 4.24-2**).

Today, the Rocky Flats National Wildlife Refuge contains a large amount of the remaining wetland complexes in the study area. According to the final *Rocky Flats National Wildlife Refuge Comprehensive Conservation Plan and Environmental Impact Statement* (CCP/EIS), 2004, wetland communities cover 406 acres of the 6,200 acres comprising Rocky Flats National Wildlife Refuge. Higher functioning wetlands are also found adjacent to the least disturbed natural stream sites in the study area.

In order to delineate wetlands in the Northwest Corridor study area, wetland scientists from the study team worked with the U.S. Army Corps of Engineers (USACE) Denver Regulatory Office to develop a process that worked with the alternatives screening process as it moved from general to specific alignments and alternatives.

Using CDOW riparian data for quantifying wetland habitat, the amount of wetlands historically present in the study area can be extrapolated in conjunction with USGS data showing land use along the Front Range. Calculations based from the USGS data determined there were approximately 26,950 acres of developed land in the study area, or 26.8 percent of land cover, in 1970. Based on CDOW analysis, wetlands comprise 2 percent of land cover in Colorado, and assuming the same percentage of wetland land cover is also true for the study area, it can be assumed that 2 percent of the developed land was wetland, given the wetlands were evenly distributed. Based on this assumption, resulting losses of 539.0 acres of wetlands were caused by development. If the calculated lost amount of wetland acreage is added to the present wetland data, it can be assumed that approximately 2,681 acres of wetlands were present in 1970.

During Level 2 alternative screening, wetland scientists conducted preliminary wetland determinations for the entire study area identifying the above noted 2,142 acres of wetlands. Delineations during Level 3 alternative screening were conducted using more detailed wetland determinations within 100 feet of the proposed right-of-way of the build alternatives. Scientists collected data on dominant vegetation, wetland plant associations (based on Colorado Natural Heritage Program's [CNHP] Field Guide to the Wetland and Riparian Plant Associations of Colorado [Carsey et al. 2003]), Cowardin wetland class (Cowardin et al. 1979), and basic wetland functions. Detailed wetland delineations and functional assessments were done for representative

wetlands in each wetland association. Wetland locations and boundaries were displayed on a representative study area wetland map created using GPS data and GIS software. At the request of USACE, riparian areas within the study were included with wetland mapping.

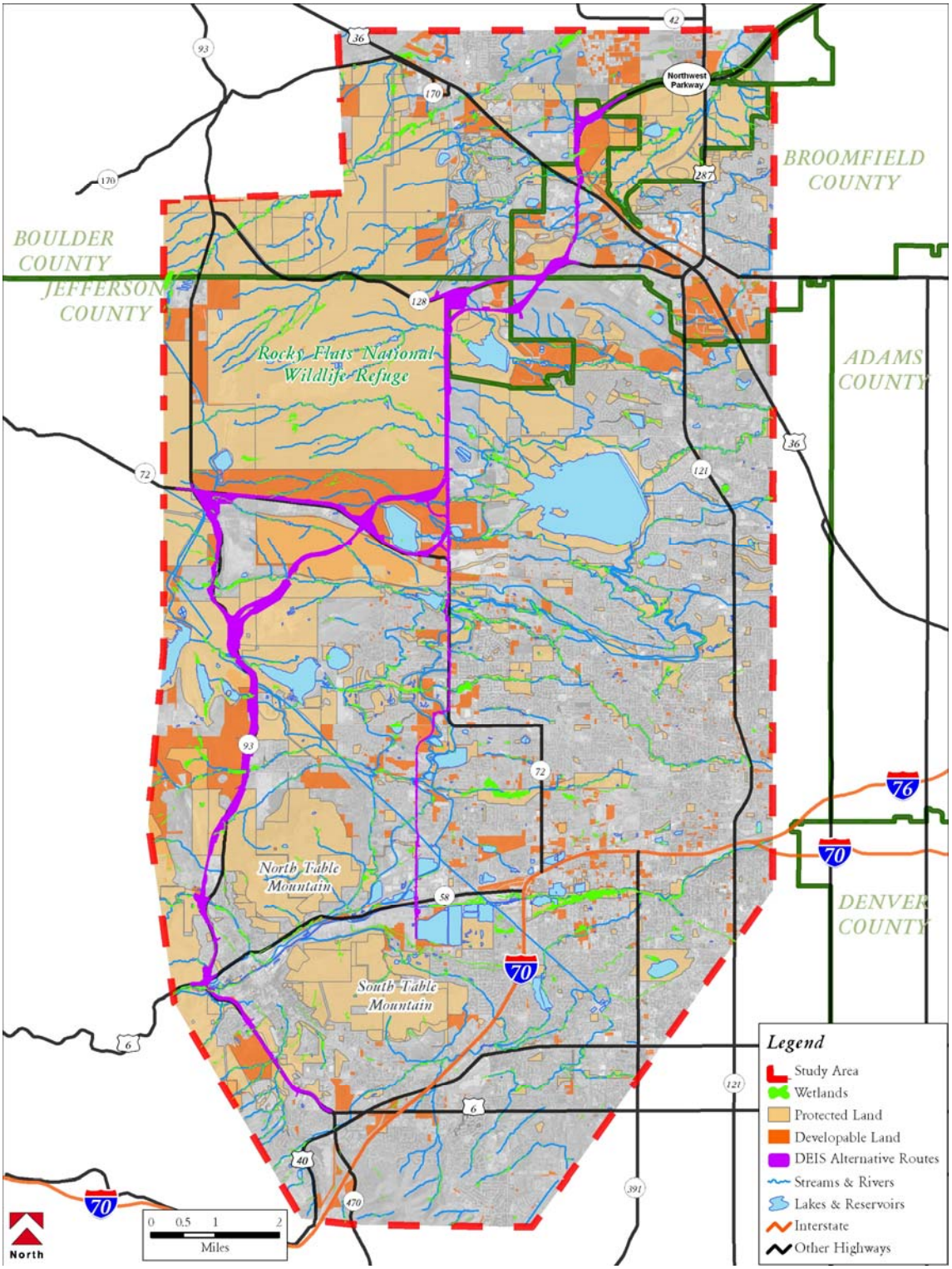
Under the No Action Alternative, wetland degradation and loss is anticipated to continue as growth and development continue to occur in undeveloped areas. A total of 244 acres of wetlands are located on land that is considered developable, and impacts to these wetland habitats can be expected. Impacts to any jurisdictional wetlands would require coordination through the proper agencies to ensure that proper mitigation efforts are initiated. The creation of more impervious surfaces may increase runoff, increasing the concentration of pollutants and sedimentation. Although Rocky Flats National Wildlife Refuge would be protected from further urbanization, planned development and associated roadways, infrastructure south and west of Rocky Flats and potential mining along its western edge could result in further impacts to wetland communities within the refuge.

An induced growth expert panel convened for this project indicated that growth would occur whether or not a build alternative is selected. The difference between the No Action Alternative and the build alternatives would be in the density, variety, and timing of development. Therefore, indirect growth related impacts to wetlands would occur regardless of whether or not a build alternative is selected. However, these impacts could occur more quickly, and in some cases be more intense with the selection of a build alternative. Indirect effects could occur to wetlands associated with Walnut Creek, Woman Creek, Ralston Creek, Van Bibber Creek, Clear Creek, and Leyden Gulch. The Combined Alternative (Recommended Alternative) could result in additional impacts to wetlands associated with Leyden Gulch, Ralston Creek, and Van Bibber Creek adjacent to the proposed roadway improvements along Indiana Street/McIntyre Street.

Construction of any of the build alternatives would result in wetland degradation and loss through the placement of fill material, roadway widening and realignment, and intersection improvements. There are approximately 70 acres of wetlands within 100 feet of the proposed right-of-way (inside the cut and fill lines). The Freeway Alternative and Tollway Alternative would directly impact approximately 15 acres of wetlands and other waters of the United States. The Regional Arterial Alternative would directly impact approximately 21 acres of wetlands and other waters of the United States. The Combined Alternative (Recommended Alternative) would impact approximately 18 acres of wetlands and other waters of the U.S.

Given the large amount of wetlands in protected areas (approximately half of those in the study area) and that the impact of the build alternatives represent approximately 1 percent or less of wetlands in the entire study area, the incremental impact of the build alternatives would not cause unacceptable deterioration of wetlands or wetland function.

Figure 4.24-2 Wetland Habitat on Developmental and Protected Lands in the Study Area



Source: Compiled by FHU, 2007.

4.24.2.5 WILDLIFE

The Northwest Corridor study area is located along the base of the eastern foothills of the Rocky Mountains. Because it is located where the foothills montane shrubland and the grasslands of the Great Plains meet, it supports a wide variety of wildlife species that depend on habitat in either or both ecosystems. Prior to 1940, the area was largely undisturbed by human activity and consisted of grasslands, shrublands, woodlands, and wetlands. Between 1940 and 2000, mining, agriculture, and urbanization have resulted in the continuous loss and alteration of wildlife habitat within the study area. Most of the eastern portions of the study area are dominated by urban development including commercial and residential land uses. Undeveloped and protected lands dominate the areas adjacent to SH 93 on the western edge of the study area.

The quality and connectivity of wildlife habitat in the study area is presently supported by the large expanses of protected open space or otherwise undeveloped land that preserves several habitat types as well as movement corridors between different habitat areas. Wildlife movement is primarily concentrated along riparian corridors. Existing roads and highways make movement of wildlife from one area to another more difficult, especially where they cross riparian corridors. Existing culverts are too small to accommodate most wildlife species; as a result, individuals either do not cross the roadways, or cross and risk being hit by vehicles. Collisions with wildlife are a safety issue in the study area, especially along SH 93 (CDOW and City of Golden, 2005).

Approximately 23,210 acres of the 35,527 acres, or 65 percent, of known habitat for common species (elk, mule deer, white tailed deer, etc.), riparian habitat, and wildlife connectivity corridors, is located on protected land. There are 5,187 acres (approximately 15 percent) of common wildlife habitat on land that is identified as developable (see **Figure 4.24.3**).

Because of its location at the interface of the foothills and the plains, the study area contains a variety of important animal communities, including populations of two species listed as threatened under the Endangered Species Act; Bald eagle and Preble's meadow jumping mouse; and one species of state concern; the Black-tailed prairie dog. The known and potential habitat for the bald eagle, Preble's meadow jumping mouse, and Black-tailed prairie dog within the study area is approximately 18,098 acres. Approximately 1,813 acres of this habitat is on protected lands (65 percent) and approximately 2,572 acres (14 percent) of this habitat is on developable lands. Impacts to resources supporting these species are expected to occur with the reasonably foreseeable future projects (see **Figure 4.24-4**).

In the No Action Alternative, transportation improvements described in the build alternatives would not be implemented. As a result, there would be no direct loss of wildlife habitat or vegetation from either new facilities or improvements to existing facilities. Current traffic patterns would continue, although traffic volumes would likely increase due to foreseeable residential and commercial development in and around the study area. Increases in traffic volume would likely increase the number of wildlife/vehicle collisions because there would be no improvements to road crossings at wildlife movement corridors.

Beneficial mitigation measures suggested for the build alternatives such as improvements to the connectivity of wildlife corridors associated with roadways would not be implemented in the No Action Alternative.

The build alternatives would result in the disturbance, degradation, or elimination of Preble's meadow jumping mouse and bald eagle habitat, as well as general wildlife habitat (see **Section 4.11**). The acreage of impact as a result of each build alternative is shown (see **Table 4.24-7**).

Regardless of which alternative is chosen, the reasonably foreseeable future projects identified would contribute to loss and degradation of wildlife habitat within the study area (see **Section 4.24.1.2**). Other proposed or planned transportation, development, and infrastructure projects would cumulatively result in impacts to wildlife and wildlife habitat, as well as to other biological resources in the study area. The developable lands within the study area contain approximately 15 percent of the overall wildlife habitat. Land use, water resources and water quality, and wetlands impacts have been discussed previously.

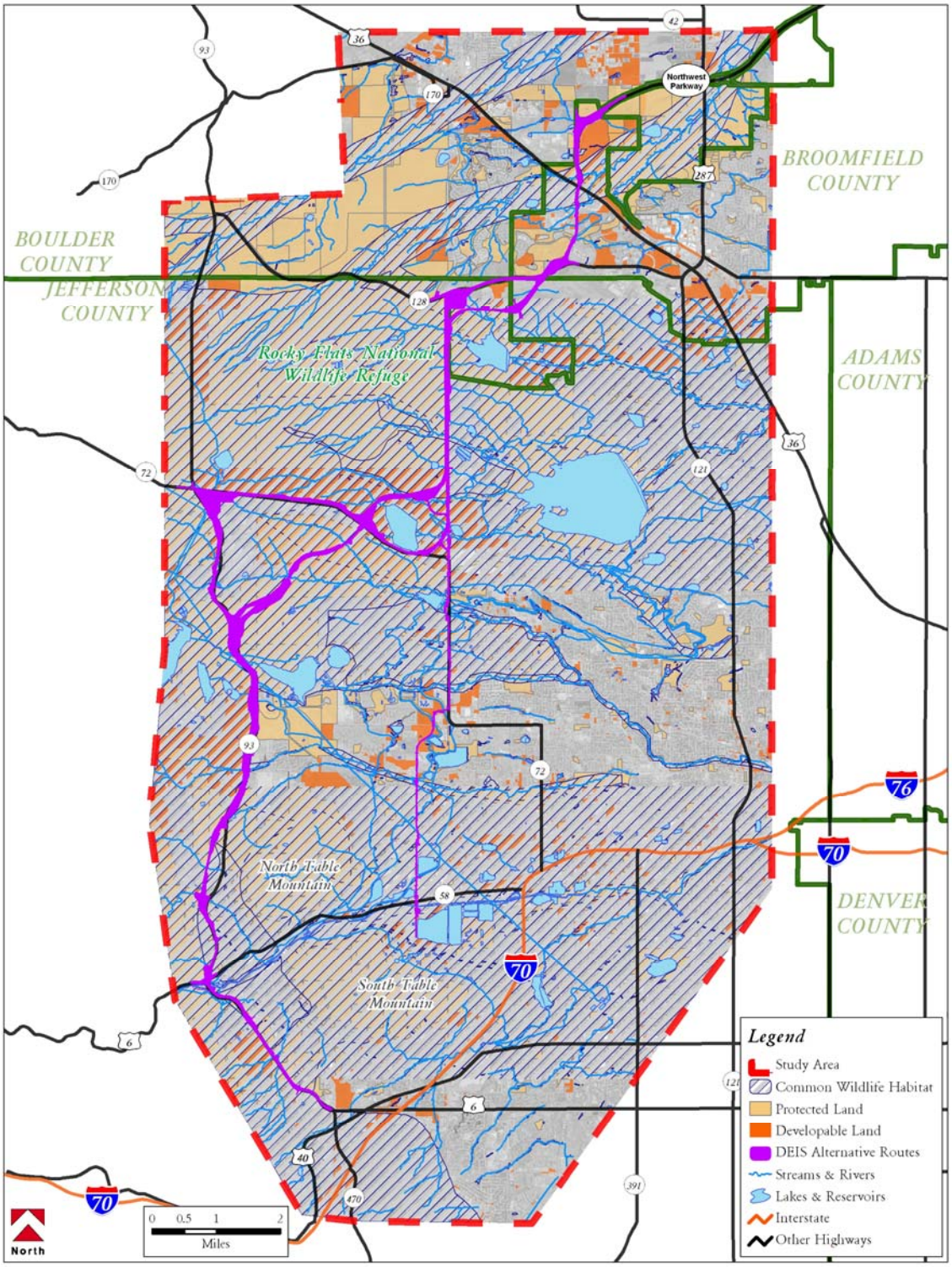
These impacts are quantified and summarized in **Table 4.11-6** and may include:

- Increased prevalence of wildlife in developed areas
- Increased mortality from wildlife/vehicle collisions
- Further disruptions of wildlife movement corridors
- Increased fragmentation or losses of open water, shrubland, wetland, riparian, and grassland habitats
- Increased potential of noxious weed infestation
- Increased noise and light disturbances

Indirect impacts to wildlife include increased light and noise from construction and transportation improvements. Such indirect effects may reduce the area of habitat used by wildlife adjacent to or near the proposed improvements. Threatened species such as the bald eagle and the Preble's meadow jumping mouse are particularly vulnerable to habitat loss or disturbance. Even with the suggested mitigation measures, the build alternatives and associated cumulative effects would result in long-term effects to plant and animal resources in the study area by changing dispersal patterns, creating environments more favorable to some species than to others, and enlarging the footprint of the human environment.

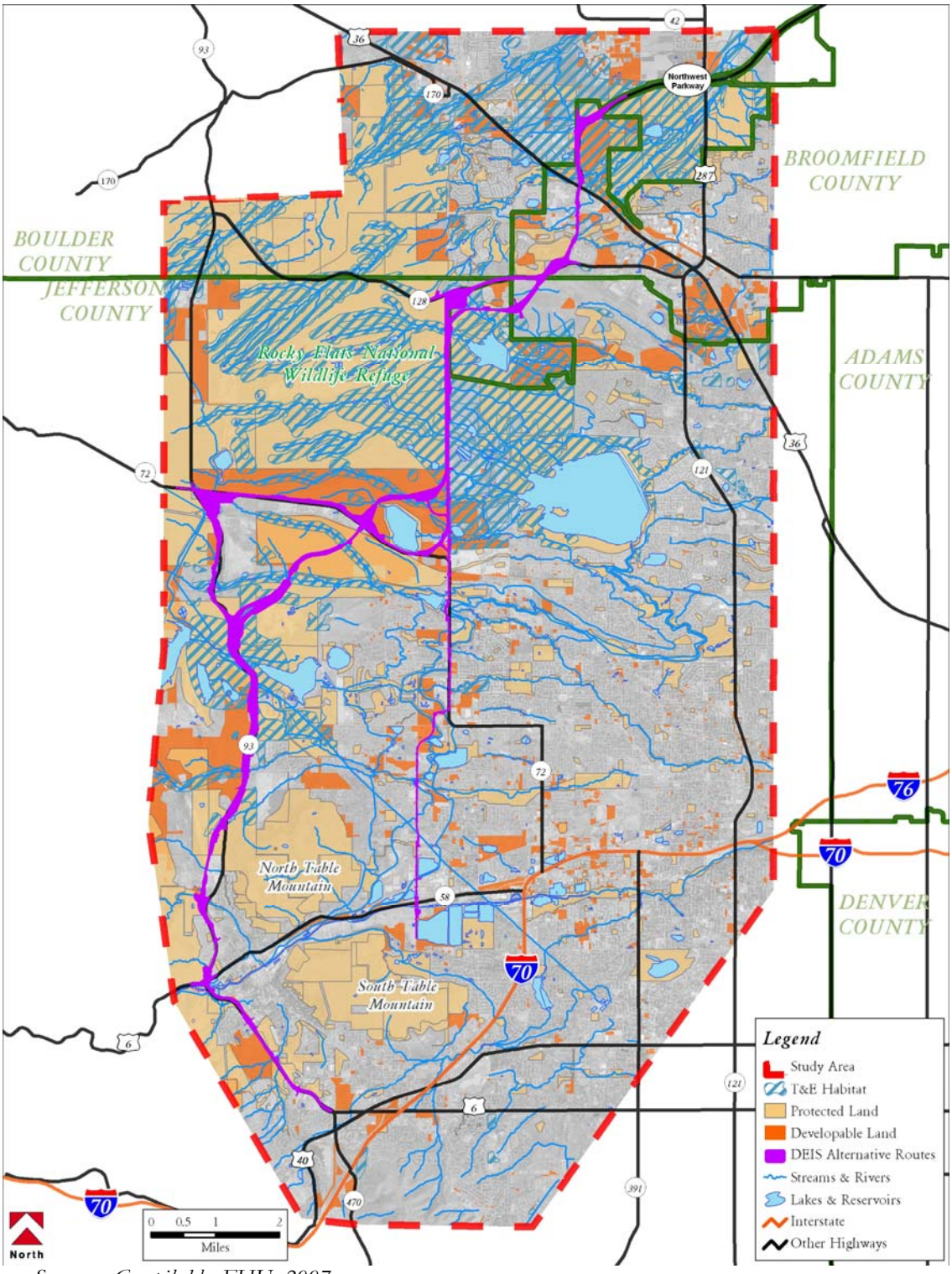
Overall impacts to wildlife habitat from the build alternatives result in less than 3 percent of the overall amount of habitat in the study area. As mentioned previously approximately 65 percent of habitat within the study area falls within protected lands.

Figure 4.24-3 General Wildlife Habitat on Developmental and Protected Lands in the Study Area



Source: Compiled by FHU, 2007.

Figure 4.24-4 Preble's meadow jumping Mouse, Black-tailed Prairie Dog, and Bald Eagle Habitat on Developable and Protected Lands in the Study Area



Source: Compiled by FHU, 2007.

Table 4.24-7 Direct Impacts to Preble's meadow jumping Mouse and Bald Eagle

Habitat Type	Acres Directly Impacted			
	Alternative			
	Freeway	Tollway	Regional Arterial	Combined (Recommended Alternative)
Preble's meadow jumping mouse	15	15	17	15
Bald Eagle Winter Range	319	351	227	272
Prairie Dog within 3 miles of Bald Eagle nest	33	33	52	35

Source: Northwest Corridor study team, 2005.

4.24.2.6 AIR QUALITY

In 2005, none of the NAAQS levels in the Denver metropolitan region were exceeded for CO, small particulate matter (PM_{10}, $PM_{2.5}$), nitrogen oxides (NO_x), or ozone (O_3) (see **Section 4.6**). However, in April 2004, the EPA designated the Denver region as nonattainment for the 8-hour O_3 standard due to a violation in 2003. Based on this designation, the Denver region entered into an Early Action Compact with USEPA for O_3 which requires attainment of the 8-hour O_3 NAAQS no later than 2007. According to recent data, progress is being made in reducing these concentrations in the Denver region through air quality management strategies identified in the Early Action Compact.

The *Metro Vision 2030 Plan* from DRCOG indicates that estimates of CO, PM_{10} and $PM_{2.5}$, and NO_x, for 2030, are all expected to fall under conformity attainment standard limits. In fact, all pollutants besides PM_{10} are predicted to decrease by 2030 even with increases in total miles traveled. Advances in vehicle technology as well as cleaner fuels have been major reasons for the improvements. Additionally, vehicles will have to be cleaner in the future to comply with stricter regulations.

Transportation projects that might cause air quality problems must meet certain requirements before they can proceed. Particularly, a regional air quality conformity evaluation is needed to show that projects are compatible with the State Implementation Plan. In addition, a local "hot spot" analysis for carbon monoxide (CO) is needed to show that the Proposed Action will not cause local violations of the National Ambient Air Quality Standards (NAAQS). Potential CO hot spots were identified through a preliminary evaluation of intersections in the study area and agency consultation (see **Section 4.6**). No CO hot spots in violation of the NAAQS are predicted and no mitigation is required.

CO concentrations are predicted to decrease at the target intersections in the future (2030), even with higher traffic volumes. This is primarily because vehicles will be emitting less CO. This benefit will be from federal vehicle emission regulation and will be realized regardless of which alternative is selected in this study.

Overall, the results from modeling potential CO impacts indicate that none of the alternatives being considered will cause violations of CO standards, so any of them would be acceptable in CO terms. None of the build alternatives have a clear and universal CO benefit over the others. Each alternative has aspects at some locations where it may benefit local air quality more than the other alternatives because of less traffic congestion.

For the No Action and build alternatives, both 1-hour and 8-hour CO concentrations are predicted to decrease within the NAAQS standard limits. By 2030, CO concentrations are predicted to decrease at the target intersections; even with higher traffic volumes (see **Section 4.6**). This is primarily because vehicles will be emitting less CO due to stricter regulations. This benefit will be realized regardless of which alternative is selected in this study. Overall, the results from modeling potential CO impacts indicate that none of the alternatives would cause violations of CO standards.

The No Action Alternative is expected to have the lowest PM_{10} emissions because of lower traffic volumes, lower traffic speeds, and greater overall congestion in the study area. The build alternatives are intended to improve traffic flow in the study area, which by itself could lead to higher PM_{10} emissions. Traffic volumes in the study area are expected to increase, which also could lead to more PM_{10} emissions. However, none of the alternatives are expected to cause or contribute to violations of the PM_{10} NAAQS even with the growth in traffic.

Existing pollutant levels of O_3 precursors (NO_x and volatile organic compounds (VOCs)) and $PM_{2.5}$ fall under conformity attainment standard limits. In addition, future emissions in 2030 are expected to decrease, even with increases in total miles traveled (see **Section 4.6**). Again, this is because vehicles will have to be cleaner in the future to comply with stricter regulations.

Since the alternatives were all found not to cause violations of the NAAQS and the emissions of most pollutants are expected to be lower in the future, the cumulative impacts to air quality as a result of build alternatives would be minimal. Mitigation measures for air quality are not required. The regional conformity analyses must still be done for a recommended alternative.

In addition to the criteria air pollutants for which there are NAAQS, USEPA also regulates air toxics. USEPA identified a reduced list of six priority mobile source air toxics (MSAT): acetaldehyde, benzene, formaldehyde, diesel exhaust, acrolein, and 1,3-butadiene. Through mobile source control programs, FHWA projects that even with a 64 percent increase in VMT, these programs will reduce on-highway emissions of benzene, formaldehyde, 1,3-dutadiene and acetaldehyde by 57 percent to 65 percent and will reduce on-highway diesel particulate emissions by 87 percent. As discussed in **Section 4.6**, a quantitative assessment of the effects of air toxic emissions on human health cannot be made at the project level. It follows that these predictions cannot be made at the study area level either. However, FHWA acknowledges that the reasonably foreseeable future projects within the study area may result in increased exposure to MSAT emissions in the study area. However, it is not possible to predict concentrations and durations of exposures. Therefore, the health effects from these emissions cannot be estimated.

4.24.2.7 NOISE

Study area residents have expressed concern over the noise impacts that could result from the build alternatives. In this study, noise impacts were evaluated by comparing the existing noise levels at locations throughout the study area to the 2030 No Action Alternative and the 2030 build alternatives (see **Section 4.7**). Impacts under the No Action Alternative (not including reasonably foreseeable future projects) were not dramatically different from existing conditions. The results also indicated that there was very little difference between the build alternatives, with the Regional Arterial Alternative having the fewest impacted receptors.

The study area was likely a quieter place in the past than it is today. As the total amount of vehicle travel in the study area increases and the region's population increases, noise levels will continue to increase. The continued demand for additional housing will likely involve higher density residential areas, as well as development occurring ever closer to noise generators, like freeways and airports. Typical rural residential areas have a community noise equivalent level (CNEL) of 39. This noise level is considered quiet and is equivalent to the sound of a bird call. An urban high density apartment could expect a CNEL of 76. This noise level is considered moderately loud and is equivalent to a vacuum cleaner. From a cumulative standpoint, as the study area continues to grow noise levels can be expected to increase in the foreseeable future, regardless of which alternative is chosen.

4.24.2.8 TRAFFIC AND TRANSPORTATION EQUITY

The study area is characterized by relatively modest proportions of both minority and low-income persons. There are about 15 percent and 16 percent minority, and about 22 percent and 14 percent low-income persons in Jefferson and Boulder counties respectively. These population groups are dispersed in pockets throughout the study area.

Given the robust level of local and regional growth, the study area has been and will continue to be affected by various transportation and development projects. It is highly probable that these projects have caused some inconvenience or annoyance to all segments of the community at various times, but there is no known, documented history of any environmental degradation from such projects that has affected minority or low-income population groups differently than the population as a whole.

Financial access to tolling is an issue that often emerges when addressing the impacts of express lanes. With the toll lanes proposed as part of the Tollway Alternative and the Combined Alternative (Recommended Alternative), users would be required to pay for their travel. Current general-purpose (i.e., "free") lanes would remain free, but the imposition of a fee to travel these new tolled lanes may be considered an inconvenience, annoyance, or at worst, an increased financial burden. For economically disadvantaged persons (i.e., low-income populations and the subset of minority populations that are also low-income) toll payments could thereby impair their access to a tolled transportation system. This could be due to obvious reasons (i.e., insufficient income), as well as to more subtle factors such as unavailability of credit cards, checking accounts, or cash savings to pay for electronic toll collection transponders. Fairness issues could also arise insofar as some low-income travelers would have to use non-toll facilities that would not offer the same transportation benefits as the toll lanes (e.g., reduced congestion and delay, and improved travel time).

There is presently no generally accepted understanding of the effects of tolling on transportation equity, and methodologies to identify and measure such effects are not well established. Equity studies conducted on express lane projects implemented in California and Texas reveal that economically disadvantaged drivers use express lanes voluntarily and are not necessarily excluded, although more frequent use is often exhibited by higher-income drivers. Most users, even those from higher-income households, choose the express lanes judiciously when they need to benefit the most from reduced congestion. A study currently underway in the State of Washington notes that the question of transportation equity has traditionally turned on the distribution of costs and benefits and the public acceptance of that distribution. Citing the proposed Jefferson Parkway (W-470), that is, the previously proposed transportation improvement program in the study area, as an example of a transportation project where the low public acceptance of tolling was a successful means of project criticism, this study observes that equity issues arising from tolling are a matter of public opinion more than anything else at the present time. Existing environmental review mechanisms (such as this NEPA process) provide the most common means for that public opinion to be expressed, according to the Washington study (Cambridge Systematics, 2005).

Comments received from the general public for this project indicated a concern that a toll facility would be expensive to build and would result in high costs to utilize. Although none of the comments indicated an inability to pay for the toll due to economic hardship, several comments expressed the opinion that a tolled facility would cater to the wealthy. It is unknown whether these comments were from minority or low-income residents, since race and income data was not asked of meeting attendees.

To make tolling more fair and equitable, if electronic tolling is included, methods would be available to overcome issues with credit cards and account debits to permit the broadest opportunity to use toll facilities. This might entail providing alternative payment options for transponder purchases and toll replenishment using cash or employer-based payroll deductions.

Under FasTracks there will be two new transit lines, Gold Line and West Corridor, within the study area. The Gold Line includes seven stations and will connect communities between Wheat Ridge and Denver. The West Corridor includes 11 stations and will connect communities between the Jefferson County Government

Center and Denver. In addition to the two new transit lines within the study area, FasTracks will also implement expanded bus service, FastConnects, throughout the region. Bus lines will be coordinated with transit lines providing links and access to transit facilities from outlying communities. Currently RTD operates bus service within the area and to Denver. Access to and use of these transit facilities would improve under a build alternative given the improvements in mobility. These improved transit facilities would provide enhanced mobility for people who do not own a private automobile.

4.24.2.9 Impacts Associated with Completion of the Beltway

In the late 1970s and early 1980s, CDOT identified the need for a beltway around the Denver metropolitan area to allow through traffic to avoid the urban core area and to facilitate suburb-to-suburb travel. Since that time 84 miles of the beltway have been completed. The first piece of this system, C-470 from I-25 in the southern Metro Denver Area to I-70 near Golden, was completed in 1990. The second piece, E-470, was completed in 2003. E-470 is the largest piece of the beltway, consisting of 47 miles from C-470 at I-25 to the northern edge of the Metro Denver Area at I-25 near 157th Avenue. E-470 connects to the third segment of the beltway, Northwest Parkway, at I-25 and 157th Avenue. Northwest Parkway also was completed in 2003. Both E-470 and Northwest Parkway are toll facilities The build alternatives being considered in this study would complete the beltway by providing the final link in the system, from the terminus of Northwest Parkway at US 36 to C-470 at US 6.

Substantial research has been conducted into the impact of highways on land use, economic development, and infrastructure, but only a few focus specifically on the impact of beltways. A general literature and case study review of documents addressing beltways indicate the following:

- Research is inconclusive as to whether the presence of a beltway contributes to the overall expansion of an area and urban sprawl (Parsons Brinckerhoff Quade & Douglas, Inc., 2003).
- Beltways do not increase the rate of growth, but may influence where growth occurs and at what densities (Handy, 2002).
- Generally, the presence of a new beltway attracts development (Parsons Brinckerhoff Quade & Douglas, Inc., 2003).
- Beltways may contribute to some loss of jobs in the Central Business District, shift in jobs to suburbs, and a change in the location and timing of regional shopping malls, office parks, and industrial parks, but not the feasibility of these projects. Feasibility depends upon market conditions, land availability, and labor force locations (Parsons Brinkerhoff Quade & Douglas, Inc., 1997 (based upon America's Highways, 1776-1976, a FHWA study)).
- Land use planning is a key factor in controlling and coordinating growth (Parsons Brinckerhoff Quade & Douglas, Inc., 2003).

According to the studies, the beltways constructed in Charlotte, Atlanta, and Houston have had varying impacts on growth and economic development. A commonality for these regions is that growth was occurring well in advance of a beltway and was anticipated to continue regardless of whether or not a beltway was constructed. A key lesson learned from these beltways is the importance of conducting regional land use planning prior to their construction to achieve a more coordinated and efficient process.

Construction of the C-470 segment of the beltway has encouraged economic development along the roadway. Following beltway completion in 1990, Jefferson County developed the *C-470 Corridor Plan* to discourage piecemeal development and encourage economic development in key areas along C-470 (Jefferson County, 2002). As part of this plan Jefferson County has proposed open space preservation, a new zoning district, and rezoning of agricultural land to commercial land in accordance with land use recommendation maps and rezoning requests.

According to Census 2000, Douglas County experienced a 191 percent population increase between 1990 and 2000, making it the nation's fastest growing county for the decade (based on percentage change). During the same period, Highlands Ranch grew from 10,181 persons to 70,931 persons, an increase of 597 percent. It is likely that the presence of C-470 facilitated this growth, making it more convenient for people to live in Highlands Ranch and work in Denver and also for people living in southwest Denver to commute to the Denver Tech Center. As a result, traffic congestion on C-470 is now a major concern for residents. More than 46,000 cars drive the four-lane roadway each day. During morning peak hours, the north/westbound traffic slows between Bowles Avenue and Morrison Road. In the evening, the south/eastbound traffic becomes bottlenecked at Morrison Road as three lanes funnel down into two lanes. As development continues to occur, expansion of the roadway and the provision of transit services will be necessary.

Land use in eastern Aurora changed very little between 1920 and 1980. However, between 1980 and 2000, rapid urbanization occurred in the vicinity of the eastern segment of the beltway, which is consistent with the completion of the first three segments of E-470 in 1991, 1999, and 2003, respectively. Land use changes have mostly consisted of a conversion of agricultural land to residential and commercial uses. The area along E-470 is projected to continue to experience major growth. This growth has been planned by the City of Aurora, Adams and Arapahoe counties, and was discussed in the 1988 E-470 Environmental Overview.

Construction of the Northwest Parkway segment of the beltway was expected to accelerate the rate of development of vacant land situated near access points. However, development at these locations was found to be consistent with local planning efforts. Further development along the parkway (other than what is planned) was not anticipated due to acquired open space along the Northwest Parkway and local zoning.

The induced growth expert panel convened for this project indicated that growth would occur whether or not a build alternative is selected. The difference between the No Action Alternative and build alternatives would be in the density, variety, and timing of development. Completion of the Metro Denver Area beltway would likely result in office, commercial, and some residential land uses around new interchange locations. This would contribute to further reductions in prime farmland, wetlands, floodplains, and wildlife habitat. In addition, once an alignment for the study area is selected, the price of land and the pressure to develop land could increase. Development pressure could extend to communities such as Morrison and western Jefferson County. Coordinated land use planning and regulations would be necessary to control the rate, location, and character of growth in these areas.

4.24.3 Suggested Mitigation

To avoid additional impacts to the identified resources of concern, local authorities and planning entities must continue to review and scrutinize development proposals to ensure that new development is consistent with local area planning goals. In addition, local authorities and planning entities should require appropriate avoidance or mitigation as part of any new development project. For transportation projects, CDOT should ensure that best management practices (BMPs) and mitigation measures are followed appropriately (see **Section 4.27**).

4.24.3.1 Land Use

Mitigation of cumulative effects for land use goes beyond the authority of FHWA and CDOT to include those with authority for local land use planning decisions (see **Section 4.1**). It is not the policy of FHWA and CDOT to engage in land use planning, however they should work with local jurisdictions to include smart growth principles in planning. One way local planning jurisdictions could reduce environmental impacts is through the implementation of smart growth initiatives. These initiatives could provide economic, social, and environmental benefits to a community. Most of the jurisdictions within the study area have incorporated smart growth policies in their comprehensive planning documents. However, they could also be incorporated into the zoning and development review processes.

Smart growth development includes compact and mixed-use land types. Compact development and mixed-use development take up less land than conventional development creating more open space and fewer impacts to wildlife and aquatic habitat. Compact zoning also reduces the amount of impervious surface reducing water quality impacts. Infrastructure requirements are greatly reduced in more densely developed areas resulting in lower building costs for developers, cities, and ultimately the consumer. In mixed-use developments, housing, offices, restaurants, entertainment, and shopping are located close together, which could reduce the number of vehicle trips and encourage walking and bicycling.

As the northwest quadrant of the metro region continues to face growth pressures, more complex and long-term strategies focusing on the root of the congestion problem could be incorporated into land use and transportation planning. Specifically, strategies could be implemented by local planning jurisdictions that encourage people to live near transit stops or near places of employment. Future land use plans could be integrated into future transportation plans. Land use characteristics directly influence the level of demand placed on transportation networks. Residential and employment density, jobs-housing balance, land use mix, site design, and the location of service/retail destinations all influence the type and length of trips made each day. Many opportunities exist and are being pursued for transit-oriented development along the two FasTracks corridors to be built in the study area.

At the local agency level, environmentally sensitive development strategies also could be incorporated into future land use and transportation plans. These efforts could contribute to the quality of life in a community. Growing communities such as those within the study area, have an opportunity to implement planning guidelines that encourage smart growth practices. Local jurisdictions in the study area have already identified environmentally sensitive development, preservation of natural resources, preservation of viewsheds, and maintenance of community character as important goals in guiding future development.

As urban development encroaches on the natural environment, there is a growing concern about the impacts it would have on ecologically sensitive areas, wildlife habitat, agriculture, open space and historic/cultural resources. Incorporating this concern for these sensitive lands in the community planning process could help in protecting these areas while preserving air, water, and visual resources.

Rapid growth and development also impact a community's infrastructure from roads to schools. Smart growth policies could help alleviate some of the burdens placed on these community facilities by rapid growth by building walkable communities, purchasing and conserving open space, restricting development on sensitive lands, encouraging pedestrian-friendly development, centering housing near commercial/retail centers and transit facilities, and providing other means of transportation. All of these strategies could create a greater sense of community while preserving the natural environment.

4.24.3.2 Water Resources and Water Quality

Impacts could be greatly diminished or avoided by following local erosion control criteria and CDOT's *Erosion and Sediment Control Manual*. The proper use and implementation of BMPs would help alleviate the amount of contaminated runoff into study area water resources, thus protecting aquatic species and water quality. Typical BMPs that could be used in the study area are listed in this document (see **Section 4.8** and the **Northwest Corridor Supporting Technical Document-Water Resources**).

In addition to mitigation suggested by CDOT, it would also be essential for the area jurisdictions and local interest groups to utilize and enforce their water protection policies and regulations to control erosion and stormwater runoff from new development.

4.24.3.3 WETLANDS

Wetlands mitigation for a build alternative would be subject to Executive Order 11990, Protection of Wetlands (1977), and Clean Water Act Section 404 permitting standards. Wetlands impacts caused by the project should be mitigated at a 1:1 ratio. All impacts to jurisdictional and non-jurisdictional wetlands associated with the build alternatives should be mitigated by CDOT. This study contains more information on suggested mitigation for impacts to area wetlands (see **Section 4.9** and the **Northwest Corridor Supporting Technical Document-Initial Wetlands Delineation**).

USACE regulates impacts to jurisdictional wetlands and generally requires mitigation at a minimum ratio of 1:1. It is up to local jurisdictions, landowners, and developers to mitigate for wetland impacts associated with their respective projects and future developments. Local jurisdictions also could implement policies that protect wetlands and riparian areas through easements, open space set asides, controlling the location of future development, and creating more compact development and less sprawling development.

4.24.3.4 WILDLIFE

Mitigation measures to reduce or avoid impacts to wildlife and vegetation have been incorporated into the proposed alternatives. Recommended measures include avoiding sensitive habitat, building wildlife crossing structures to prevent fragmentation of habitat and animal/vehicle collisions, using mesh fencing to protect smaller animals from crossing the highway, and conducting construction activities at selective times outside of breeding seasons (see **Section 4.11**). To reduce visual impacts on wildlife from the build alternatives, final design should include lighting plans that minimize glare and illumination beyond right-of-way. Local jurisdictions could obtain wildlife easements or open space to protect habitat as well as locating development away from wildlife areas. Further suggested mitigation efforts are described in **Section 4.11.3**.

4.24.3.5 AIR QUALITY

Given that air pollutants are not predicted to exceed the NAAQS or any other relevant air quality standards in the future, mitigation measures for air quality are not necessary. Future emissions from on-road mobile sources will be minimized through several federal regulations, such as emission standards, and regional controls such as street sanding regulations. The Denver area maintenance plans that are already in place for CO, O_3, and PM_{10} will serve to avoid and minimize pollutant emissions from vehicles. Standard emission minimization measures for construction activities are discussed in this document (see **Section 4.6** and the **Northwest Corridor Supporting Technical Document-Air Quality Assessment**).

4.24.3.6 NOISE

As part of the noise analysis, noise barriers were evaluated for traffic noise mitigation per CDOT guidelines. CDOT's goal for noise barriers is a reduction of 10 decibels with a minimum reduction of 5 decibels. The noise barrier evaluation takes into account topography, physical placement, safety, and access issues. For the build alternatives, 18 locations for noise barriers were analyzed with several being recommended. This study contains more detailed information on noise impacts and suggested mitigation for the build alternatives (see **Section 4.7** and the **Northwest Corridor Supporting Technical Document-Noise Impact Assessment**).

Some noise-generation issues are national issues that local government cannot readily influence (e.g. noise regulation applicable to interstate commerce via aircraft, train and interstate trucking). Noise control measure available to local government largely fall in the category of land use planning and noise ordinances. Land use planning can include minimizing future development near freight rail corridors, airports and freeways or separating residences from noise-producing industry.

4.24.3.7 TRAFFIC AND TRANSPORTATION EQUITY

The tolled portions of the Tollway Alternative and Combined Alternative (Recommended Alternative) may be considered to have potentially disproportionate effects on minority or low-income populations in terms of effects of tolling on transportation equity. However, because travel options would continue to exist, including the existing general purpose (i.e., "free") lanes, and because options for alternative purchasing of tolling transponders would exist, there do not appear to be any noteworthy equity issues.

Future studies and observations regarding tolling equity issues, including the Colorado Tolling Enterprise amendment to the 2030 Regional Transportation plan, will be reviewed as available to ensure the latest state of the practice may be incorporated or cited in future documentation. If either the Tollway Alternative or Combined Alternative (Recommended Alternative) is chosen and constructed, ways to make tolling more fair and equitable would be sought. For example, issues related to credit cards and account debits would be considered in order to permit the broadest opportunity as possible to use toll facilities. This might entail providing alternative payment options for transponder purchases and toll replenishment using cash or employer-based payroll deductions. All segments of the population would continue to be properly involved throughout the process of identifying projects and considering the impacts on their communities.

4.24.4 SUMMARY

The environmental impacts discussed above, when added to past, present, and reasonably foreseeable future projects, result in cumulative impacts to the surrounding area. The majority of the cumulative impacts to the resources identified are more a result of the growth and development already expected to occur in the area whether or not any transportation improvements are made. Since this project may contribute to the timing, variety, and density of development, it contributes to cumulative impacts. Overall the build alternatives contribute slightly more than the 2030 No Action Alternative to cumulative impacts to resources of concern in the study area.

By directing growth to communities where people already live and work, the number of new paved and other impervious surfaces that cover the landscape can be limited, making existing communities more attractive, and discouraging new infrastructure that alters natural hydrologic functions and increases taxpayer's burdens. Smart growth strategies generally entail integrating planning and incentives with infrastructure investments to revitalize existing communities, prevent sprawl, provide more transportation choices, and protect open space.

Of particular interest relating to new development in the northern and western portions of the study area as it pertains to availability of water, is a study, Paving Our Way to Water Shortages: How Sprawl Aggravates Drought (American Rivers, the Natural Resources Defense Council, and Smart Growth America, 2002). The study investigated what happens to water supplies when our natural areas are replaced with roads, parking lots, and buildings. The use of smart growth techniques can reduce the impacts associated with development and the increase in amounts of impervious surface area. These approaches protect farms and forests on the metropolitan fringe by encouraging investment in the urban core and older suburbs. The study found that when communities focused their efforts on preserving forests, wetlands, and other valuable lands, their vital role in recharging groundwater was not compromised.

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