

# CHAPTER 3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

## 3.1 INTRODUCTION AND OVERVIEW

This chapter provides a description of the existing social, physical, and biological environment of the C-470 Corridor and discloses the environmental effects that may occur by implementing the No-Action, Eight-Lane General Purpose Lanes with Auxiliary Lanes, or tolled Express Lanes Alternatives. For simplicity, these alternatives in this chapter are described as the No-Action Alternative, the GPL Alternative, and the EL Alternative, respectively. As discussed in **Chapter 2**, the EL Alternative was identified as the Preferred Alternative. However, both action alternatives as well as the No-Action Alternative are evaluated in this chapter to disclose the differences between the two with regard to environmental effects. Alternatives are compared to each other based on mitigated packages. Therefore mitigation commitments are part of each alternative. This chapter is organized by resource, such that the affected environment, environmental consequences, and mitigation measures are discussed sequentially under each resource heading. Resource topics are broken down into the social, physical, and biological environments. Following the resource discussions, effects and mitigation measures are summarized in **Tables 3-45** and **3-46**. A cumulative effects discussion follows the summary tables in **Section 3.6**.

The project area evaluated for direct and indirect effects includes 13 miles of C-470 from Kipling Parkway to the I-25 interchange. Direct effects for all environmental resources are summarized in **Table 3-45**. The cumulative effects assessment included broader spatial and temporal boundaries, as discussed in **Section 3.6.1**. Data used for the effects analysis were collected from a variety of sources including Arapahoe, Douglas, and Jefferson Counties and federal, state, and local resource agencies. From August 2003 to September 2004, field delineation was completed for social, physical, and biological environment components using global positioning systems.

## 3.2 SOCIAL ENVIRONMENT

The social environment of the C-470 project area consists of the people and businesses that exist within one mile of the highway. Transportation improvements can affect the social environment both positively and negatively by altering economic development plans and patterns, changing land use, changing growth patterns, relocating homes or businesses, or dividing communities. Effects to the social environment were evaluated for demographics; environmental justice; housing and community facilities; economics; land use; parks and recreation; and right-of-way (ROW).

### 3.2.1 Demographics

For the purpose of this demographic analysis, U.S. Census Bureau census block group data from the 2000 Decennial Census were used to describe the social characteristics of the population living within the project area. The project area population consists of individuals living within approximately one mile of C-470. This area is composed of 65 census block groups. Population density, historical and projected population, and age composition data are compared for the project area population, and for Arapahoe, Douglas, and Jefferson Counties. Minority and income population characteristics are described in **Section 3.2.2**.

#### 3.2.1.1 General Population Characteristics

The 2000 population within the project area was 103,467; the combined total of Arapahoe, Douglas, and Jefferson Counties was 1,190,789. The project area contains 37,337 households. The July 2003 estimated population for the three Counties is Arapahoe County (516,060), Douglas County (223,471), and Jefferson County (528,563). Among the incorporated cities within the project area, the estimated July 2003 population is Centennial (98,586), Littleton (40,599), and Lone Tree (7,600). The average population density within the project area (65 block groups) is approximately 2,600 persons per

square mile. As shown in **Figure 3-1**, population density varies through the project area. Generally, the density is relatively low, which is consistent with the suburban nature of the Corridor.

**Table 3-1** shows the population and its change from 1990 to 2000 for the project area and for Arapahoe, Douglas, and Jefferson Counties. All three counties had robust population growth between 1990 and 2000. Douglas County had the distinction of being the fastest growing county in the United States during the 1990s, with a 191.0 percent population growth rate. Arapahoe and Jefferson Counties had population growth rates that were considerably lower for the decade, at 24.6 percent and 20.2 percent, respectively. In terms of the numeric change in population, however, these two counties added almost as many people during the decade as did Douglas County. Almost

26,000 people were added to the project area during the 1990s, representing 33 percent growth. These growth rates were higher than those of Arapahoe and Douglas Counties, but considerably lower than that of Douglas County.

**Table 3-2** shows the projected population from 2000 to 2030 for the three counties, all of which are expected to grow more slowly than during the 1990s. The average annual percent change in population from 1990 to 2000 was 2.2 percent for Arapahoe County, 11.3 percent for Douglas County, and 1.9 percent for Jefferson County. Generally, the population growth rates are expected to increase, but at decreasing rates for each subsequent decade. Arapahoe and Jefferson Counties have similar projected population growth from 2000 to 2030, at 36.5 percent and 34.7 percent, respectively. These two counties are also expected to add approximately 180,000 people each during the 30-year period. Douglas County is expected to grow at 150.1 percent from 2000 to 2030, which is a substantially higher rate than the other two counties. Douglas County is expected to add almost 264,000 people during the 30-year period.

**Table 3-1  
Population Change 1990 to 2000**

Location	Population		% Change
	1990	2000	
Project Area	77,772	103,467	33.0
Arapahoe County	391,511	487,967	24.6
Douglas County	60,391	175,766	191.0
Jefferson County	438,430	527,056	20.2

Source: 2000 U.S. Census

**Table 3-2  
Projected Population Growth**

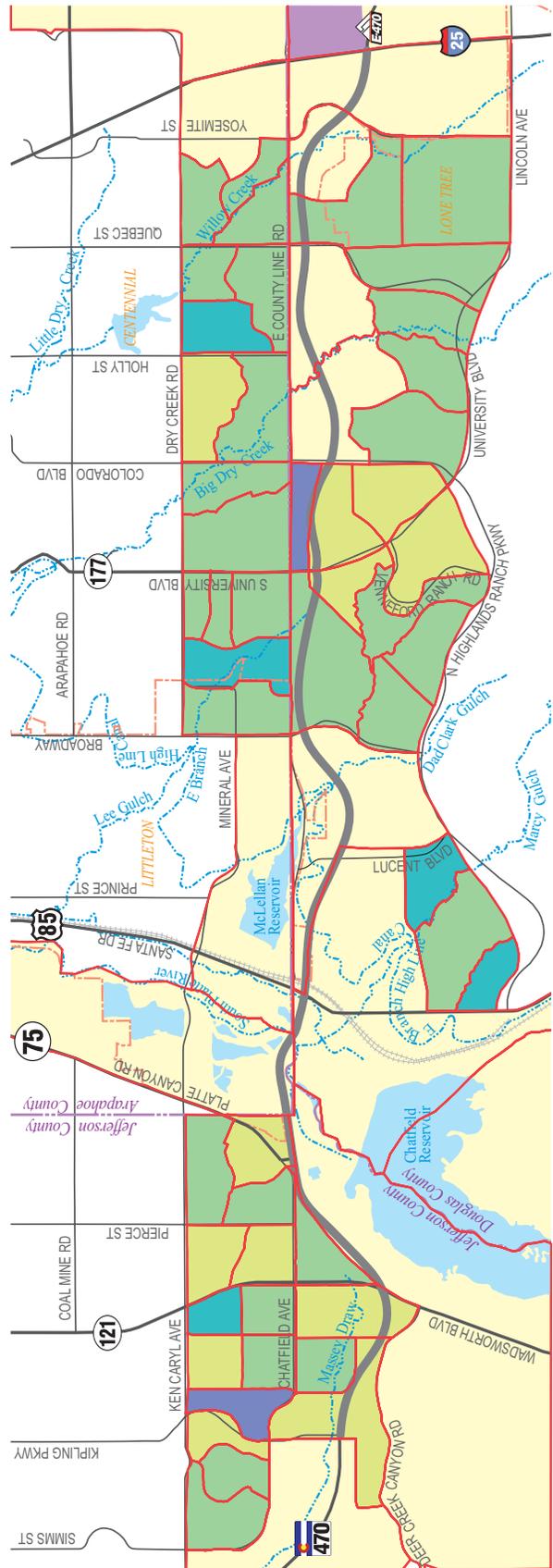
County	Population				% Change in Population			
	2000	2010	2020	2030	2000 to 2010	2010 to 2020	2020 to 2030	2000 to 2030
Arapahoe	487,967	560,698	621,884	666,262	14.9	10.9	7.1	36.5
Douglas	175,766	274,921	364,876	439,585	56.4	32.7	20.5	150.1
Jefferson	527,056	576,784	647,332	709,958	9.4	12.2	9.7	34.7

Sources: 2000 U.S. Census

Projected numbers by the Colorado Department of Local Affairs, 2004

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**Figure 3-1  
Population Density**



**Legend**

— Census Block Groups (2000 Census) boundary

— County Limits

— C-470 Corridor Study Limits

**Population Per Square Mile**

- 0
- <2,000
- 2,000 - 3,999
- 4,000 - 5,999
- 6,000 - 7,999
- > 8,000

Source: 2000 U.S. Census

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and Douglas County (33.7 years) but slightly less than that of Jefferson County (36.8 years). Over 50 percent of the population within the study area is between 30 and 64 years old. Another nearly 25 percent are children between 5 and 17 years, leaving some gap in the population distribution between 18 and 29 years and over 65 years. This provides some indication that residents of the corridor consist of working age families and their children.

**Neighborhoods**

The majority of the neighborhoods that have evolved around C-470 were either under construction or built following the initial construction of the highway. Neighborhoods, as they are traditionally known, evolved from subdivision enclaves. Therefore, the existing neighborhoods are identified by the names of their respective subdivisions. Generally, single-family residential development is offset from the highway 300 to 500 feet, with the exception of those subdivisions developed prior to C-470, and a group of apartment complexes between University and Colorado Boulevards. Due to the suburban nature of the existing neighborhoods and development timeframe, all neighborhoods

are self-contained. Access from each neighborhood to nearby commercial development and community facilities is provided via collector streets and major arterials crossing C-470 at one to three mile increments. The neighborhoods adjacent to the highway are identified from west to east, on either side of C-470.

The Chatfield Bluffs neighborhood lies south of C-470, immediately east of Kipling Parkway. Continuing east of Chatfield State Park, Highlands Ranch comprises the majority of the suburban development south of the highway, between Santa Fe Drive and Quebec Street. The majority of this portion of Highlands Ranch adjacent to C-470 is comprised of single-family homes, with the exception of the Shadow Ranch condominiums, currently under construction, and the Palomino Park apartments between Colorado Boulevard and Quebec Street. East of Quebec Street follows the Acres Green neighborhood and the Park Meadows commercial development. All these neighborhoods were built after C-470.

North of C-470, commercial development is located along Kipling Parkway, followed by the

**Table 3-3  
Year 2000 Age Composition by County and Project Area**

Age	Project Area		Arapahoe County		Douglas County		Jefferson County	
	Population	% of Total	Population	% of Total	Population	% of Total	Population	% of Total
Under 5	7,839	7.6	33,720	6.9	16,950	9.6	1,723	7.2
5 to 17	22,956	22.2	96,634	19.8	38,527	21.9	5,182	21.6
18 to 21	3,519	3.4	22,742	4.7	4,981	2.8	934	3.9
22 to 29	8,043	7.8	56,738	11.6	15,035	8.6	2,142	8.9
30 to 39	18,020	17.4	79,928	16.4	36,866	21.0	4,317	18.0
40 to 49	20,676	20.0	84,284	17.3	32,693	18.6	4,629	19.3
50 to 64	16,521	16.0	71,992	14.8	23,392	13.3	3,721	15.5
65 and Up	5,893	5.7	41,929	8.6	7,322	4.2	1,332	5.6
Total	103,467	100.0	487,967	100.0	175,766	100.0	23,980	100.0

Source: 2000 U.S. Census



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Deer Creek Condominiums and the Wingate neighborhood. Meadowbrook Heights, Herrick-Dale Acres, and Columbine Hills neighborhoods were developed prior to C-470 and are the oldest residential neighborhoods along the Corridor. Continuing east of the Kiewit gravel pits and South Platte Park, the Wolhurst Community lies in the southwest quadrant of the Santa Fe Drive interchange. Land previously part of the Bowen Farm lies east of Santa Fe Drive. This land was recently acquired by a developer and will be constructed as a mixed-use development north and south of C-470. The Bluffs Apartments are located immediately west of Broadway, surrounded by open space adjacent to the High Line Canal trail. Between Broadway and University Boulevard, commercial development exists between County Line Road and C-470. Several apartment and condominium complexes – Autumn Chase, Traditions, and Copper Canyon apartments, followed by Canyon Ranch Condominiums – are located from west to east along C-470 between University and Colorado Boulevards, with access from County Line Road. All remaining development immediately adjacent to C-470 is commercial in nature.

### 3.2.1.2 Environmental Consequences No-Action Alternative

The No-Action Alternative would require no new ROW, and would require no business or residential relocations. However, increased traffic congestion on C-470 may shift forecasted population growth to other portions of the three county area, outside the immediate project area. Demand for community facilities, services, and housing would increase in response to the projected population growth. The locations of these resources would generally follow development and land use plans identified by the counties and cities. This alternative would not bisect any existing neighborhoods or create a barrier effect between residential and commercial community areas. For additional discussion about effects to land use patterns, see **Section 3.2.5.**

### General Purpose Lanes Alternative

The GPL Alternative would require partial acquisition of several parcels to accommodate ROW needs, but it would require no business or residential relocations. The GPL Alternative may provide opportunities for projected development to occur more quickly in the project area, in response to capacity improvements on C-470 and a corresponding congestion decrease. While populations in these counties are projected to grow regardless of the study alternatives, transportation improvements may affect the timing of this growth. With the GPL Alternative, demand for community facilities, services, and housing would increase at a rate that is consistent with projected population growth. The locations of these resources would generally follow development and land use plans identified by the counties and cities.

This alternative would not bisect any existing neighborhoods or create a barrier effect between residential and commercial community areas. By adding three grade separated trail crossings at Santa Fe Drive, Colorado Boulevard, and Quebec Street, the GPL Alternative improves east to west pedestrian travel where the C-470 trail crosses major arterial roadways.

### Express Lanes Alternative (Preferred Alternative)

The EL Alternative would require partial acquisition of several parcels to accommodate ROW needs, but it would require no business or residential relocations. This alternative would neither divide nor isolate any particular neighborhood nor separate residents from community facilities.

Like the GPL Alternative, the EL Alternative may also provide opportunities for development to occur more quickly in the project area. While populations in these counties are expected to grow, transportation improvements may affect the timing of this growth. With the EL Alternative, demand for community facilities, services, and housing would increase at a rate that is constant with projected population

1 growth. The locations of these resources would  
2 generally follow development and land use  
3 plans identified by the counties and cities.  
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5 This alternative would not bisect any existing  
6 neighborhoods or create a barrier effect between  
7 residential and commercial community areas. By  
8 adding three grade separated trail crossings at  
9 Santa Fe Drive, Colorado Boulevard, and Quebec  
10 Street, the GPL Alternative improves east to west  
11 pedestrian travel where the C-470 trail crosses  
12 major arterial roadways.  
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### 14 3.2.1.3 Mitigation

15 No mitigation measures are anticipated for  
16 changes to the demographic composition of the  
17 project area. Because land use is guided by local  
18 government zoning, these agencies should  
19 consider the community's transportation and  
20 infrastructure needs and the impacts of the land  
21 use on the existing transportation infrastructure  
22 when considering changing land use zoning  
23 patterns. Local governments should examine the  
24 results of the transportation study to see what  
25 land use decisions may be consistent with the  
26 alternatives.  
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### 28 3.2.2 Environmental Justice

29 In February 1994, President Clinton issued  
30 Executive Order (EO) 12898, *Federal Actions to*  
31 *Address Environmental Justice in Minority and Low-*  
32 *Income Populations*. The EO states, "To the greatest  
33 extent practicable and permitted by law, ... each  
34 Federal agency shall make achieving environ-  
35 mental justice part of its mission by identifying  
36 and addressing, as appropriate, disproportion-  
37 ately high and adverse human health or environ-  
38 mental effects of its programs, policies, and activ-  
39 ities on minority populations and low-income  
40 populations." The EO also requires that, "Each  
41 Federal agency shall work to ensure that public  
42 documents, notices, and hearings relating to  
43 human health or the environment are concise,  
44 understandable, and readily accessible to the  
45 public."  
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47 In April 1997, the U.S. Department of  
48 Transportation (DOT) issued DOT Order 5610.2  
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51 on Environmental Justice to develop and  
52 implement procedures to ensure compliance  
53 with the EO. In December 1998, the Federal  
54 Highway Administration (FHWA) subsequently  
55 established guidelines (Order 6640.23 Actions to  
56 Address Environmental Justice in Minority and  
57 Low-Income Populations) to implement DOT  
58 Order 5610.2 and EO 12898.  
59

### 60 3.2.2.1 Affected Environment

61 To determine the presence of minority or low-  
62 income populations along the C-470 Corridor,  
63 2000 Census data was analyzed. Percentages of  
64 minority and low-income residents in each  
65 Census block group were compared to the  
66 county-wide averages for Jefferson, Arapahoe,  
67 and Douglas Counties. Percentages greater than  
68 county averages were analyzed using  
69 Geographic Information System (GIS). GIS  
70 mapping was then used to present the  
71 demographic data within the project area block  
72 groups. As discussed in the following sections,  
73 the effects of each alternative were compared to  
74 the identified block groups of low-income and  
75 minority populations. Environmental effects  
76 analyzed include ROW acquisition, traffic, air  
77 quality, noise, and aesthetics. Lastly, avoidance  
78 and minimization measures and mitigation  
79 measures are presented for each alternative. A  
80 detailed analysis of the project area's minority  
81 and low-income populations is in the  
82 *Environmental Justice Technical Report* (March  
83 2004). This report also documents steps taken to  
84 avoid adverse effects to identified populations  
85 subject to EO 12898 and the public process  
86 undertaken to provide opportunity for  
87 meaningful involvement from these commu-  
88 nities.  
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### 90 Minority Populations

91 The U.S. DOT Order 5610.2 defines "minority" as  
92 "A person who is (1) Black (a person having  
93 origins in any of the black racial groups of Africa);  
94 (2) Hispanic (a person of Mexican, Puerto Rican,  
95 Cuban, Central or South American, or other  
96 Spanish culture or origin, regardless of race); (3)  
97 Asian American (a person having origins in any  
98 of the original peoples of the Far East, Southeast  
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Asia, the Indian subcontinent, or the Pacific Islands); or (4) American Indian and Alaskan Native (a person having origins in any of the original people of North America and who maintains cultural identification through tribal affiliation or community recognition).” And, “Minority Population means any readily identifiable groups of minority persons who live in geographic proximity, and if circumstances warrant, geographically dispersed/transient person (such as migrant workers or Native Americans) who will be similarly affected by a proposed DOT program, policy or activity.”

It is important to note that the Census Bureau definition of race (including White, Black/ African American, American Indian and Alaska Native, Asian, Native Hawaiian and other Pacific Islander, or other race) is separate and distinct from Hispanic or Latino, which is considered an ethnicity. Because the Hispanic or Latino category is considered a minority category under EO 12898, the race and ethnicity data are combined in this evaluation of minority populations.

Percentages of minority households in each of the census block groups in the project area were compared to the averages for Arapahoe, Douglas, and Jefferson Counties. **Table 3-4** shows year 2000 race and ethnicity data for the project area and the three counties. Generally, the project area and the

three counties have low percentages of minority population. Minorities compose only 10.4 percent of the project area population. Arapahoe, Douglas, and Jefferson Counties contain 26.1, 10.3, and 15.1 percent minority populations, respectively. As shown in **Figure 3-2**, 14 block groups in Douglas County have a percentage of minority households greater than the minority percentage of total population for the entire county. No block groups in the project area in Arapahoe or Jefferson Counties have a percentage of minority households greater than the minority percentage of the counties’ total population.

**Low-Income Populations**

The U.S. DOT Order 5610.2 defines low-income as “a household income at or below the Department of Health and Human Services poverty guidelines.” A “Low-Income Population means any readily identifiable group of low-income persons who live in geographic proximity, and, if circumstances warrant, geographically dispersed/transient person (such as migrant workers or Native Americans) who would be similarly affected by a proposed the FHWA program, policy, or activity.” The HHS national poverty level for 2000 was \$17,050. Because this income level is too low to accurately reflect low-income in many Colorado communities, the Colorado Department of Transportation (CDOT) developed and adopted

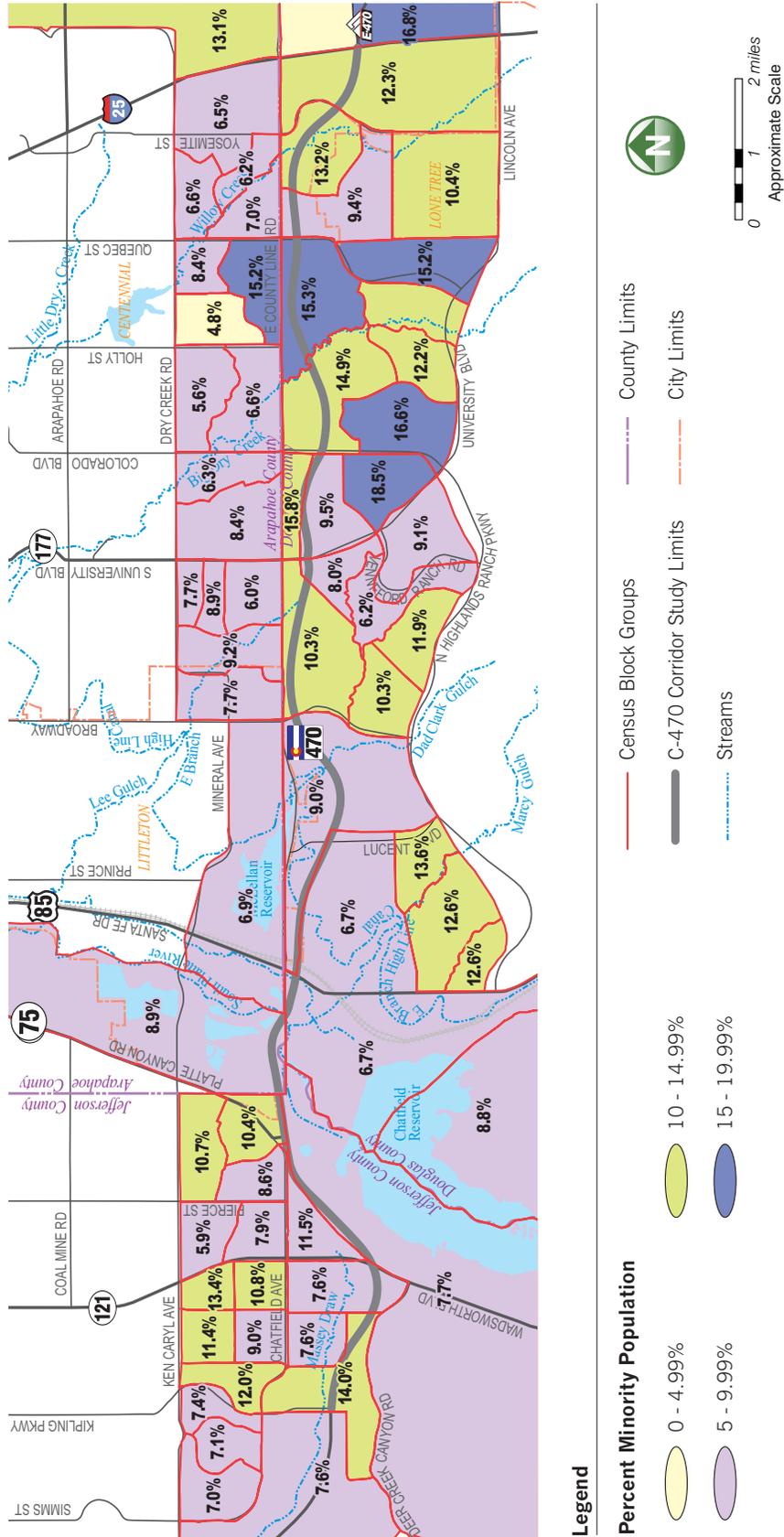
**Table 3-4**  
**Year 2000 Project Area and Three-County Race and Ethnicity**

	Project Area Population		Arapahoe County Population		Douglas County Population		Jefferson County Population	
	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total
Caucasian	92,736	89.6	360,744	73.9	157,686	89.7	447,416	84.9
African-American	944	0.9	36,254	7.4	1,596	0.9	4,312	0.8
Other Race	4,690	4.5	33,357	6.8	7,598	4.3	22,879	4.3
Hispanic or Latino	5,097	4.9	57,612	11.8	8,886	5.1	52,449	10.0
Minority	10,731	10.4	127,223	26.1	18,080	10.3	79,640	15.1
Total Population	103,467	100.0	487,967	100.0	175,766	100.0	527,056	100.0

Source: 2000 U.S. Census



**Figure 3-2**  
**Minority Populations by Block Group**



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