INDIRECT INDUCED GROWTH EFFECTS ANALYSIS

Prepared for:

The E-470 Public Highway Authority, City of Aurora, Colorado Department of Transportation, and Federal Highway Administration

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1.0 INTRODUCTION

This technical report describes the "Delphi-Plus" methodology that was utilized for assessing indirect induced growth effects in the *Environmental Assessment* (EA) of the construction of an improved/new interchange system at I-70/E-470. Once completed, the I-70/E-470 project will link I-70 with the E-470 tollway system in the metropolitan Denver-Aurora, Colorado area.

The study area for the analysis of indirect induced growth effects was chosen to represent the area that would most likely be influenced by the construction of an improved/new interchange at I-70/E-470, including possible new interchanges on either side of the existing interchange. Study area boundaries include Tower Road on the west, Monahan Road on the east, 6th Parkway on the south, and 26th Avenue/32nd Avenue on the north. The study area for the indirect effects analysis is shown in Figure-1**.**

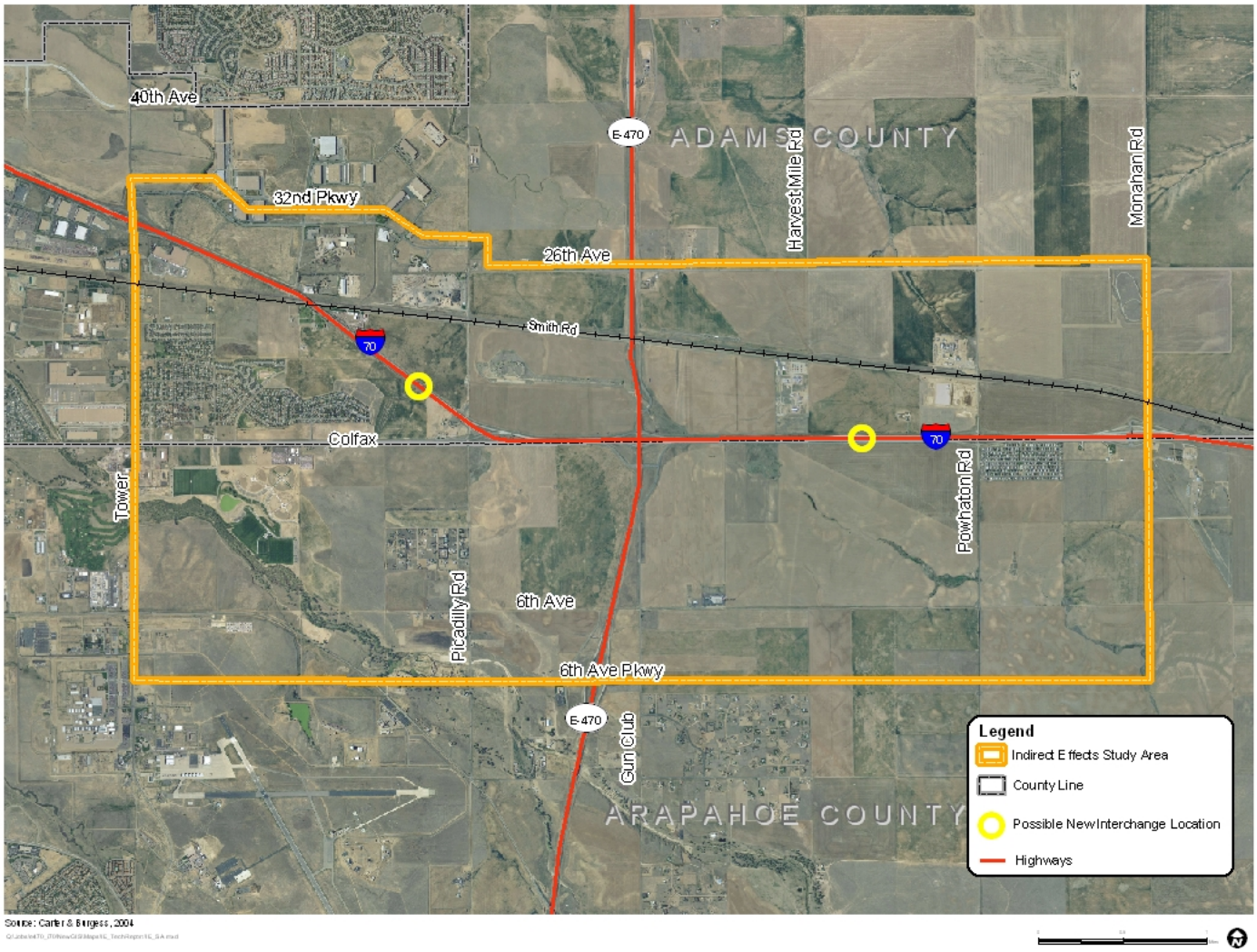
The current planning and environmental assessment is based on input from local, state and federal agency coordination including the City of Aurora, Adams County, Arapahoe County, as well as the Colorado Department of Transportation (CDOT) Region One, the Denver Regional Council of Governments (DRCOG), and the Federal Highway Administration (FHWA).

In the early stages of planning, cooperating agencies determined that potential indirect growth-related impacts from the interchange alternatives warranted detailed assessment. In response, the Delphi-Plus methodology was developed and employed. Among other things, this involved convening a panel of local land, socio-economic, and economic experts to discuss the possible induced growth impacts associated with the range of alternatives being considered in the EA.

The purpose of this report is to document this work effort, including results and mitigation recommendations. This document provides the following information:

- Description of the proposed action
- Definition of indirect effects
- Overview of the "Delphi-Plus" methodology employed for the analysis
- Summary of results
- Recommended mitigation measures and next steps

FIGURE 1
INDIRECT EFFECTS STUDY AREA



2.0 PROPOSED ACTION

The proposed action is the construction of a new/improved interchange at I-70/E-470, including possible new interchanges on either side of the existing I-70/E-470 interchange. The Preferred Alternative (constructing new interchanges at both Picadilly and Harvest Mile Roads) is shown in Figure 2. Three additional alternatives (including the No-Action, constructing an interchange at Picadilly Road, and constructing an interchange at Harvest Mile Road) also received consideration in the *Environmental Assessment* (EA) for this project. The No-Action and Preferred Alternative are described below.

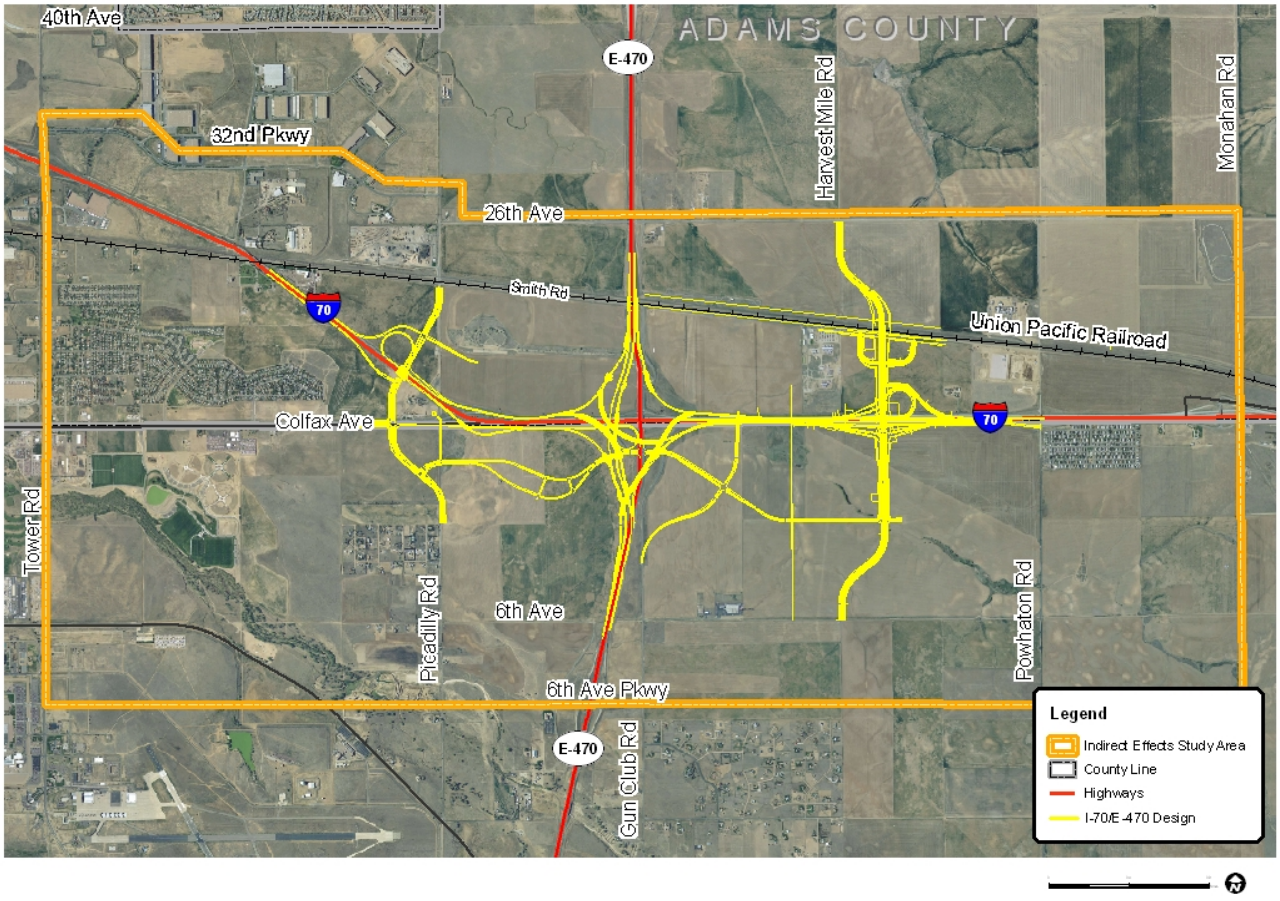
2.1 NO-ACTION

The No-Action alternative would result in no new construction or improvements to I-70 at E-470 other than what is already committed by the E-470 Public Highway Authority. This includes building an overpass that will carry E-470 over I-70. Local access will still be available at Gun Club Road and I-70. Construction of this project (commonly referred to as the "fly-by") began in early 2005 and is scheduled for completion in 2007.

2.2 I-70/E-470 INTERCHANGE RECONSTRUCTION: CLOSE GUN CLUB AND CONSTRUCT NEW INTERCHANGES AT BOTH PICADILLY AND HARVEST MILE ROADS (PREFERRED ALTERNATIVE)

The Preferred Alternative involves closing the Gun Club diamond interchange and constructing new interchanges at both Picadilly and Harvest Mile Roads. At the Picadilly Road and I-70 interchange, three alternative design concepts are being considered: including retaining Colfax connections to/from East and adding Picadilly ramps to/from West (half diamond), closing Colfax ramps and adding a full diamond at Picadilly, and closing Colfax ramps and adding a partial cloverleaf at Picadilly. At the Harvest Mile Road and I-70 Interchange, two alternative design concepts are being considered: a full diamond or partial cloverleaf at Harvest Mile.

FIGURE 2
I-70/E-470 INTERCHANGE RECONSTRUCTION: CLOSE GUN CLUB/CONSTRUCT NEW INTERCHANGES AT PICADILLY AND HARVEST MILE



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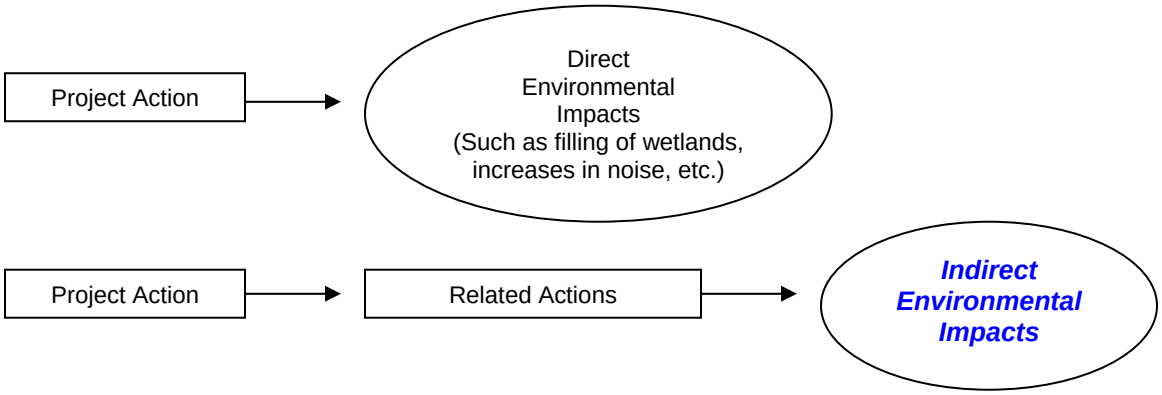
3.0 INDIRECT EFFECTS DEFINED

The Federal Highway Administration (FHWA) and other federal agencies' responsibility to address and consider indirect impacts in the National Environmental Policy Act (NEPA) process was established in the Council of Environmental Quality (CEQ) *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act* (40 CFR § 1500-1508).

As shown in Figure 3, direct impacts are those that are actually caused by project activities. Indirect impacts, on the other hand, are caused by another action or actions that have an established relationship or connection to the project. These induced actions are those that would not or could not occur except for the implementation of the project. These actions are often referred to as "but for" actions and generally occur at a later time or some distance removed from the original action.

FIGURE 3
DIRECT AND INDIRECT IMPACTS DIAGRAM



Indirect effects as defined in the Code of Federal Regulations are those effects that are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air, water and other natural systems, including ecosystems. (40 CFR § 1508.8)

Changes in land use patterns, growth or decline, in a give locale are attributable to many circumstances, events, and activities including federal, non-federal, and private actions. While transportation projects are not the only or primary factor in possible land use changes, the potential for certain transportation proposals to influence land use is undeniable.

A proposal for a new alignment project in an area where no transportation facility currently exists, or one that adds new access to an existing facility may indicate the potential for project related indirect impacts from other distinct but connected actions. The potential relationship of a transportation proposal to cause indirect impacts must be established on a case-by-case basis, early in the NEPA project development process.

4.0 DELPHI-PLUS METHODOLOGY

The Delphi Plus methodology relies on established models of transportation analysis and geographical research to predict how land use will change with a new transportation project. The technique applies the results of research on the land use impacts of transportation projects to local data, such as infrastructure plans, growth policies, and existing and future zoning and land uses. Once assembled, planners utilize this information to identify potential land use impacts. A team of land, socio-economic, and economic experts review the data and finalize the prediction of potential indirect effects. Related impacts to environmental resources are then assessed.

The Delphi Plus methodology is built upon the well established "Delphi" technique of using expert panels to provide expertise in areas such as land use changes. The added feature of the Delphi Plus methodology relates to the application of the input from the expert panel to a specific geographic area. It thus allows local planners to be alerted to possible land use changes that could occur in a certain geographic area.

The Delphi Plus methodology considers a significant amount of land surrounding a new project. Impacts on surrounding land for new highways can extend five miles on either side and at both ends; new interchanges can affect a radius of up to three miles.

The major work elements associated with the Delphi Plus indirect effects analysis for the I-70/E-470 environmental assessment included the following items:

- Review the results of research on the land use impacts of interchanges
- Identify land use influence area
- Data collection (land use, zoning, development, environmental resources)
- Characterize development in the project area (historic, existing, future)
- Analyze regional population and employment projections
- Identify market forces that influence land uses changes
- Convene expert panel
- Identify potential land use impacts
- Assess potential impacts to environmental resources
- Determine mitigation if warranted

4.1 LAND USE IMPACTS OF INTERCHANGES

In February of 2004, Carter & Burgess conducted informal research regarding the land use impacts of transportation projects. This research involved a review of case studies and literature that addressed the relationship between land use and transportation projects. The impacts of several types of transportation projects were considered in this research including: new highways, highway widening, transit stations, and interchanges.

Research revealed that though there is general agreement that there is a correlation between transportation and land use, there are major discrepancies about the nature of this correlation. Some of the factors, other than transportation, that are found to influence land use change and economic development include distance to a major city, distance to another interchange, accessibility to other regional markets, interchange

design, traffic volume, parcel location, timing and completion of construction, economy, public and policy maker attitudes, zoning, previous land use, land availability, and infrastructure. There is also general agreement that a new or improved transportation facility is unlikely to result in new growth in a regional area; it is more likely that growth may be shifted from one part of a regional area to a location closer to the new or improved transportation facility.

While it is generally agreed that transportation investments and economic activity are positively linked, the nature of the relationship remains uncertain. The timing of land use impacts seems largely dependent on general economic conditions. Where capital is available and there is demand for new development in a city, greater impacts are likely..

The impacts of highway interchanges are highly localized. The extent of these impacts can vary greatly and are dependent upon a number of additional factors (such as those listed above) making it difficult to predict.

The full research summary report titled *The Land Use Impacts of Transportation Projects* and bibliography is included in Appendix A.

4.2 LAND USE INFLUENCE AREA

The I-70/E-470 indirect effects study area was chosen to represent the area that would most likely be influenced by the construction of an improved/new interchange at I-70/E-470, including possible new interchanges on either side of this existing interchange. For this reason, major arterials surrounding the interchange at Gun Club/E-470 were included in the influence area. The study area is comprised of approximately 16 square miles that are bounded by Tower Road on the west, Monahan Road on the east, 6th Parkway on the south, and 26th Avenue/32nd Avenue on the north. The study area for indirect effects is shown in Figure 1.

The figure that most researches use when studying the impact an interchange may have on an area is one-half mile. The I-70/E-470 indirect effects analysis utilized a land use influence area of two miles at potential interchange locations. Any larger radius would have exceeded study area boundaries and resulted in overlapping areas of analysis.

4.3 DATA COLLECTION

The following reports and plans were referenced for the analysis of indirect effects:

- *E-470 Environmental Overview*, 1987
- *Metro Vision 2020 Plan*, DRCOG
- *Adams County Comprehensive Plan*, 2004
- *Arapahoe County Comprehensive Plan*, 2001
- *City of Aurora Comprehensive Plan*, 2003
- *City of Aurora Adopted Budget,* 2004
- *City of Aurora Capital Improvement Program*, 2004
- *City of Aurora Municipal Code – Zoning District Provisions for the E-470 Zone District*, 2001

Other data utilized in the analysis of indirect effects include a list of E-470 corridor development activities (provided by the E-470 Authority), aerial photographs (October 2003), historical and future land use maps (provided by DRCOG), 2030 population and employment projections (provided by DRCOG), wildlife mapping (Colorado Division of Wildlife - Natural Diversity Information Source), wetland data (interpreted from aerial photographs) and a list of reasonably foreseeable development and transportation actions as compiled by the City of Aurora. In addition, the City of Aurora Utility Department provided information about utilities development in the project area.

4.4 DEVELOPMENT IN THE PROJECT AREA

4.4.1 Historical Development of the E-470 Corridor

Prior to 1990, the majority of the land along the E-470 corridor was used for agricultural, ranching and low-density residential purposes. The consistent topography in the vicinity of the I-70/E-470 interchange accommodated predominantly agricultural and ranching activities. There were scattered residential buildings that were inhabited by farmers and ranchers who either owned their agricultural land or had sold or leased back portions to continue farming operations. The roadway network in the vicinity of the I-70/E-470 interchange was relatively undeveloped and consisted primarily of rural unpaved roads that served these low density and agricultural developments.

In 1987, land north of Colfax/I-70 was primarily used for agricultural purposes, with the exception of one farm residence and several farm related structures. Land south of Colfax/I-70 was also primarily used for agricultural purposes, with the exception of a mobile home park. The first segment of the E-470 Tollway opened in 1991 and by 2000, more substantial residential and industrial development had begun to occur in the area.

4.4.2 Existing Development in the Study Area

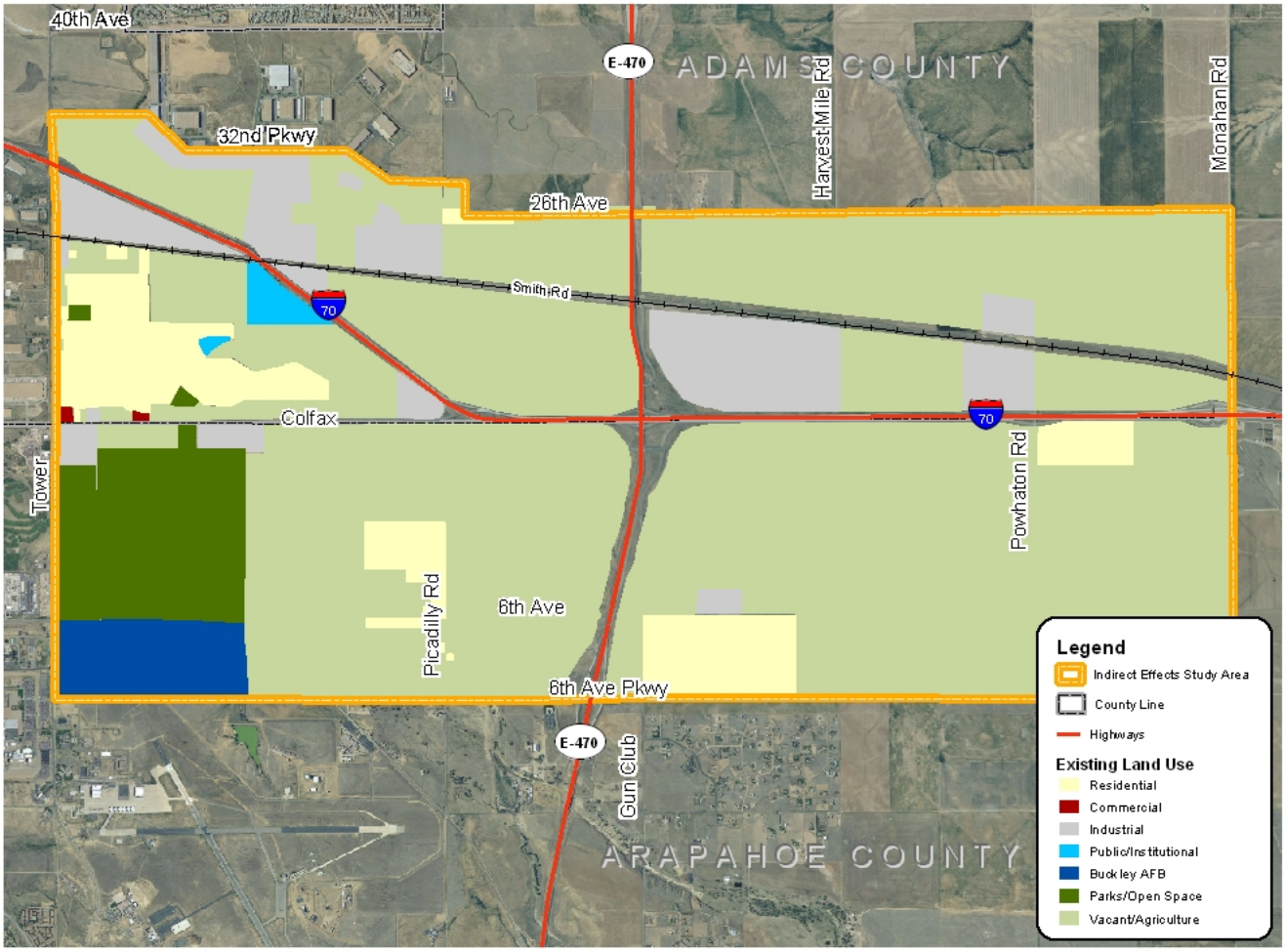
Approximately 75 percent of the land immediately adjacent to the I-70/E-470 Interchange remains undeveloped. There are several parcels of land in the northwest quadrant of the study area that consists of commercial, residential, and agricultural land uses. A portion of Buckley Air Force Base is located in the southwest quadrant of the study area. One location on the eastside of the study area consists of industrial land uses. There are also several residential developments located outside of the interchange area. Existing land use in the indirect effects study area are detailed in Table 1 and shown by location in Figure 4.

Table 1: Existing Land Use in the Study Area

Land Use	Acres	Percentage
Residential	750	7
Commercial	7	< 1
Industrial	848	9
Public/Institutional	53	1
Buckley AFB	248	3
Parks/Open Space	548	6
Vacant/Agricultural	6,812	74
Total	9,266	100

Source: City of Aurora Planning and GIS Departments, 2005.
Note: The acreage and percentage of each land use category are approximate.

FIGURE 4
EXISTING LAND USE IN THE STUDY AREA



Source: City of Aurora Planning & GIS Departments, 2005.
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Much of the study area consists of large parcels of land that are zoned for commercial, residential, and industrial purposes. Zoning designations for the study area are described in Table 2 and shown by location in Figure 5.

Table 2: Zoning in the Study Area

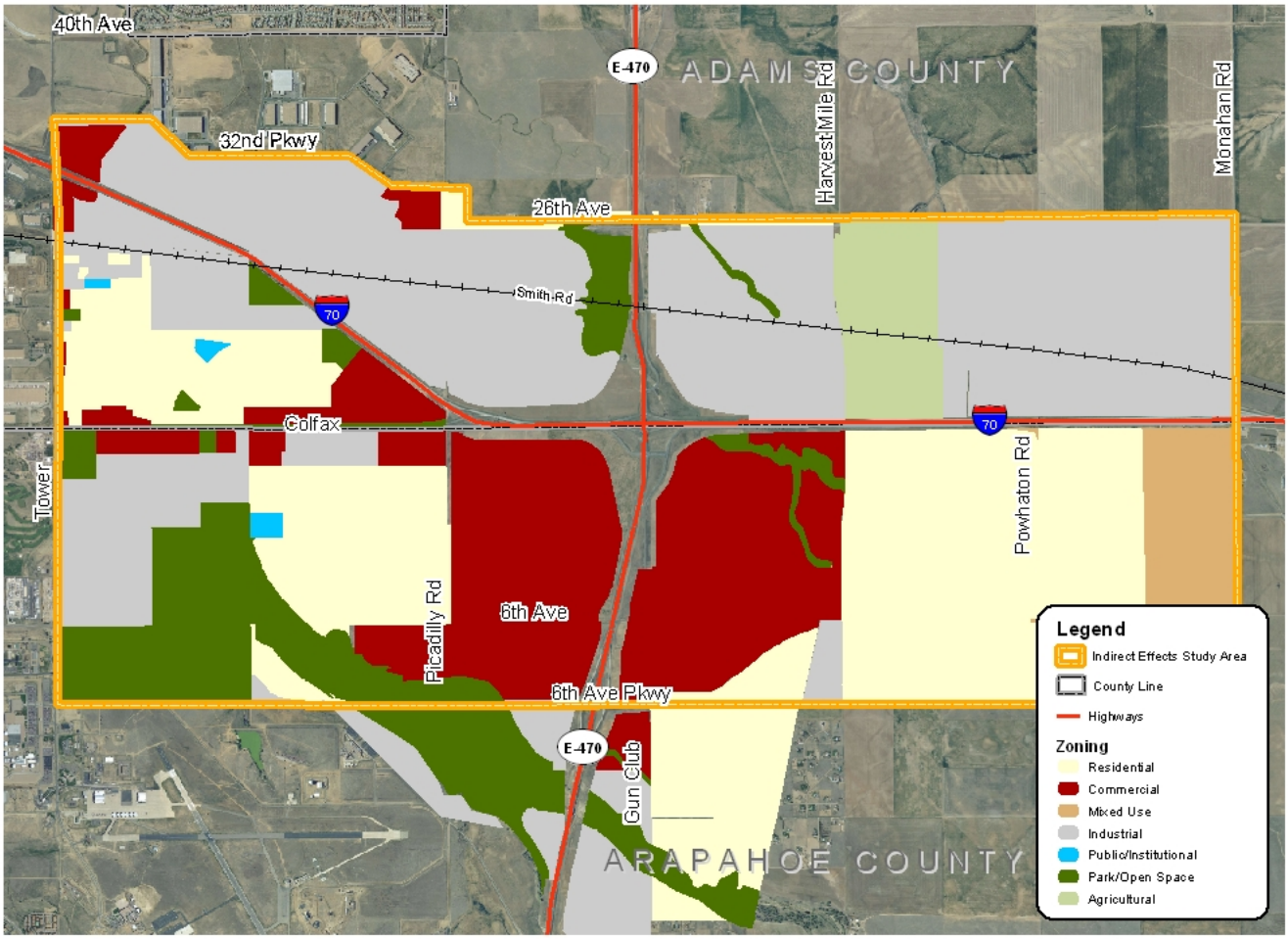
Zoning	Description	Acres	Percentage
Residential	Primarily medium density; within the E-470 environs intended to encourage the development of master-planned, medium-density, high-quality residential land uses.	2602	28
Mixed Use	Combination of commercial, industrial, and residential uses (Arapahoe County).	287	3
Industrial	Primarily light industrial & office uses; includes Buckley Research and Development sub area; intended to encourage the development of industrial, technology, and assembly land uses.	3361	36
Commercial	Retail and commercial development including Regional Activity and Regional Retail Commercial Center sub areas; intended to encourage the development of major economic generators and employment centers.	1785	19
Agricultural	Agricultural productions; includes some residential use (Adams County).	324	3
Parks/Open Space	Intended to include large open land areas, which because of topographical features or proximity to natural drainage courses are unsuitable for development.	881	10
Public/Institutional	Intended to include public/quasi-pubic uses such as educational or religious facilities.	26	< 1
	Total	9,266	100

Source: City of Aurora GIS (including the E-470 Zone District), City of Aurora Municipal Code Zoning District Provisions, 2004.
Note: The acreage and percentage of each zoning category are approximate.

4.4.3 Reasonably Foreseeable Development in the Study Area

In their comprehensive planning documents, Adams County, Arapahoe County, and the City of Aurora have identified the E-470 area along I-70 as a strong employment growth area. Due to this planned growth along the E-470/I-70 corridor, especially in the interchange area, land use is expected to change from agricultural to a higher intensity of land use including light industrial, regional retail, and regional activity center. These land use changes would most likely lead to an increase in property tax revenues and personal incomes for area residents. Future land use in the study area is depicted in Figure 6.

FIGURE 5
ZONING IN THE STUDY AREA



Source: City of Aurora GIS (including the E-470 Zone District); City of Aurora Planning Department, 2005; Adams & Araphoe County zoning was interpreted from a paper map.
Note: For the purposes of this analysis, zoning designations were grouped into like categories; Planned Development categories were broken down by use.

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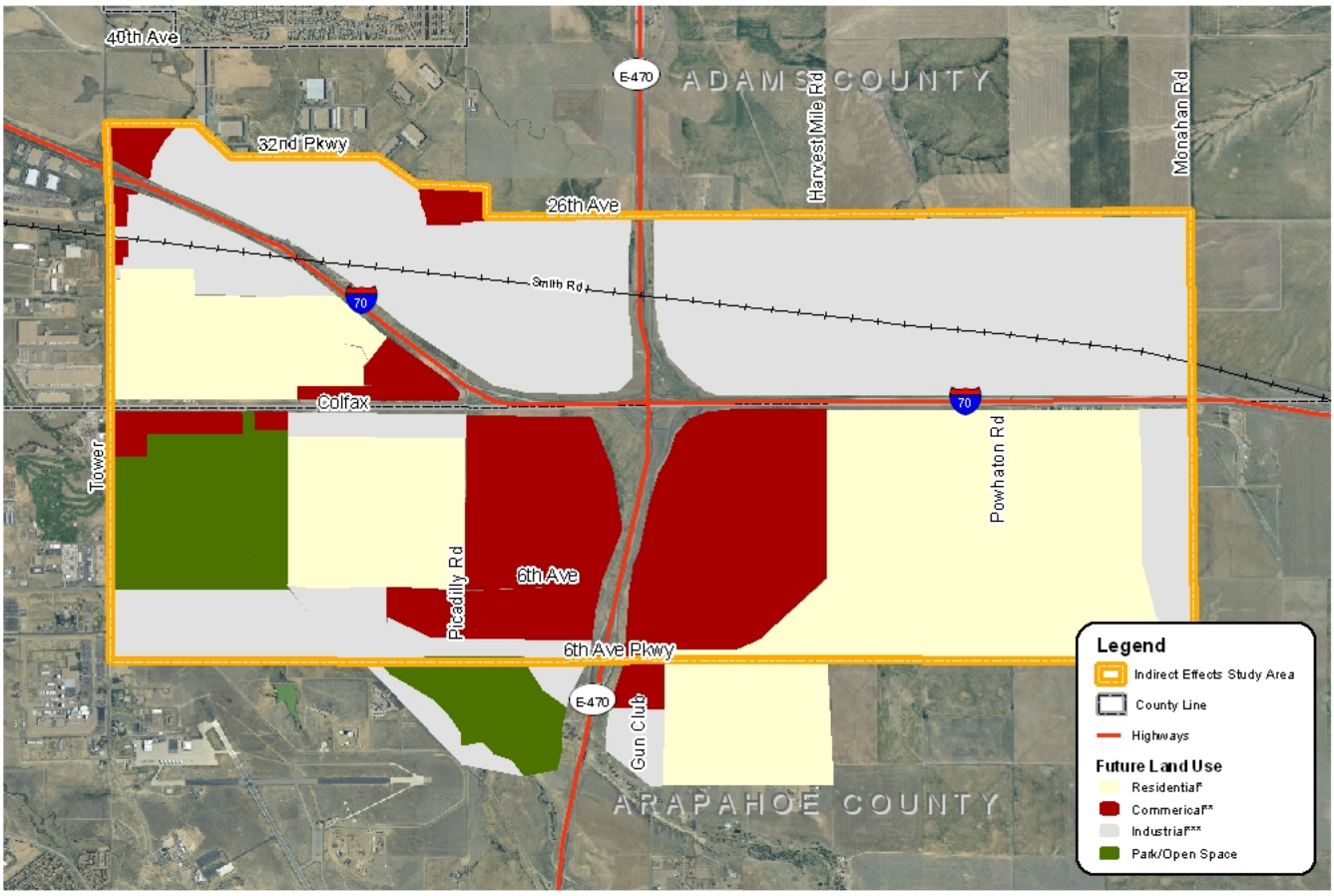
FIGURE 6
FUTURE LAND USE IN THE STUDY AREA



Source: City of Aurora Comprehensive Plan - E-470/Northeast Plains Land Use Map, 2003; City of Aurora Planning Department, 2005;
Adams County Comprehensive Plan - Future Land Use Map, 2003; Arapahoe County Comprehensive Plan - Comprehensive Land Use Plan, 2001.

Note: For the purposes of this analysis future land use classifications have been grouped into like categories.
* Includes low, medium, and high density residential
** Includes retail as well as regional activity and commercial centers.
*** A flexible category including light and heavy industrial, Buckley Air Force Base, and offices uses.

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Table 3 below summarizes planned development within the I-70/E-470 indirect effects study area. Data was obtained from the E-470 Authority, the City of Aurora, Arapahoe County and Adams County in July and November of 2004.

Table 3: Planned Development in the Study Area

Development Name	Type	Acres	Status	Description
Adonea	Residential	447.5	Site Plan and Plats Approved	NW corner of Alameda Pkwy & Powhaton Rd. 1,545 dwellings.
Airways Park	Commercial/ Industrial	195	Planning stages	Smith Road and Tower Road. An industrial/business park with finished commercial and industrial sites. Platted and fully developed lots are available for immediate construction.
APS Site	Residential	100	N.A.	Between 6th Parkway and future 6th Avenue extension, east of Cross Creek. Site for high school and middle school.
Aurora Commerce Center	Commercial/ Industrial	162	Planning stages	Bordered by 26th Ave, E-470, Smith Rd., and Picadilly Rd. Business and light industrial, distribution. Targeted start date first quarter 2004, build-out over an eight-year time frame. Lauth Properties. Industrial warehousing.
Bounds Sell Coakes	Residential	444	Proposed	West of E-470, south of I-70. 3,263 dwelling units.
Buckboard	Commercial	N.A.	Inactive	South of 6th Ave. & 1/4 mile west of Picadilly Rd. From A-1 to E-470 corridor zone district region retail/commercial sub-area. Initial zoning.
Celtic IV parcel	Residential	323		Between Alameda Ave & future 6th Ave extension, approx. 1 mile east of E-470. Tarco/CLS.
Celtic V parcel	Residential	149		Between 6th Pkwy & future 6th Ave extension, approx. 1.5 miles east of E-470, US Home.
Celtic VI parcel	Residential	149		Between 6th Pkwy & future 6th Ave extension, approx. 1.5 miles east of E-470, US Home.
Cross Creek	Residential	218	Under construction	East of Gun Club Rd, south of 6th Ave. 1,070 dwelling units, commercial development, US Home.
EastGate Business Center	Commercial/ Industrial	295	Planning stages	NW corner of E-470/I-70. Light industrial and distribution warehouse. 3.5 million sq. feet of distribution space. Catellus.
EastPark 70 - Master Plan	Commercial	110	Planning stages	SW corner of Smith Rd & Himalaya Rd. Master plan for industrial park. Site plan for 9.5 acre phase 1 and a 28 lot subdivision plat.
Green Valley Ranch	Mixed-Use	2,212	Planning stages	Between 26th & 56th Avenues bounded by Picadilly & Powhaton Roads. In E-470 and NE plains zones, partial annexation and initial zoning. 11,200 residential units; 70% single family; commercial, retail, school, parks. Denver portion golf course community. Oakwood homes.
Horizon City Center - RealtiCorp	Mixed-Use	503	Planning Stages	SW corner of I-70 and the E-470 toll road. To include more than 500 homes and 5 million square feet of commercial/retail/office space.
Majestic Commercenter	Commercial/ Industrial Office	1,000	Under construction	I-70 and Tower Road. This offers tenants the prime warehouse/distribution location near DIA. Existing buildings total nearly 2 million sq ft and range from 50,000 to 280,000 sq ft and will have more than 15 million sq ft at buildout.
Northeast Plains	Residential	1,674	Proposed	East of Gun Club Rd, between Alameda Ave & I-70. 14,530 dwelling units.
ProLogis Park 70	Commercial/ Industrial	182	Under construction	The intersection of E-470 and I-70. Final development plan to revise design standards; Conceptual site plan and plat for a 276,113 sq. ft industrial building. There will be 2.9 million sq ft of distribution and warehouse space at build out. General Motors recently completed its new 404,928 square foot parts and distribution facility.
Traditions	Residential	290	Under construction	SE corner of 6th Ave & Harvest Mile Rd; NE corner of Harvest Mile Rd. & Alameda Ave. Conceptual site plan and plats for Single family detached lots. 1,064 Dwellings.
Wal-Mart at Gateway Park IV East	Commercial	N.A.	Under construction	NW corner of I-70 & Tower Rd. For 212,313 sq ft supercenter including use approval for auto service and 5 pad sites and fuel dispensing use.

4.5 Regional Population and Employment Projections

Year 2030 population and employment forecasts provided by DRCOG reflect the planned development in the study area. Data comparing existing and forecasted population and employment within the study area is detailed in Table 4 below.

Table 4: Projected Future Population and Employment in the Study Area

	2001	2030	Difference	% Change
Population	6,096	24,913	18,817	300
Employment	1,253	28,115	26,862	2100

Source: DRCOG, 2004

As development occurs in Aurora, Picadilly and Harvest Mile Roads will be built to provide access north and south through the study area. This street network will be built regardless of any interchange with I-70.

4.6 Market Forces Influencing Growth

A preliminary review of the market forces that could potentially influence growth within the study area revealed that water, sewer, and fiscal considerations could potentially act as constraints to development. These municipal resources are critical components of growth and development in Aurora.

4.6.1 Water Supply

Aurora receives 95% of its water supplies from snowmelt runoff. A total of 12 reservoirs and lakes serve approximately 300,000 people. Limited amounts of non-renewable, deep groundwater are also used to supplement the renewable surface water supplies during drought periods or as an interim water service before connection with the city's core water system.

The current levels of water demand are approximately 58,000 acre-feet per year. Aurora's water system currently has about 150,000 acre-feet of storage capacity. Water demand is expected to grow proportionally with population increases (1.8 percent per year). Aurora's Master Utility Plan includes future development in its capacity planning. Aurora's goal is to double storage capacity by the year 2030 to 300,000 acre-feet, which would meet projected water demand.

The city's existing water supply program was designed to meet customer demands with an operating reserve under average year hydrologic conditions. In the future, Aurora has chosen to design a system based on the premise that droughts will occur. This approach is better able to respond to multi-year droughts and will require greater investment into the system and additional water rights, storage, and delivery.

Because the city's master utility plan has anticipated the level of investment that will be necessary to support projected corridor development, water supply is not anticipated to constrain growth within the E-470 Corridor.

4.6.2 Water Treatment and Distribution

The city has two water treatment plants that deliver potable water that meets or exceeds all water quality standards. Existing facilities are anticipated to meet the water treatment demands of the community to 2010. At this time, the city plans to have a third water treatment plant up and running. Alone, this plant could eventually serve up to 200,000 people. With all three plants, the water treatment system could serve a population of 500,000.

The Metropolitan Wastewater Reclamation District provides a large portion of Aurora's wastewater treatment. Since 1968, the city has operated the Sand Creek Water Reclamation Facility as an advanced treatment plant for reclaimed water. This reclaimed effluent is used on city golf courses, parks, greenbelts, and the Aurora Municipal Center lawns for irrigation. An ongoing program of repair and replacement has kept the sewer system in excellent condition. The city is currently investigating the construction of a second reclamation plant to increase the amount of reclaimed effluent for irrigation. This plant would reduce the demand for potable water for irrigation.

Because the city's master utility and wastewater treatment plans have anticipated the level of investment that will be necessary to support projected corridor development, capacity for water treatment is not anticipated to constrain growth within the E-470 Corridor.

4.6.3 Water Plans, Programs, and Projects

The current drought's duration and severity has stressed the yields of the city's water rights portfolio and the storage capacity of the water supply system. Due to the relatively junior makeup of the city's water rights, reservoir storage levels have declined dramatically and reached historic low levels. In response, Aurora's 10-Year Capital Improvement Program includes land acquisition and pre-construction studies for two reclaimed water reservoirs and two treated water storage tanks. The city also intends to develop additional finished water storage reservoirs in the high areas along Smoky Hill Road as well as along the E-470 corridor.

The purchase of additional shares of Rocky Ford Ditch water is budgeted in 2004 and will add 5,100 acre-feet of water to Aurora's water supply portfolio. Other capital improvement projects budgeted in 2004 and beyond include various water acquisition and storage projects, water and sanitary sewer extensions and system improvements, reclaimed water system planning, and system security upgrades.

Aurora has comprehensively planned to meet the water needs of the existing and future population. Expansion of the existing system is provided for in the city's Capital Improvement Plan and thus supports the growth and development that is anticipated within the E-470 Corridor.

4.6.4 Fiscal Considerations

Aurora's 2004 Adopted Budget takes anticipated city growth into account as a major factor for both planning and funding operations, as well as capital improvements.

However, Aurora has been significantly affected by the economic downturn that began in 2001. As a consequence, numerous city services and projects have taken budget cutbacks that limit the city's ability to respond to growing demands for services in the face of limited revenue growth.

The Utility Capital Improvement Program provides funding for utility maintenance and expansion and is, therefore, less susceptible to General Fund budget cutbacks. As an "enterprise" fund, utilities are a pay-as-you-go system funded through a mix of user fee and tap fee increases. Revenue bonds are also used. Under this program, developers pay for added capacity and geographic expansion of the system and users pay for system improvements. As long as growth continues to occur as projected, expansion of utility services is likely to occur as planned.

The General Fund is the primary source of funding for most city operations and includes funding for operating costs related to public safety, public works, parks, and libraries. As the city continues to work on its long-term financial plan for 2005 and beyond, staff expects that reductions in these services may continue into the near future. In addition, significant increases in expenditures for any portion of the budget would likely place the city in a position where additional service reductions would be required.

4.7 Preliminary Assessment of Potential Indirect Effects

Analysis of the data described thus far resulted in several assumptions about the potential for indirect effects. These include:

Local Plans Anticipate New Interchanges. Adams County, Arapahoe County, and the city of Aurora have already identified the E-470 area along I-70 as a strong growth area. DRCOG has projected large increases in population and employment within the study area. All of these agencies assumed that by the year 2030, there would be two new interchanges at I-70, on either side of the E-470/I-70 interchange.

There Are No Reasonably Foreseeable Forces That Would Constrain Anticipated Growth. Aurora has comprehensively planned to meet the water needs of the existing and future population. Utilities development is funded by *The Utility Capital Improvement Program*, which is a pay-as-you-go system funded through a mix of user fee and tap fee increases.

Interchange Construction Would Influence Future Land Use Patterns Within the Study Area. Existing zoning and future land uses are consistent with the land uses that are typically associated with new interchanges. Within the interchange area, comprehensive planning efforts and reasonably foreseeable developments reflect the expectation for land uses to change from agricultural to a higher intensity of use including light industrial, regional retail, and regional activity center.

4.8 Expert Panel

Local planning agencies and business development councils were contacted for their input on changes in development anticipated between the existing condition, a No-Action

scenario, an improved interchange at E-470/I-70, and new interchanges at Picadilly Road/I-70 and Harvest Mile Road/I-70. On November 17, 2004 participants met to discuss the preliminary findings and evaluate the potential indirect induced growth impacts of these transportation improvements. Representatives from the following agencies participated in the indirect effects panel meeting:

- Denver Regional Council of Governments (DRCOG)
- City of Aurora Planning
- Arapahoe County Planning
- Adams County Planning
- Aurora Economic Development Council
- Front Range Airport
- TransPort
- Environmental Protection Agency (EPA)
- Colorado Department of Transportation (CDOT)
- Federal Highway Administration (FHWA)

Input received at the meeting determined that indirect impacts would occur within all four quadrants of the I-70/E-470 interchange complex. The changes in land use patterns that could be expected to result from not constructing an interchange, constructing an interchange at Picadilly Road, constructing an interchange at Harvest Mile Road, or constructing an interchange at both Picadilly and Harvest Mile Roads are discussed in Section 4.9 below and shown graphically in Figures 7, 8 and 9. For reference, a full copy of the minutes from the indirect effects panel meeting is contained in Appendix B.

4.9 PREDICTED LAND USE IMPACTS

4.9.1 No-Action

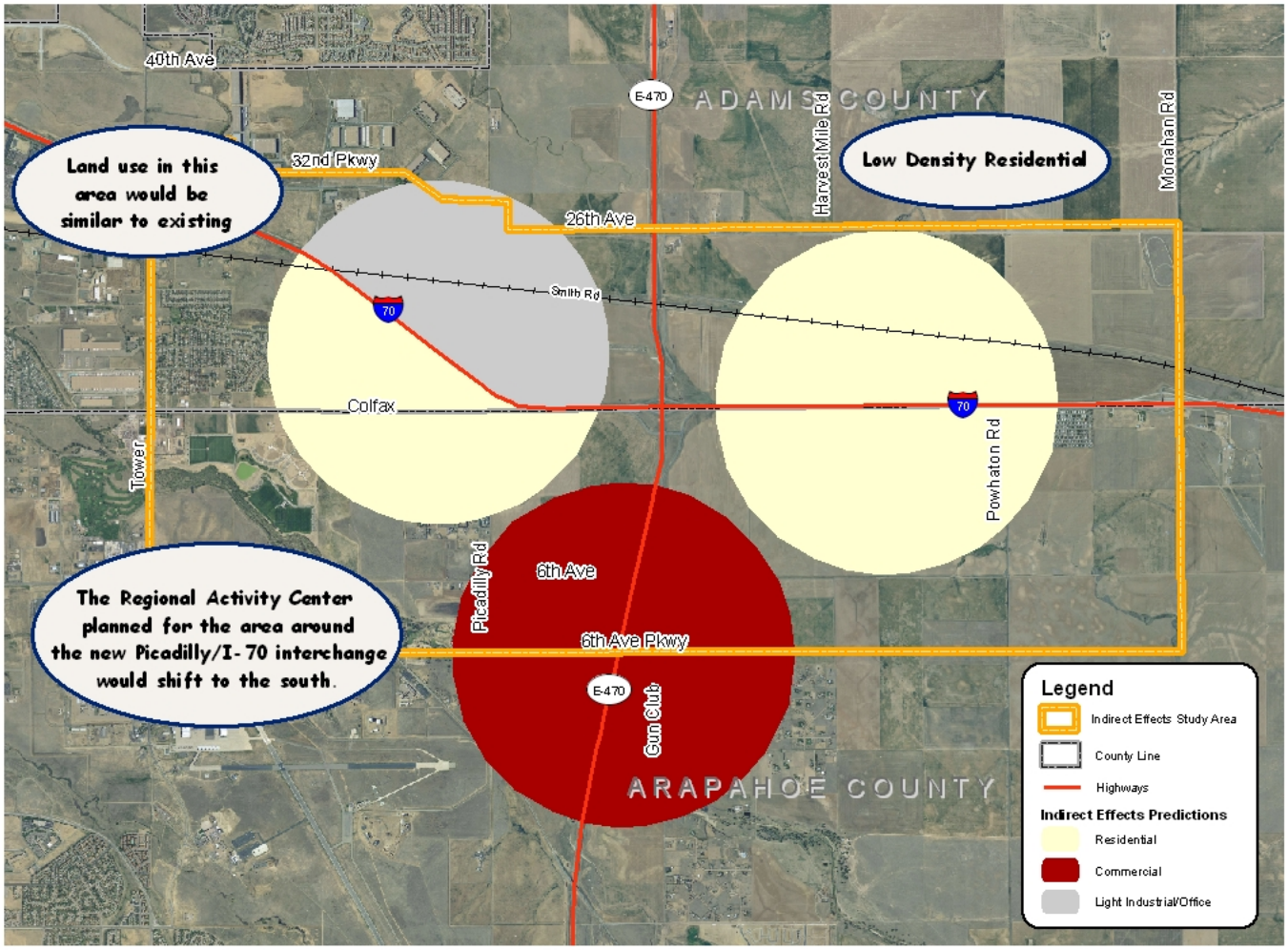
The No-Action alternative could result in future land uses that are incompatible with existing zoning and land use plans. This is largely because Adams County, Arapahoe County, and the City of Aurora have identified the E-470 area along I-70 as a strong employment growth area and in their comprehensive planning documents have provided the necessary support (via infrastructure, land use policy, and budget) for the development of this area. This includes assumptions of the two new interchanges. Indirect land use changes predicted from the No-Action Alternative include the following:

1. If a new interchange is not constructed at Picadilly/I-70, the regional activity center Aurora has planned for this area would likely shift towards 6th Parkway at the E-470 interchange. At Picadilly/I-70, future development would likely be similar to existing land use.

2. If a new interchange is not constructed at Harvest Mile/I-70 land parcels will be slower to develop and will likely be more residential than commercial.

Note: The I-70/E-470 indirect effects analysis utilized a land use influence area of two miles at potential interchange locations. Any larger radius would have exceeded study area boundaries and resulted in overlapping areas of analysis.

FIGURE 7
POTENTIAL INDIRECT LAND USE IMPACTS OF THE NO-ACTION ALTERNATIVE



Source: Carter & Burgess, Inc. [based upon input received from indirect effects panel, November 2004].
Q:\Jobs\e470_i70\NewGIS\Maps\IE_TechReport\IE_Predictions.mxd

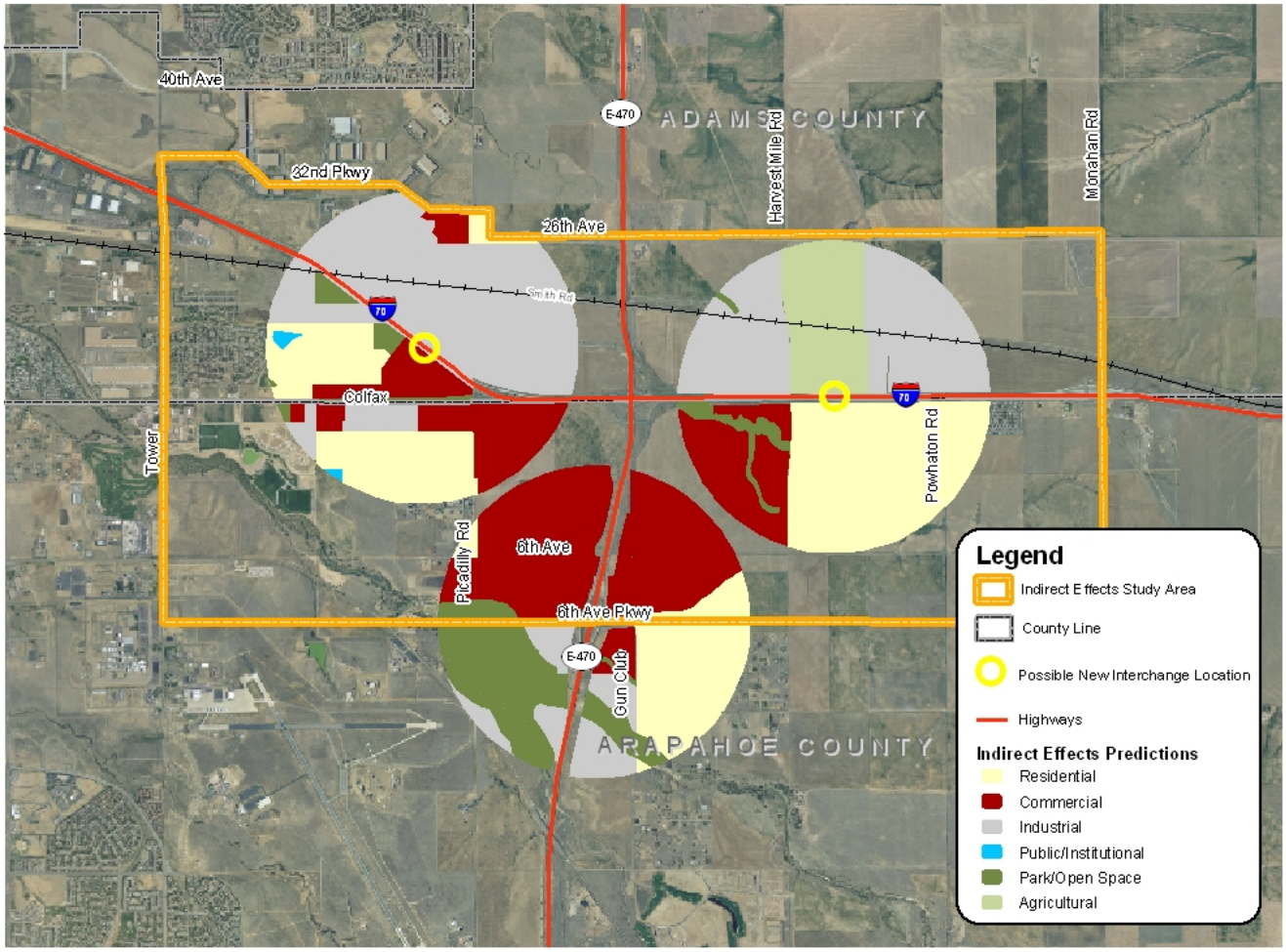
4.9.2 I-70/E-470 Interchange Reconstruction: Close Gun Club and Construct a New Interchange at Either Picadilly or Harvest Mile

The indirect impact of a new interchange at either Picadilly/I-70 or Harvest Mile/I-70 could be that development in the area around the new interchange would occur in a manner that is consistent with city and county planning efforts. If a new interchange is not constructed at Harvest Mile/I-70, land parcels in that area could be slower to develop and would likely be more low density residential than commercial in character. If an interchange were not built at Picadilly Road/I-70, the regional activity center planned for this area could be shifted further to the south, towards 6th Parkway at the E-470 interchange.

4.9.3 I-70/E-470 Interchange Reconstruction: Close Gun Club and Construct New Interchanges at Both Picadilly and Harvest Mile

The indirect impact of new interchanges at both Picadilly/I-70 and Harvest Mile/I-70 could be that development in the vicinity of both interchanges occurs in a manner that is consistent with city and county planning efforts.

FIGURE 8
POTENTIAL INDIRECT LAND USE IMPACTS OF CONSTRUCTING NEW INTERCHANGES AT BOTH PICADILLY/I-70 AND HARVEST MILE/I-70



Source: Carter & Burgess, Inc. [based upon input received from indirect effects panel, November 2004 and Aurora, Adams County, and Arapahoe County Zoning].
Q:\Jobs\e470_i70\NewGIS\Maps\IE_TechReport\IE_Predictions.mxd

4.10 ENVIRONMENTAL RESOURCES - RELATED IMPACT ANALYSIS

The environmental resources that could potentially be affected by the indirect growth-related impacts discussed above include wildlife, wetlands, and floodplains. Only indirect effects generated by the No-Action and Preferred Alternative are considered in this section. Direct impacts to wildlife, wetlands, and floodplains from these Alternatives are documented in the *Environmental Assessment* for this project.

4.10.1 Wildlife

According to wildlife habitat mapping provided by the Colorado Division of Wildlife - Natural Diversity Information Source, the following species could be present in the study area: Bald Eagle (portions of the study area contain roosting sites and are included in the winter range for this species), Great Blue Heron (potential foraging sites are located in the study area), Snow Geese (the study area contains potential foraging sites and is in a portion of the winter range for this species), Burrowing Owl, Prairie Dogs (colonies may be located throughout the study area), and White Tailed Deer (a portion of their overall range crosses the study area but there are no known population concentrations of this species in the study area). White tailed deer are known to occur along the riparian area associated with Sand Creek.

A portion of the overall range for Mule Deer and Pronghorn occurs east of Picadilly Road, but there are no known migration corridors, resident populations or population concentrations of these species within the study area. In addition, the study area falls within the overall range for the Prebles Jumping Mouse but is not included in the occupied range for this species. Wildlife habitat in the study area is shown in Figure 9.

4.10.2 Related Impacts to Wildlife

Wildlife within the study area depends upon the riparian habitat associated with the First and Sand Creek drainages. If a new interchange were not constructed at Picadilly/I-70, the regional activity center Aurora has planned for this area could shift towards 6th Parkway at the E-470 interchange, potentially impacting a greater amount of the prairie dog and white tailed deer habitat located along the Sand Creek corridor. As much as 1,678 acres of deer habitat could be affected (453 more acres than would be expected under the under the Preferred Alternative). Correspondingly, if an interchange is constructed at Picadilly/I-70, development pressure to areas along the Sand Creek corridor could be lessened.

If a new interchange were not constructed at Harvest Mile/I-70, lower density residential development could occur along I-70, east of E-470. While there is a prairie dog colony in this area, impacts to prairie dog habitat from residential development would not differ substantially from those incurred by light industrial/office development. There would, however, be less of an impact on the white tailed deer range. Indirect effects-related impacts to wildlife are shown in Figure 10.

FIGURE 9
WILDLIFE HABITAT

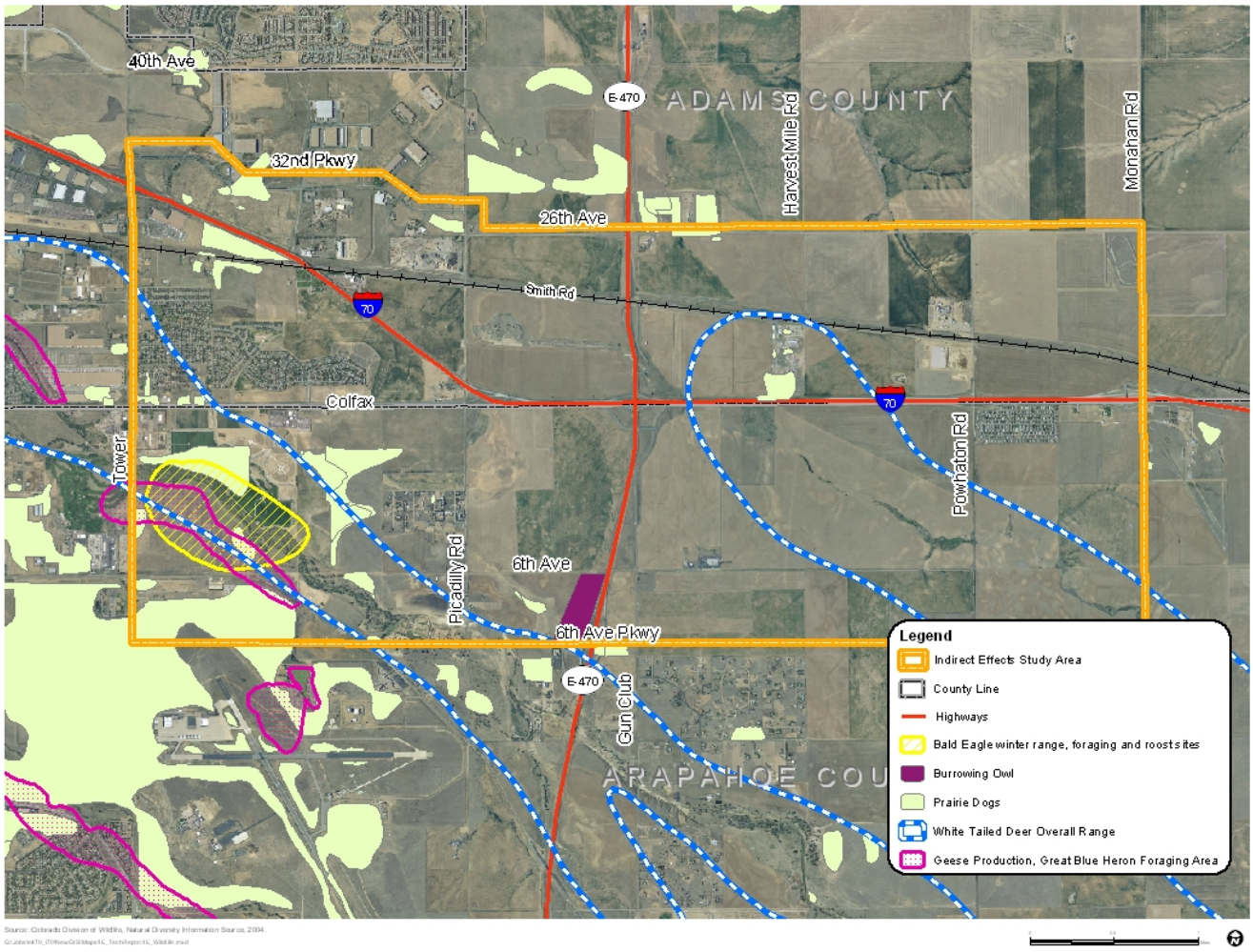
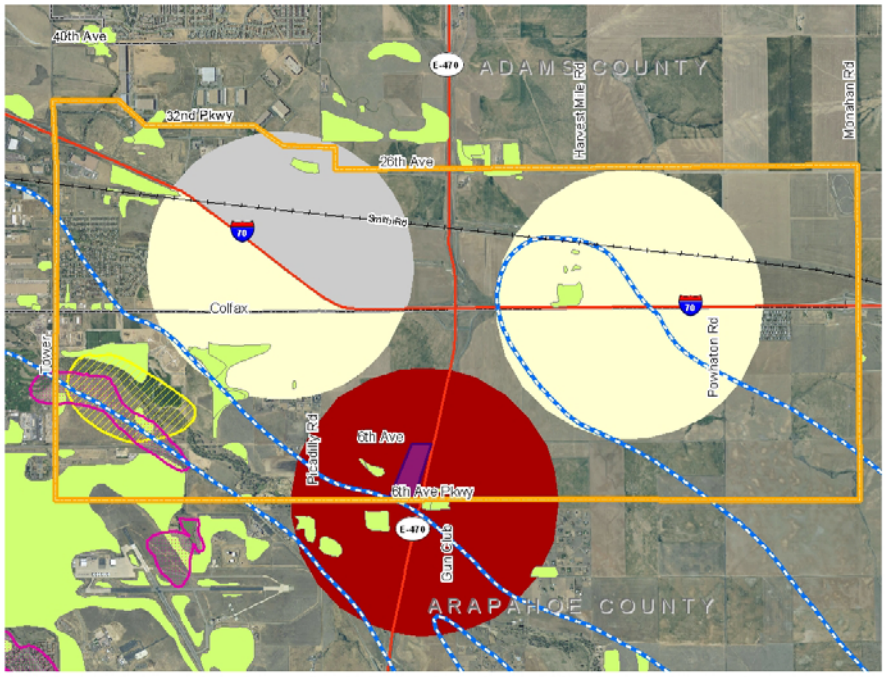


FIGURE 10
RELATED IMPACTS TO WILDLIFE

No-Action



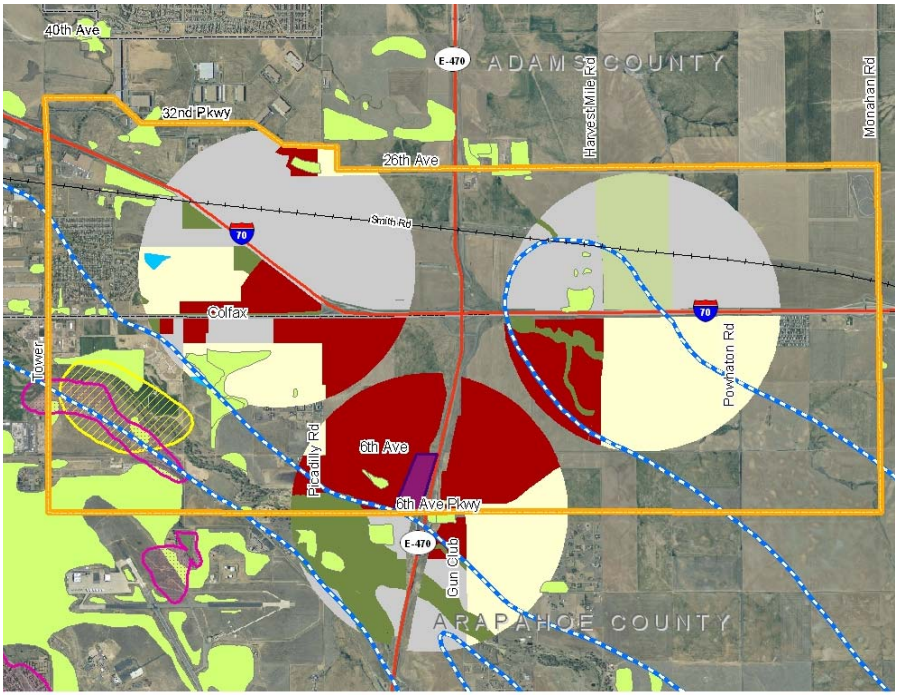
Legend

- Indirect Effects Study Area
- County Line
- Highways
- Bald Eagle winter range, foraging and roost sites
- Prairie Dogs
- White Tailed Deer Overall Range
- Burrowing Owl
- Geese Production, Great Blue Heron Foraging Area

Indirect Effects Predictions

- Residential
- Commercial
- Industrial
- Public/Institutional
- Park/Open Space
- Agricultural

New Interchanges at Both Picadilly and Harvest Mile



4.10.3 Wetlands

Potential wetland areas were interpreted from 2003 aerial photographs of the study area. Results indicated that wetlands are potentially located along riparian corridors and ditches within the study area. These are shown in Figure 11.

4.10.4 Related Impacts to Wetlands

If a new interchange were not constructed at Picadilly/I-70, the regional activity center Aurora has planned for this area could shift towards 6th Parkway at the E-470 interchange. Under this scenario the most intensive development could occur near the riparian area associated with the Sand Creek corridor. The City of Aurora has already designated portions of the corridor as open space, so no development would likely occur in Sand Creek, but there could be indirect impacts to as many as 14 acres of wetlands by development occurring adjacent to Sand Creek. An additional 12 acres of wetlands could be impacted by either alternative in the southeast quadrant of the study area. Indirect effects-related impacts to wetlands are shown in Figure 12.

FIGURE 11
POSSIBLE WETLAND LOCATIONS

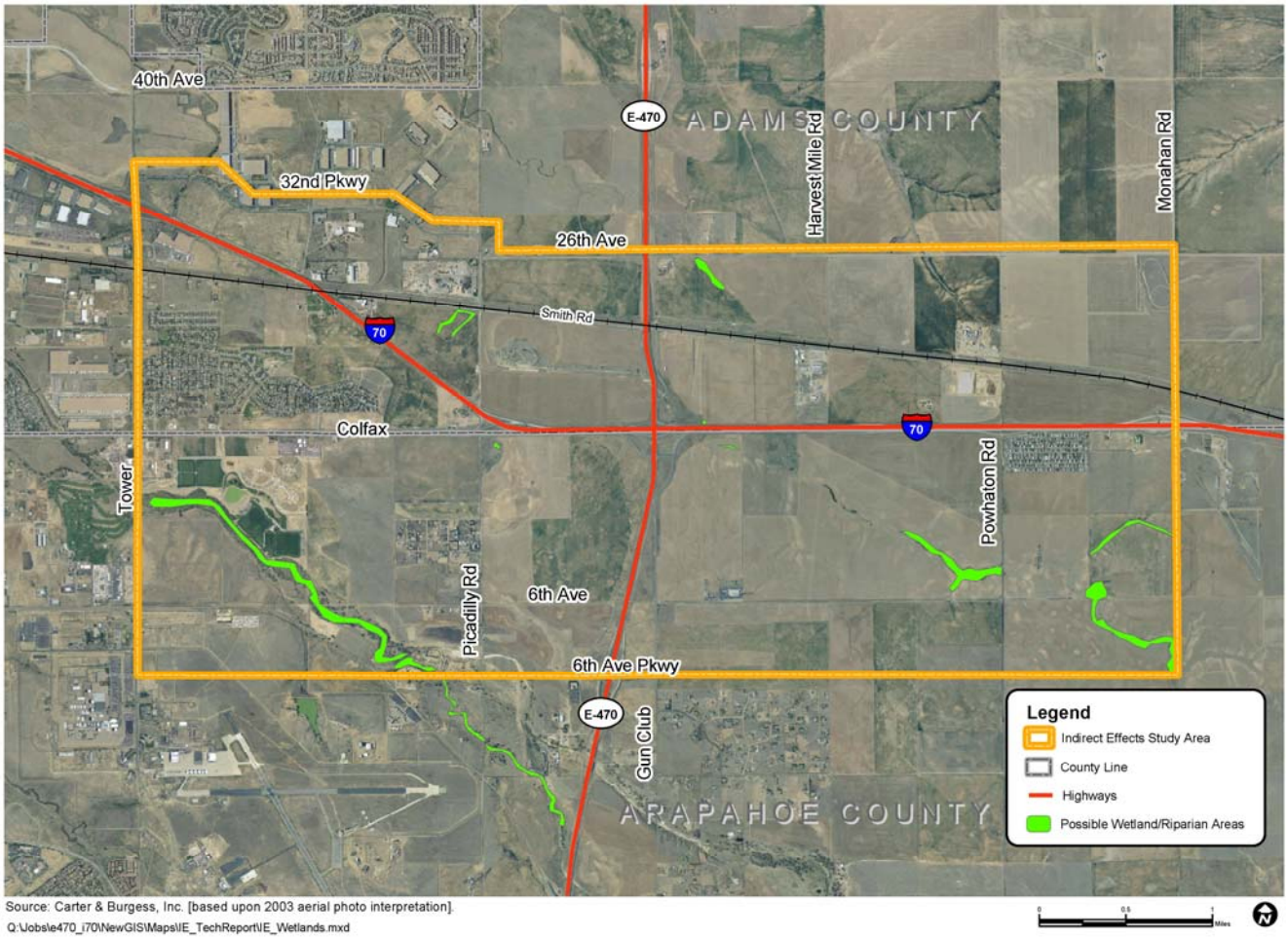
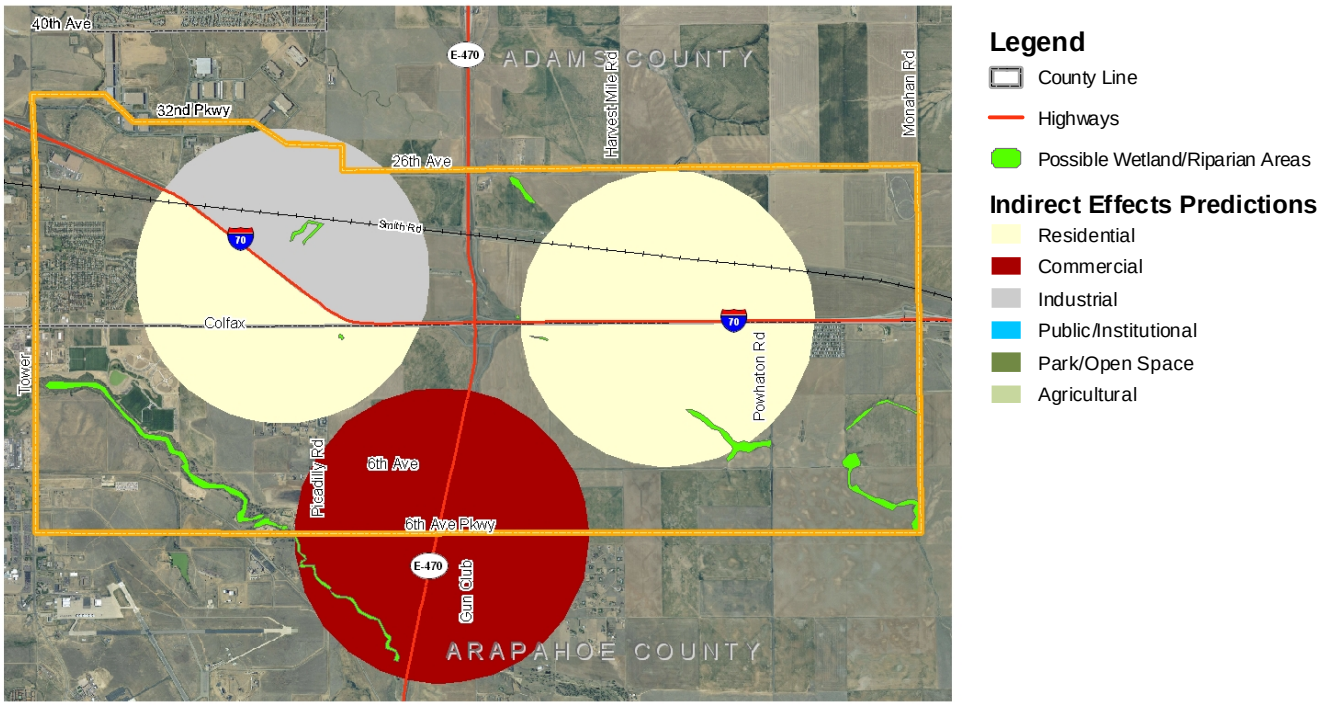
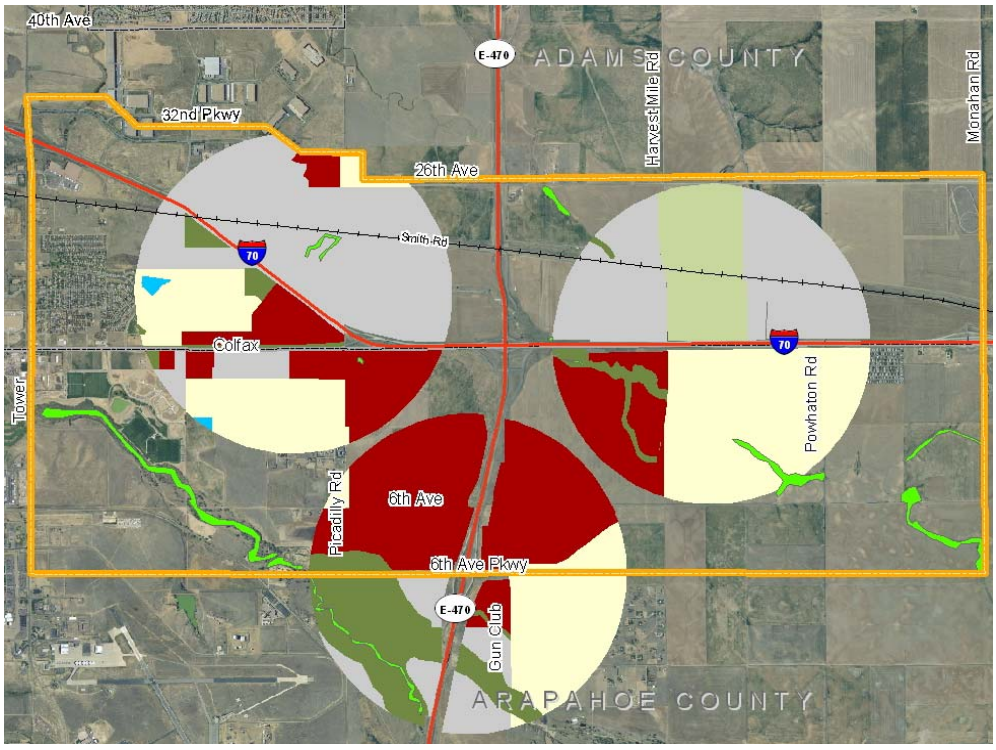


FIGURE 12
RELATED IMPACTS TO WETLANDS

No-Action



New Interchanges at Both Picadilly and Harvest Mile



4.10.5 Floodplains

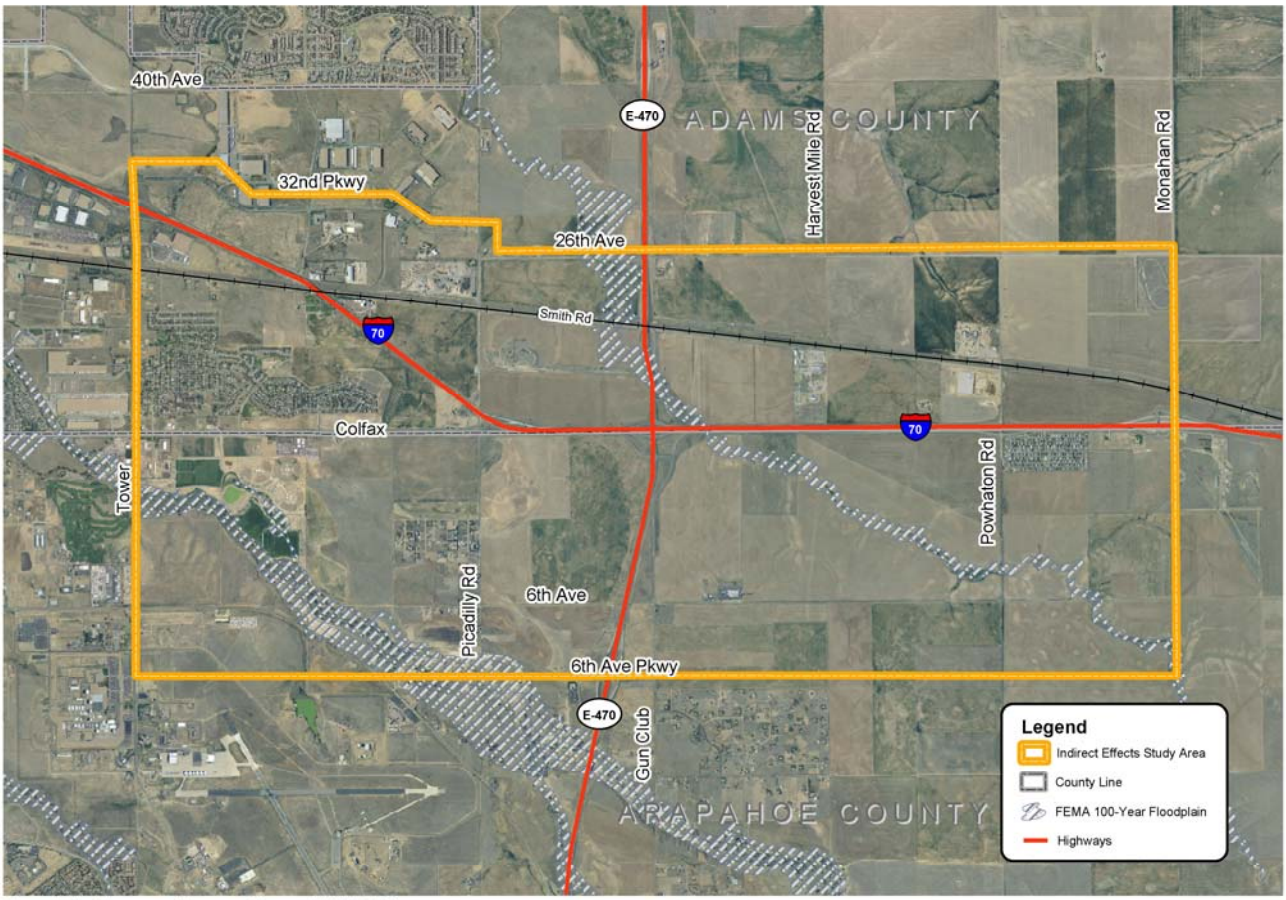
Two FEMA regulated 100-year floodplains occur within the study area: Sand Creek and First Creek. Floodplain locations within the study area are shown in Figure 13.

4.10.6 Related Impacts to Floodplains

If a new interchange is not constructed at Picadilly/I-70, the regional activity center Aurora has planned for this area could shift towards 6th Parkway at the E-470 interchange. Development in this area could encroach upon as much as 335 acres of FEMA regulated 100-year floodplain, although open space zoning may control this.

At Harvest Mile/I-70, a new interchange and its associated development could encroach upon the First Creek floodplain. If the interchange is not built, the less intensive development could have less of an impact on the First Creek floodplain. Indirect effects-related impacts to floodplains are shown in Figure 14.

FIGURE 13
FLOODPLAIN LOCATIONS



Source: Federal Emergency Management Agency (FEMA), 2004.
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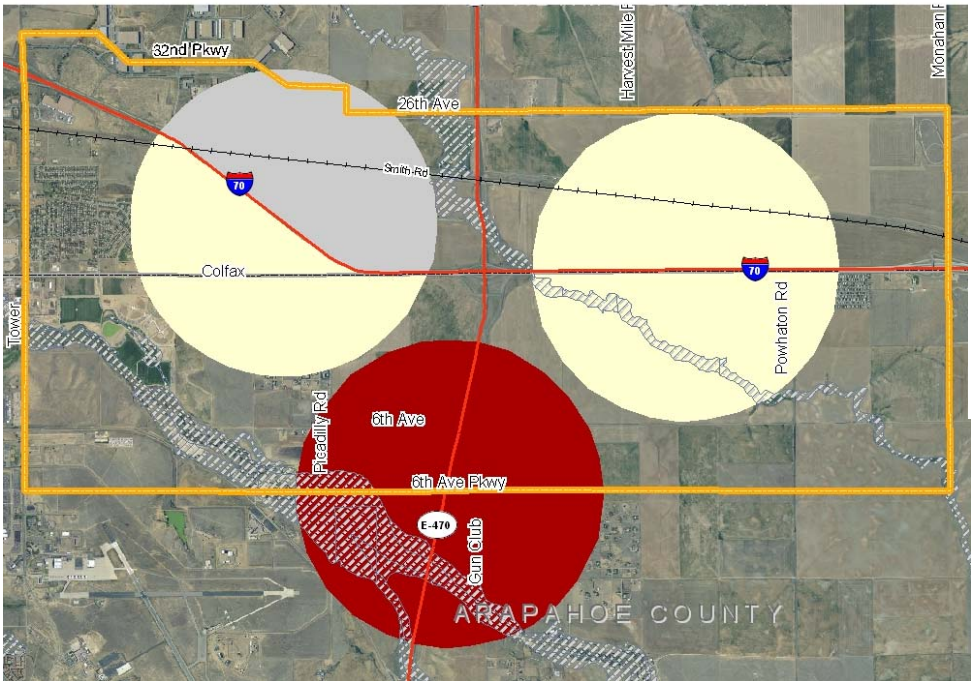
FIGURE 14
RELATED IMPACTS TO FLOODPLAINS

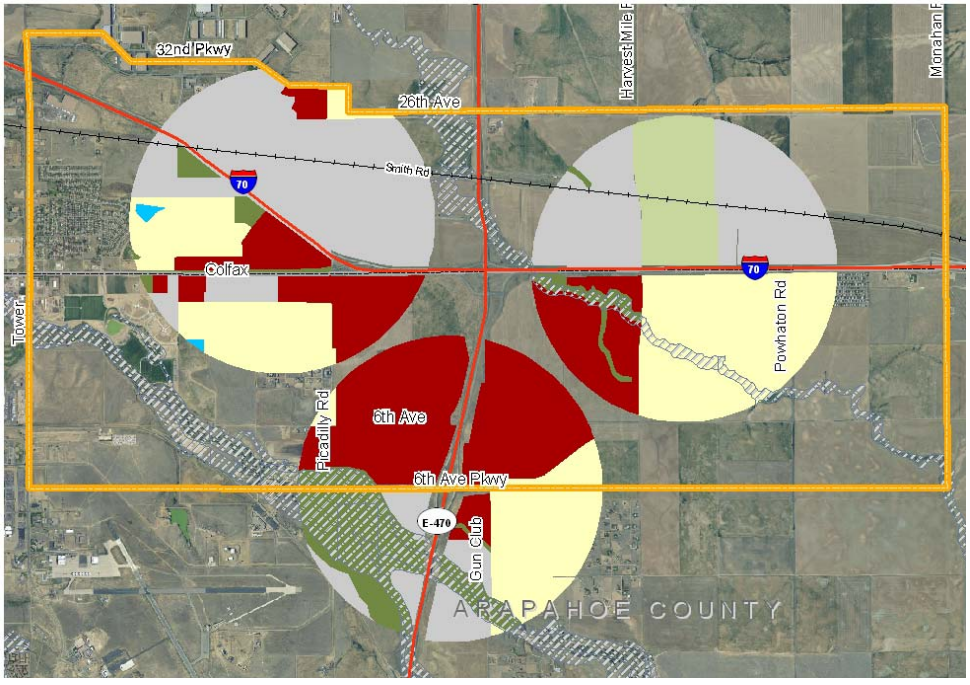
No-Action



Legend
- County Line
- FEMA 100-Year Floodplain
- Highways

Indirect Effects Predictions
- Residential
- Commercial
- Industrial
- Public/Institutional
- Park/Open Space
- Agricultural

New Interchanges at Both Picadilly and Harvest Mile



4.10.7 Land Use Planning

In their comprehensive planning documents, Adams County, Arapahoe County, and the City of Aurora have identified the E-470 area along I-70 as a strong employment growth area. The *City of Aurora Comprehensive Plan* (2003) established the E-470 Sub Area to plan for the development of the E-470 Corridor. By 2003, Aurora had completed major planning efforts for the corridor with a corridor plan, a new zoning district (adopted in 1999), and specific development and design standards. More than 11,000 acres of land have been rezoned to the E-470 Corridor Zoning District.

The *Adams County Comprehensive Plan* (2003), identifies the E-470 Corridor as an area of major opportunities for enhanced access and development. The County encourages concentrated development around interchange hubs and limited low-density residential development.

The *Arapahoe County Comprehensive Plan* (2001), envisions the E-470 Corridor as a mixed-use node, incorporating residential and employment/commercial uses. The preferred location for residential neighborhoods is in the area surrounding employment uses.

In the *Metro Vision 2020 Plan* (2000), the Denver Regional Council of Governments (DRCOG) anticipates regional growth in the vicinity of the interchange, including full/partial interchanges along I-70.

As identified in Section 4.9, the No-Action Alternative would be the most inconsistent with city, county, and regional planning in the area. Not constructing an interchange at Harvest Mile/I-70 could result in low-density residential development in the parcels around I-70, east of E-470, which is inconsistent with Adams County recommendations. Construction of new interchanges at both Picadilly/I-70 and Harvest Mile/I-70 support the development within the study area in a manner that is consistent with city and county planning efforts.

4.11 MITIGATION ANALYSIS

Typical mitigation for the indirect growth-related impacts of a project includes the adoption of smart growth policies, open space acquisition, and/or the implementation of transportation demand management policies and design standards.

Mitigation that could be considered for local jurisdictions includes:

- Commitments to enforcing Smart Growth policies.
- Commitments for open space set asides or acquisitions, particularly along the floodplains of Sand Creek and First Creek.
- Adequate and timely investments in supportive infrastructure - such as the local street system.
- Commitments to appropriate design standards to minimize air pollution and traffic impacts (development in the vicinity of the new interchanges would replace rural, undeveloped land potentially impacting visual quality and quality of life for residents currently living in this mostly rural area).

5.0 SUMMARY AND CONCLUSION

The following conclusions can be drawn from this analysis:

- At E-470/I-70, development would not change between a No-Action and a reconstructed interchange, because access would not be improved because of the interchange reconstruction. In fact, current access at Gun Club Road will be severed, which would tend to slow development pressure.

- At Picadilly/I-70, if a new interchange is built, development in this area is expected to be generally consistent with Aurora's plans for a regional activity center. This area would be developed at a faster rate after construction of an interchange. Denser development would also be anticipated. Environmental resources in this area that could be impacted by this include the loss of farmland, increased traffic on Picadilly and increased noise and visual impacts at the existing residential area. Some of this residential area is classified as low income or minority.

- If a new interchange is not built at Picadilly and I-70, the regional activity center Aurora has planned for this area could be oriented more towards 6th Parkway at the E-470 interchange. The location of a regional activity center in this area could result in more impact along the Sand Creek floodplain, potentially impacting the floodplain, wetlands, water quality, raptor use, and other big and small mammals using this floodplain. In the vicinity of the Picadilly/E-470 interchange, development patterns would then be similar to existing development (residential south of I-70 and industrial to the north).

- If a new interchange were built at Harvest Mile and I-70, development would be consistent with Aurora's plans for commercial and industrial uses. This development would occur at a faster rate and would be expected to be denser than if an interchange is not built. Environmental resources in this area that could be impacted by this include the First Creek floodplain and white tailed deer range. More traffic and associated noise and air pollution would occur along Harvest Mile.

- If a new interchange is not built at Harvest Mile and I-70, the parcels along I-70, east of E-470 could be slower to develop. In the general vicinity of the interchange, land could develop more slowly, and would likely be more residential than commercial.

- Commitments by the City of Aurora to enforce "Smart Growth" principals and enforce wide open space buffers or proceed with open space acquisition along important floodplains such as along Sand Creek and First Creek are recommended.

6.0 APPENDIX A: LAND USE IMPACTS OF INTERCHANGES

Land Use Impacts of Transportation Projects

Revised Preliminary Findings

February 13, 2004

Carter & Burgess, Inc.
Denver Transportation Unit
Environmental Planning Group

Prepared by: Shana Beckham

Table of Contents

Abstract

This report examines land use impacts as a result of four types of transportation projects: new highways, widening of existing highways, new interchanges, and new transit lines or stations. The objective of this study is to survey various transportation projects and literature and extrapolate a rubric that can be used to predict various types of land use changes for transportation projects. The findings of this study suggest that it is not possible to come up with a general formula to predict land use impacts of transportation investments. Transportation is only one of several factors that are necessary in facilitating land use changes in a locality. Some researchers argue that elements such as economy, public attitude, policy, zoning, and others, can play a much more important role in deciding whether or not a project will impact its environs (transportation investments can be a necessary but not sufficient condition of change, but some would argue that transportation infrastructure is not always necessary for growth to occur).

Note: The scope and breadth of this report is limited due to time and resource considerations.

Introduction

Transportation and Land Use have been studied together for several decades. Though there is a general agreement that there is a correlation between the two, there are major discrepancies about exactly what the correlation is. It was difficult to amass empirical data into one (or even a couple of) comprehensive tables in which different factors could be compared. Practically every study or research project uses different methods to measure different attributes.

The improvement type (interchange, highway widening, etc.) Influences the type of land uses that occur in the surrounding area. For example, commercial uses are more likely to be located near interchanges due to the accessibility they provide. Industrial uses are often times located further away from interchanges. In addition to accessibility, Forkenbrock at al. suggest that posit that the land-rent theory is "the single best explanation of how transportation investments can affect urban form (2001: p.11.) Less intensive land uses (single family residential) will be out-bid by higher intensity land uses (commercial, retail, multi-family). When transportation [costs] become cheaper, land prices even out, resulting in more scattered development.

Other Factors Influencing Land Use Change and Economic Development

Improvement type
Proximity to project
Parcel location at key network points (i.e., proximity to interchange)
Timing and completion of construction
Economy
Public attitude
Zoning
Previous land use
Availability (undeveloped/ re-developable land)
Infrastructure

Common Research Approaches

Types of Impacts
- Re-distributive
- Generative
- User/Non-User Benefits

Scale
- Zone or tract
- County or region

Location
- Urban
- Suburban
- Rural

Land Use Impacts of New Highways

The effect of new highways and of highway widening is difficult to generalize. There have been numerous research projects and papers and books written about the subjects for the last 45 years and as many different conclusions. The studies can be divided up into two basic groups, those that focus on the overall effect of highway projects, and those that study the net effects of a project in a more localized area (Carey 2001). Results tend to vary with the method of analysis.

Most researchers agree that the net effects associated with freeway development are not directly comparable from one region to another (Carey 2001). Langley (1981) implies that the impact of a freeway is strongly influenced by the local setting. Therefore, generalizations from one site to another are not suitable. The research does suggest, however, that the development of a local site can be influenced to the extent that local planning and policies are involved (taking into account the overall economy, etc.).

Even though most researchers would agree that the construction of a new freeway increases commercial development in the impact area, it is not necessarily a net gain to the region (many business relocate to be closer to the freeway – re-distributive impacts) (Carey 2001). Furthermore, Carey notes that Mahaday *et al* (1981) found that preexisting trends in the local economy were "the most important determinants of how construction of a particular highway affects an area" and that new highways are "unlikely to create new [trends] (10).

Research indicates that land use impacts occur primarily at points of access (at least initially). Along highways that are limited access, most land use changes will occur at interchanges.

Study Area
Several studies have used ½ mile on either side of the highway as the study area (direct impacts). Highways tend to have certain impacts on larger areas (regional, unlike transit stations and interchanges), as in the case study of the Superstition Freeway Corridor (6-7 miles on either side).

Property Value
Some research suggests that land value is impacted by highways on a very local level (within several blocks of the project) (Burkhardt 1984). General findings suggest that land values are impacted positively with proximity to the corridor.

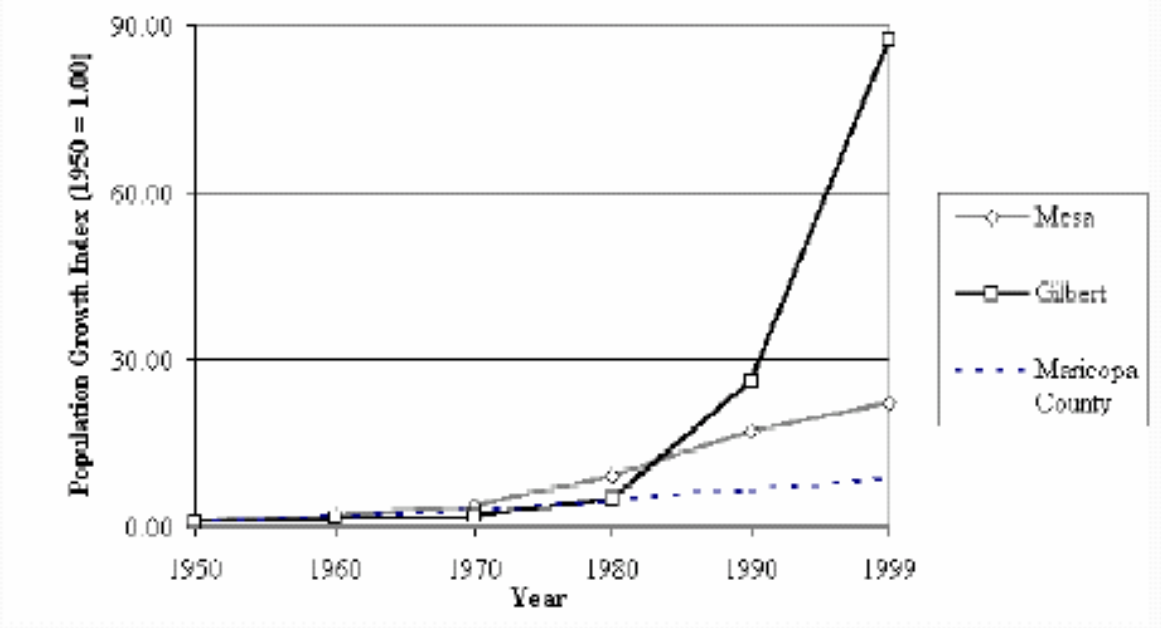
Case Study: I-494

Location: Minnesota
Type: Urban
Notes: Completed in the 1960's. Rapid increases in land value happened first at the eastern terminus (close to the airport) and, at the interchange of I-35W. By the 1980's there was no vacant land left. Mall of America was constructed on the eastern end (the developer would not begin construction until an interchange was installed). Land along the corridor was zoned for commercial and office use. Residential development has occurred behind the more intensive uses along the corridor. Land values have increased along the corridor. Corridor developed in part due to regional access, local growth, and land use policies.

Case Study: *Superstition Freeway Corridor*

Location: *Phoenix-Mesa Metropolitan Area*
Type: Suburban
Study area: ½ mile on either side of the highway
Notes: Constructed between 1969 – 1985, widened from 4 → 6 lanes in 1983-84

Figure 1. Population Growth in Superstition Freeway Corridor



Sources: US Census Bureau, 2001; Arizona Department of Economic Security, 2000.

Findings (Carey 2001):

- Detached single-family homes were negatively impacted by proximity to the freeway (up to ½ mile from the freeway, impacts were greatest for homes adjacent to the freeway).
- Price appreciation was lower for single-family homes nearest the freeway.
- House price appreciation for single-family homes within 5 miles of the freeway (excluding those ½ mile from the freeway) was higher than house price appreciation in the metropolitan area.
- Homes located on major surface streets also experienced negative impacts (house price appreciation).
- Multi-family residential developments appeared to benefit from proximity to the freeway and from locations on major surface streets. Condominium owners experienced a slight rise in property values for properties adjacent to the corridor.
- Vacant commercial land appeared to be more highly valued than initially expected.
- Retail properties appeared to command higher prices closer to the freeway.
- Large apartment buildings were priced at a premium in the study area.

Case Study: *Southern Tier Expressway*

Location: Allegany, Cattaraugus, and Chautauqua Counties, NY
Type: Rural
Study area: 3 county region of Allegany, Cattaraugus, and Chautauqua
Notes: This study is preliminary. True measurement of impacts may not be observed for 20 + years. Upgraded from 2 lanes to 4 lanes in the 1980's and 1990's. Construction completed in 1999.

Table 1: Places located within 5 miles of I-86

Place	Population	Development	Comments
Allegany	8,230 (town) 1,883 (village)	Frito Lay distribution center Home Depot Advanced Monolythic Ceramics (expand)	Allegany re-wrote zoning regulations
Cuba	3,392 (town) 1,633 (village)	New office building 2 new businesses	Small increase (15%) in property value. No community planning
Falconer	2,540 (village)	Sealy Mattress factory CVS drugstore (relocation) 3 new housing starts	Developers expressed interest in several parcels of land. Committee formed to study community planning in response to I-86
Friendship	1,927 (town) 1,176 (CDP)	Dresser-Rand $20 million expansion	500 acres of open land reserved for economic development
Jamestown	31,730 (city)	Rite Aid drugstore Tim Horton's Restaurant Holiday Inn Express	Impacts have been concentrated on traffic and visitor-serving activities
Mina/ Findley Lake	1,176 (town)	Harley Davidson dealership Residential development	+57% traffic Increased tourism Appx. 10% increase in property values Revised zoning and updated comprehensive land use plan
Olean	15,347 (city) 2,029 (town)	Dresser-Rand Headquarters Truck body manufacturer Several Distribution Centers Home Depot 2 national chain restaurants	Adopted and implemented community planning study recommendations. +5% increase in property values city-wide Increased tourism and traffic (spending)
Salamanca	6,097 (city) 544 (town)	Gator Grip Mfg plant Small manufacturer (relocation) Rite Aid drugstore Several retail and service-based stores Holiday Inn Express	Salamanca updated local land use plan
Alfred	5,140 (town) 3,954 (village)	None	Relatively isolated No ideal route to I-86 for heavy trucks No community planning
Angelica	1,411 (town) 903 (village)	None	Low traffic volumes No increase in traffic and spending related to tourism
Ellery/ Bemus Point	4,579 (town)	Cellular phone towers	No community planning No change in tourism spending
Poland	2,467 (town)	Nothing significant	No growth in tourism traffic
Randolph	2,681 (town) 1,316 (village)	12 new businesses 5 went out of businesses 1 left town	Isolated Economic development corporation formed New visitor kiosk

Findings (Rychnowski & Miller 2003):

- Interest in land development leads to new land use plans and raises land values.
- The manufacturing sector grew faster (than in the control area)
- Measurement of overall county wide employment and income trends indicate that the study area performed slightly better that the control area before and during the completion of the highway.

Land Use Impacts of Highway Widening

Study Area
The study areas vary greatly in previous research projects (meters from the project to miles). Some studies address regional impacts, while others focus on local impacts (1/2 mile in either direction on the corridor). Others go so far as to measure impacts within yards of the project.

Case Study: 5 Highway widening projects in Oregon
Location: Oregon
Notes: All 5 case studies were completed in the late 1980's or early 1990's.

Table 2: 5 Case Studies of small highway widening projects in Oregon

Place	Date Completed	Description	Comments
Albany	1988, 1994	Widening OR highay 99E 5.5 miles 2 → 4 lanes	Since 1988, growth has been distributed through out the city, not concentrated along Hwy 99. • Planning and public policy encourage growth in other parts of the city as well as along the corridor • Did not create new access • Economic conditions had profound impact (recession of the early 1980's) • Limited availability of water and sewage infrastructure
Bend	1991	Widening US 97 2.2 miles 2 → 4 lanes	Development has occurred in the corridor, does not account for large amount of growth in rest of city • Planning and policy allowed for growth in other areas besides the corridor • Did not create new access • Strong economy and rapid population growth • Few large commercial sites existed outside of the study area (plus good access and visibility) • Expanded city limit in 1998
Corvallis	1992	Widening OR 99W 2.2 miles	No substantial land use changes • Current planning trends emphasize mixed-use, multi-modal development • Economic expansion in the 1990's • A few property owners control pace of large-scale development in certain areas • Drainage issues and lack of water/ sewer may have limited industrial development in study area
Island City/ La Grande	1992	Widening 1.42 miles of OR 82 2 → 5 lanes	Significant increase in development in study area, evidence shows highway widening not the only factor • All growth located within Urban Growth Boundary • Study area already developing before highway widening • Existing development pattern due to I-84/ Island Ave. interchange (only full access interchange n area) • Rezoning occurred as well as extension of water and sewer infrastructure • Increased traffic may have spurred additional development (from highway widening or Wal-Mart)
McMinnville	1993	Widening OR 18 2.2 miles 2 → 4 lanes	No substantial land use change as a result of highway widening. • Planning and public policy consistently support it's Planning Unit Development overlay • City does not heavily promote development of any type (no additional incentives) • Residents and developers not attracted to project area for residential use. Residents see project area as geographically and culturally separate from rest of city

Source: A Guidebook for Evaluating the Indirect Land Use and Growth Impacts of Highway Improvements (2001)

Findings (ECONorthwest 2001):

- Development was consistent with envisioned local plans
- Scale of land use change correlates with the scale of the improvement to accessibility
- Good accessibility is necessary but not sufficient condition for local development
- Development of all types were dispersed throughout the communities
- Presence or absence of sewer and water infrastructure played a significant role in whether development occurred
- *Conclusion: highway widenings, by themselves, are not likely to cause change in land use from what they would have been without the improvements*

Case Study: *State Trunk Highway 29*
Location: Chippewa Falls to Abbotsford, Wisconsin
Notes: Expanded from 2 lane highway to 4 lane Highway 29, completed in 2000

Table 3: Cities located in the State Trunk Highway study area

Location	Completed	Community Perception	Comments
Abbotsford	Nov. 1999	• Variety of concerns: • business related • location of access routes • Alignment of bypass	• Annexation of land near the bypass into the city limits • Local officials attribute development to improved safety, speed, and convenience of the bypass • City upgraded its entire water and sewer systems • No formally designated land uses in planning process, no official land use plan
Boyd	1994	• No negative concerns • Positive anticipation about possible growth	• Increased property value • 8 new houses • beauty salon • crafts & flower shop
Cadott	1993	• Local roads that previously intersected highway converted to cul-de-sacs – farmers complained	• Substantial amount of development and proposed development • Property values have increased near the interchange
Chippewa Falls	2001	• Strong community support for bypass and new highway alignment • Concerns about type of development that might occur as a result	• St. Josephs's Hospital, Marshfield Clinic, and Technical College • City very proactive in planning for future development near corridor
Colby	1999	• Concerns about additional costs to community for installing sewer and water on newly annexed lands	• City annexed majority of land to the north • Rapid growth of single family housing (many commuters) • Increased property value • Interest from developers in recently annexed land

Findings (Leong *et al* 2003)

- Positive impacts of traffic levels for retail establishments
- Highway improvement has spurred interest in economic development along the corridor
- Commuters report safer and shorter driving times to work
- Ease of access and faster travel times have benefited repair shops and agricultural services
- Slightly higher population growth rate compared to control area
- Some shifts in downtown business' traffic patterns
- Steady increase in the number of new businesses along corridor
- Increase in property values new the highway

Land Use Impacts of Interchanges

The impacts of highway interchanges are usually highly localized. The extent of the impacts can vary greatly (and are dependant upon a number of other factors – location or distance to major city, previous land use, availability, zoning, infrastructure, distance to the next interchange, traffic volume (Gillespie 1995)), and therefore, are difficult to predict.

Study Area
The figure that most researchers use when studying the impact an interchange may have on an area is ½ mile (Cervero, e-mail exchange 2004). The effects of an interchange, however, may also be seen miles away. For example, in one case study, a developer said that the decision to build a mall was influenced by the site's proximity to an interchange 3 miles away (Moses and Weisbrod 2000).

Table 4: Case Studies

Interchange	Date	Location	Location Type	Land use			Comments
				Pre	Post	Change	
Florence Mall (exit 183)		I-71/75 KY					
I-91 & I-90	1950's -1960's	West Springfield, MA	Urban				Limited access connector road (no major development). Freeway access & market growth has driven development (+)
NYS Thruway & I-87	1950/1960/mid 80's	Albany, NY	Urban	mixed-use			sensitive environmental lands in close proximity (-); land fill, undevelopable (-); no changes to land use policy (-); redevelopment efforts focused on downtown area (-)
I-10 & SHTR East		Houston, TX	Urban	warehousing/ industrial	warehousing/ industrial	none	city & economic development assoc. have not focused efforts on development of this area (-); no city zoning (-)
I-10 & SHTR West	1986	Houston, TX	Urban	commercial	commercial	substantial growth	
I-45 & SHTR North		Houston, TX	Urban	commercial (strip malls, car dealership) Low-density office	strip mall, car dealership, offices	thriving	
I-45 & SHTR South	1996	Houston, TX	Urban	limited commercial	limited commercial/ warehousing	none significant	
I-494 & US 169	1960's	Bloomington, MN	Urban	mix	mix	none notable	natural features (-); existing uses (-); negative impact on single family residential area
I-494 & SR 100	1960's	Bloomington, MN	Urban	sf residential/ office & manufacturing/ commercial		same w/ substantial redevelopment	strong market forces (+)
I-494 & Trunk hwy 77	1991	Bloomington, MN	Urban	mix	Mall of America		airport (-); natural features (-)
I-496 & I-76	1980's	Conshohocken, PA	Urban	industrial			location of interchange (+); proximity to booming real estate markets; establishment of Enterprise Zone (+)
I-496 & I-276		Plymouth Meeting, PA	Suburban				proximity to King of Prussia (+); booming economy (+); sprawl (+)
I-76 & I-276		King of Prussia, PA	Suburban	farmland	commercial	explosive commercial growth	accessibility to other important business markets (+)
I-285 & GA 400		Atlanta, GA	Urban		Retail, office	Major business center	Good access

Source: Moses, Wray, and Weisbrod. *The Development Impacts of Highway interchanges in Major Urban Areas: Case Study Findings.* 2000

Findings (Wray, Moses, & Weisbrod 2000):

- Interchanges between two highways have an effect on an area's access to nearby business and commercial markets.
- Improved accessibility can generate development pressures, natural and other land use limitations (zoning) can channel where and if such development occurs.
- The effects of an interchange on an industrial area can vary. Commercial sites are often re-developed for commercial and office use if there is a strong demand from nearby communities for space.
- Areas that are distressed will not necessarily experience an economic upswing as a result of an interchange.
- The design of an interchange itself can have important implications for development potential in its vicinity.

Case Study: *Interstate 75*
Location: Florida, Georgia, Tennessee, Kentucky, Ohio, Michigan

Table 6: Commercial Establishments at I-75 Interchanges

Type of Establishment	Number	Percent
Gasoline Stations		
Major Oil Company	730	28.1
All other stations		
Motels and Motor Hotels		
Major Chains	179	6.9
All other Motels	187	7.2
Eating Establishments		
Fast Food Chains	203	7.8
Restaurant Chains	167	6.4
All other Establishments	263	10.1
Other Services		
Retail Outlets, Plazas, Malls	357	13.7
All other Roadside Services	281	10.8
Total	2,598	99.9

Source: Norris 1987

Table 7: Levels of Development at I-75 Interchanges by State

State	I-75 Mileage	Number of Undeveloped Exists	Number of Developed Exists	Number of Establishments	Number of Establishments per Exit
Florida	211	3	39	274	7.0
Georgia	355	14	86	720	8.4
Tennessee	162	2	33	229	6.9
Kentucky	192	4	29	361	12.4
Ohio	210	11	52	467	9.0
Michigan	394	18	63	567	9.0
Total	1424	52	304	2618	8.6

Source: Norris 1987

Land Use Impacts of Transit Stations

Study Area
Many studies use the figure of ¼ mile. A study by Henry Moon in 1990, however, used 1/3 mile radius around the station to measure the impact area ("…maximum share of impact will occur within one-third mile of the station in any given direction" (74)).

It is the general consensus that rail transit does not influence land use changes in a suburban setting without several other factors being present. These include the public's attitudes towards growth, zoning restrictions, and land availability. The stations areas that have experienced a boom in growth have strong government support and policy for transit oriented design.

Studies show that although certain stations may experience large growth, there is little system wide impact or changes in regional land use.

"…land-value impact of rail investments [are suggested] to be highly localized. (Schwager 18).

Case Study: *Bay Area Rapid Transit and Metrorail(METRO)*
Location: San Francisco, California and Washington D.C.

Table 5: Land Use around 20 Transit Stations

Station	System	% Transportation Related	% Vacant	% Residential	% Commercial/ Industirial/ Institutional
Concord	BART	14.5	0.0	36.2	49.3
Pleasant Hill	BART	25.6	8.6	47.1	18.7
Walnut Creek	BART	22.0	0.0	38.4	39.6
Lafayette	BART	19.9	9.6	44.2	26.3
Orinda	BART	34.5	13.7	32.0	19.8
Hayward	BART	18.7	4.5	62.8	14.0
Union City	BART	14.9	7.4	5.0	72.7
Freemont	BART	15.1	38.6	5.7	40.6
Shady Grove	METRO	44.7	28.0	0.0	27.3
White Flint	METRO	22.4	30.9	5.7	41.0
Grosvenor	METRO	19.1	18.0	28.7	34.2
New Carollton	METRO	39.1	34.0	14.6	12.3
Landover	METRO	23.8	15.5	38.4	22.3
Cheverly	METRO	19.2	34.6	34.6	11.6
Addison Road	METRO	11.3	41.0	34.3	13.4
Eisenhower	METRO	37.0	24.5	8.5	3.0.
Huntington	METRO	15.9	21.0	51.6	11.5
West Falls Church	METRO	41.1	27.4	17.1	13.8
Dunn Loring	METRO	27.0	6.8	62.2	4.0
Vienna	METRO	41.5	42.7	15.8	0.0
BART Average		20.7	10.3	33.9	35.1
METRO Average		28.5	27.0	26.0	18.5
Overall Average		25.4	20.3	29.2	25.1

Source: Henry Moon. "Land Uses Around Suburban Transit Stations," *Transportation 17* (1990) pp. 67-88.

Summary of Readings/Findings

Knight & Trygg, 1977

No evidence of generative impacts
Re-distributive impacts under certain conditions

Cervo, 1984

Conditions for development: strong economy, developable land, policies

Cervo, 2001

Cervo uses Natural Logarithms and regression analysis to analyze the relationships between road expansion, urban growth, and induced travel. Operating speeds, lane mile additions, and personal income were all factors in the decision to build. Higher income areas tended to grow more. Other "control" factors such as population density and racial-economic attributes, in most cases, exerted a stronger influence on VMT (vehicle miles traveled) shares. Over all, it takes about 2-3 years for development activity to respond to the addition of lane miles.

TCRP Report, 1995

"Transit investments and services are incapable by themselves of bringing about significant and lasting land-use and urban form changes…"

Vesalli, 1996

"Transit system's impacts on land use are limited to rapidly growing regions with a healthy underlying demand for high-density development."

Handy

The research tells us that new highway capacity influences where growth occurs. Also, LRT may facilitate density with the right help.

Moon, Henry (1990)

Land use of 20 suburban transit stations were analyzed in San Francisco (BART) and Washington D.C. (METRO). The researches concluded that finding a "generalizable pattern of land use" was difficult and "While trends of land use are apparent, individual station areas seem to be indicated by local conditions – markets, land-use restrictions, accessibility, population, physical geography, etc." Furthermore, "The primary contributors to station area development are residential and commercial developers themselves".

Forkenbrock et al. (2001)

The researchers conclude that they have developed a frame work for assessing probable effects on land use patters within growing urban areas of specific types of transportation, depending on varying local conditions. They state that transportation is one of the key forces affecting city's land use patterns.

Hanson, et al, 1998

"Highway capacity expansion stimulates development activity, both residential and non-residential, in [expanded] corridor."

Moses, Weisbrod, and Wray, 2000

The researches conclude that, drawing upon past experiences, some important information can be gleaned and summarized as follows:

-

David Hartgen, 2003

"Access to interstate highways was only mildly correlated with county population growth…" and "the largest effects ([of rural arterial widening] occurred at the rural-suburban interface…" (2-14% overall growth in population).

Key Findings:

- the determinants of growth within census tracts are largely local in character
- a tracts prior growth is critical in determining its future growth
- major road improvements generally have only a minor effect on growth
- the impact of road widening is about 2-14% points added to decade baseline growth, which is at maximum about the same as the impact from a single small McDonald's restaurant.

Conclusions

- While it is generally agreed that transportation investments and economic activity are positively linked, the nature of the relationship remains uncertain.
- "The timing of land use impact seems largely dependent on general economic conditions. Where there was no demand or capital available for new development in a city or region, little if any impact took place" (USDOT 8).
- "Local land use policy changes have often been instrumental in facilitating transit's land use impacts" (USDOT 8).
- The transit improvement itself has often led to changes in land use policies" (USDOT 8).

There is a lack of data (empirical evidence) to accurately predict future trends in land use due to transportation improvements (moreover, when data exists, interpretations of the data can vary widely). Several methods have been used in the past that have attempted to model the interactions between land use and transportation, but were too limited to be effective (to come up with a generalized framework). In short, past lessons can be used when trying to determine what impact a *specific* project may have on land use (taking into consideration many other (and often stronger influencing) factors.

Related Topics

- Urban sprawl
- Transit oriented design
- Rail ridership/ travel behavior
- Induced travel (all changes in trip making, new and diverted)
- Induced Demand (changes in trip making due to new traffic)

Bibliography

Adams, John and Laura Smith. Highway Improvements and Land Development Patterns in the Greater Twin Cities area, 1970-1997: Measuring the Connection. University of Minnesota (2002).

Beckwith, James and Glen Weisbrod. "Measuring Economic Development Benefits for Highway Decisiom-making: The Wisconsin Case," *Transportation Quarterly, Vol. 46 No. 1* (1992).

Beimborn, Edward and Alan Horowitz. Measurement of Transit Benefits. Center for Urban Transportation Studies. Milwaukee, WI (1993).

Boarnet, Marlon. Do Highways Matter? Ecidence and Policy Implications of Highways' Influence on Metropolitan Development. University of California (2000)

Boarnet, Marlon. The Direct and Indirect Economic Effects of Transportation Infrastructure. University of California, Irvine (1996).

Boarnet, Marlon and Nicholas Compin. "Transit Oriented Development in San Diego County," *APA Journal* (1999). pp. 80-94.

Boarnet, Marlon and Saksith Chalerpong. New Highways, Induced Travel, and Urban Growth Patterns: A "Before and After" Test. University of California (2002).

Boarnet, Marlon and Saksith Chalerpong. "New Highways, House Prices, and Urban Development: A Case Study of Toll Roads in Orange County, CA," *Housing Policy Debate Vol. 12 Issue 3* (2001).

Brown, Dennis. Highway Investment and Rural Economic Development: An Annotated Bibliography. Economic Research Service, U.S. Department of Agriculture. (1999).

Cambridge Systematics, Inc and Economic Development Research Group. Public Transportation and the Nations Economy: A Quantitative Analysis of Public Transportation's Economic Impact. (1999).

Carey, Jason. Impact of Highways on Property Values: Case study of the Superstition Freeway Corridor. Arizona Department of Transportation.

Center for Urban Transportation Research. *Community Impact Assessment: A Handbook for Transportation Professionals* (Handbook). University of South Florida: Tampa Fl.

Center for Urban Transportation Studies. An Overview, Land Use and Economic Development in Statewide Transportation Planning. (1999)

Cervo, Robert. Road Expansion, Urban Growth, and Induced Travel: A Path Analysis. University of California, Berkley (2001)

Cervo, Robert. Transport and Land Use: Key Issues in Metropolitan Planning and Smart Growth. University of California, Berkley

Cervo, Robert and Mark Hansen. Road Supply-Demand Relationships: Sorting Out Causal Linkages. Institute of Transportation Studies, University of California, Berkley (2000)

Economic Development Research Group, Inc. and Cambridge Systematics, Inc. *Using Empirical Information to Measure the Economic Impact of Highway Investments*. 2001.

ECONorthwest and Portland State University. A Guidebook for Evaluating the Indirect Land Use and Growth Impacts of Highway Improvements. (2001)

FHWA, Community Impact Assessment: A Quick Reference for Transportation, September 1996.

Forkenbrock, David and Shauna Benshoff. Assessing the Social and Economic Effects of Transportation Projects. (2001).

Forkenbrock, David, Sondip Mathur and Lisa Schweitzer. Transportation Investment Policy and Urban Land Use Patterns. (2001)

Gillis, William and Kenneth Casavant. "Lessons from Eastern Washington: State Route Mainstreets, Bypass Routes and Economic Development in Small Towns," *EWITS Research Report Number 2* (1994).

Handy, Susan. "Smart Growth and the Transportation-Land Use Connection: What Does the Research Tell Us?" *New Urbanism and Smart Growth: A Research Symposium* (2002).

Hart, Arno, Daniel Hodge and Glen Weisbrod. Do New Highways Attract Businesses? The North Country (NY) Case Study. (2003)

Leong, Dennis et al. Economic and Land Use Impacts Study of State Trunk Highway 29: Phase 1 – Chippewa Falls to Abbotsford, WI. (2002).

Leong, Dennis et al. *Relationship of Highway Rehabilitation Projects and Economic Development.* Wisconsin Department of Transportation. (1996).

Litman, Todd. "Land Use Impact Costs of Transportation," *World Transport Policy & Practice, Vol. 1 No. 4.* (1995) pp. 9-16.

Moon, Henry. "Land Use Around Suburban Transit Stations." *Transportation, Vol. 17*(1990) pp.67-88.

Moses, Susan, Glen Weisbrod and Steve Wray. The development Impacts of Highway Interchanges in Major Urban Areas: Case Study Findings. April 2000.

Parsons Brinckerhoff Quade and Douglas, Inc. Land Use Impacts of Transportation: A Guidebook. (1998).

Rychnowski, Don et al. Preliminary Economic Impact of the Southern Tier Expressway: Western Portion. (2003)

Sanchez, Thomas and Kenneth Dueker. *A GIS Methodology for Assessing the Growth Impacts of Highway Investments.* Portland Statue University.

Seithoff, Brian and Kara Kockelman. Property Valies and Highway Expansions, and Investigation of Timing, Size, Location, and Use Effects.

Seskin, Samuel. Guidance for Land Use Impacts of Transportation.

Schwager, Diane. "An Evaluation of the Relationships Between Transit and Urban Form" *Research Results Digest.* Federal Transit Administration, Number 7. (June1995)

Transportation Research Board. Expanding Metropolitan Highways: Implications for Air Quality and Energy Use – Special Report 245 (1995) pp. 174-209.

U.S Department of Transportation. *Land Use Impacts of Rapid Transit* (DOT-TPI-10-77-29) 1977.

Weiss, Martin. “Economic Growth from Transportation Improvements: Does it or Doesn’t it?” www. fhwa.dot.gov/planning/econdev/econdoes.html. 2002

Zhao, Fang et al*. Modeling the Interaction between Land Use and Transportation Investments Using Spatiotemporal Analysis Tools*. Lehman Center for Transportation Research: 2003.

7.0 APPENDIX B: MEETING MINUTES

Carter Burgess

Meeting Minutes

Project: I-70/E-470 Interchange Complex EA

Purpose: Indirect Effects Panel Meeting

Date Held: November 17, 2004

Location: E-470 Public Highway Authority

Attendees: **E-470 PHA**: Curt Eckhardt
CDOT: Cecelia Joy
FHWA: Monica Pavlik
City of Aurora: Mac Callison, Jay Pierce (Planning)
PB: Drew Olsen
Arapahoe County Planning: Ron Hovland
DRCOG: Larry Mugler
Adams County Planning: Jim Hayes
EPA: Deb LeBow
C&B: Gina McAfee, Shonna Sam, Troy Halouska
Transport: Dennis Champine
Front Range Airport: Dennis Heap
Aurora Economic Development Council: Chris Grey

Copies: Attendees, Pam Hutton, Jack Tone, Matt McDole, Ken Frantz, Elliot Sulsky, File #071218.301

Summary of Discussion:

1. Gina welcomed the panel and gave an introduction to the purpose of the Indirect Effects Panel and the purpose for the meeting. People with a star on their name badge are part of the expert panel.

   Gina described the “flyby” project and noted that that is not part of this project. She described what this project is about: including freeway-to-freeway at E-470/I-70 and two possible new interchanges.

   We are asking for feedback from the expert panel on what would likely be the difference in development patterns, including land use type and density, between a No-Action scenario and a build scenario that includes reconstruction of the existing E-470/I-70 interchange and possibly building one or two new interchanges at Picadilly and Harvest Mile.

2. Drew reviewed the flyby concept. Construction will begin January 2004, with completion scheduled for 2006.

3. Cecelia questioned the issue of access to Gun Club Road. Drew responded that they will be evaluating these issues and solutions.

4. Drew gave a general description of the different possible interchange concepts. We are currently evaluating whether or not we need both of the two interchanges or just one or the other. He described the process for determining interchange location. Right now the interchanges are one mile apart. Is two miles a federal standard? No.

5. Drew also described the general development in the area, including the Prologic development. Drew also described access with the new and planned development. The reconstruction of the interchange will not necessarily improve access, since Gun Club Road access may be closed.

6. The type of interchange affects where development will occur. A fully-directional interchange will tend to push development to the next access point.

7. Aurora is planning to build out their street system with or without any new interchanges. This includes 6th, Picadilly, and Harvest Mile.

8. Gina summarized the research findings: that a new interchange may accelerate development, if other policies are in place. Gina also summarized the DRCOG 2030 land use assumptions – 300% increase in population and 2,100% increase in employment.

9. Has the right-of-way been preserved? Yes, for the E-470 interchange, not the other two interchanges.

10. Want to stress that no decision has been made yet – could be a combination of interchange options.

11. Shonna presented development activity within the study area. There are currently 19 going on in different stages. Mac said Kingsley development is a mixed-use development. It is designated as an activity center on plans. An application has not been formally submitted.

12. Many of the developments noted on Table 1 are past the planning stage. Shonna received update from Jay Pierce (City of Aurora).

13. Jay Pierce (City of Aurora) noted one additional development – the LDS Church (pre-application meeting). The LDS Church owns 1,000 acres in the study area (east of E-470 and south of I-70) and they have submitted a plan for mixed-use development. They are obviously interested in a Harvest Mile interchange.

14. How was the indirect effects area determined? Isn't the traffic influence area larger? Yes, this is just for land use.

15. The Transport development is eight miles to the east of Watkins. It is a 10,000 acre development. It is 6,300 acres, the airport is 3,000 acres. The prototype is the Alliance project in Texas. When Union Pacific moves, they would move out to this area. Currently scattered over seven metro locations – they will consolidate and move. FasTracks will buy the old rail.

16. Today we will estimate what land use is with and without these improvements. We will be looking at transportation impacts as well in the document.

17. Deb pointed out that we want to figure out if development will happen sooner or later.

18. One critical factor is how each development parcel would get access to DIA. The parcels with easy access to DIA will seem more valuable.

19. The development community around E-470/I-70 expect the interchange to be built. We do not have any decisions made yet. I think we can assume the inevitable.

20. Do you think just E-470/I-70 interchange will change development all that much? This could actually hurt access to the area, but there are other options with other changes.

21. What would be the differences in development – need local access, i.e., if you do not have Harvest Mile Road, parcels along I-70 will be much less attractive.

22. From private developer's perspective, the property owners in the four corners of E-470/I-70 interchange area and at Picadilly expect development. Harvest Mile is likely more speculative.

23. It seems like in the direct vicinity of E-470/I-70, there would not be much change in land use. Interchanges at Harvest Mile and Picadilly might have greater indirect effects. See less impacts at Picadilly than Harvest. All businesses on north seem to be industrial.

24. Ron asked how the project would affect residential zoning outside the study area – would construction speed up?

25. If there is no interchange at Harvest Mile, the type of development might be more residential, and development would occur more slowly.

    Is Harvest Mile being considered for some sort of cargo expansion along DIA?

    Front Range and Transport may push some of the cargo movement further east.

26. An interchange could change the cargo/DIA land use dynamic by facilitating development.

27. For Front Range Airport, the more you clean up E-470/I-70 the better.

28. The E-470/I-70 interchange improvements will help out the Front Range Airport.

29. At Picadilly, there is a lot of development already there. Aurora is initiating a land use study along Colfax in the Picadilly area. Aurora will be looking at the zoning in that area. This project is not initiating these changes, but may contribute to them.

30. From DRCOG's perspective, there is a bump in development if there is a new interchange. (This is already included in the 2030 Plan.)

31. Discussion regarding DRCOG 2030 models. Do they include all three interchanges? If so, we may have to make some assumptions about what these could be without interchanges.

32. On the southwest and southeast corners of Picadilly, a regional activity center (Kingsley/Horizon City Center) is planned with office and residential. If there is no interchange at Picadilly, the primary access would be at 6th and E-470. There may be less density and the development will take longer (at Picadilly and I-70). Residential will likely occur south of I-70 and industrial to the north.

33. The land use pattern is pretty firm. It may affect rate of development, but not the pattern.

34. Would density of development change without access?

35. What about utilities? Does Aurora have waterlines accessible to properties along Picadilly? Available along all four quadrants of E-470.

36. If there is not an interchange at Picadilly, two developments would be greatly impacted -- access to the parcel in the southwest corner would be from 6th and E-470. If Picadilly is not there, the regional activity center may shift to 6th and E-470 instead of Picadilliy/I-70 and the corner would be much less attractive. There is a floodplain that would be a problem in that area.

37. Commercial race track? Not heard anything.

38. Deb asked the local planners for planned developments, have the environmental impacts been considered? How does environmental impact analysis fit into the development process? Has thought been given to avoiding environmental impacts? From Adams and Arapahoe County's perspective, they are not encouraging development. From Aurora's perspective, when they did the E-470 Plan, open space and pedestrian corridors were considered to avoid environmental resources. Adams and Arapahoe counties defer to Aurora – environmental considerations are in Aurora Plan.

Summary:

- At E-470/I-70, development will not change between a No-Action and a reconstructed interchange, because access will not be improved because of the interchange reconstruction.

- At Picadilly/E-470, if a new interchange is not built, the regional activity center Aurora has planned for this area will likely be oriented more towards 6th/E-470. In the vicinity of the Picadilly/E-470 interchange, development patterns will be similar to existing development (residential south of I-70 and industrial to the north).

- At Harvest Mile/E-470, if a new interchange is not built, the parcels owned by the LDS church will be slower to develop. In the general vicinity of the interchange, the future land use will develop more slowly, and will likely be more residential than commercial.

I-70 E-470 INTERCHANGE COMPLEX

Sign-in Sheet

Indirect Effects Panel Meeting
Wednesday, November 17, 2004
1:30 p.m.
E-470 Offices at 6th Avenue Parkway and E-470

Name	Representing	Address	Phone/E-mail
Shonna Sam	Carter & Burgess	707 17th St. Denver, CO	samsd@c-b.com
Gina McAfee	"	"	mcafeeVL@c-b.com
Cecelia Joy	CDOT R1	18500 E. Colfax	cecelia.joy@dot.state.co.us
Jay Pierce	City of Aurora	15151 E. Alameda 80012	jpierce@auroragov.org
Front Range Airport	Dennis Heap	5200 Front Range Parkway 80022	dheap@FTG-Airport.com
Ronald Houland	Arapahoe County	10730 E. Bircharood Ave. Suite 100 Centennial, CO. 80112	rhouland@co.arapahoe.co.us
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Dennis Champine	Transport.	325 University Blvd Denver Co	303 740-5400 dennischampine@qwest.com
Deborah Lebow	US EPA	999 18th St, Suite 300, Denver 80202	303 312-6223 lebow.deborah@epa.gov
Larry Mugler	DRCOG	400 Cherry Creek Dr, Ste 800, 80246	lmugler@drcog.org

Carter::Burgess

also:

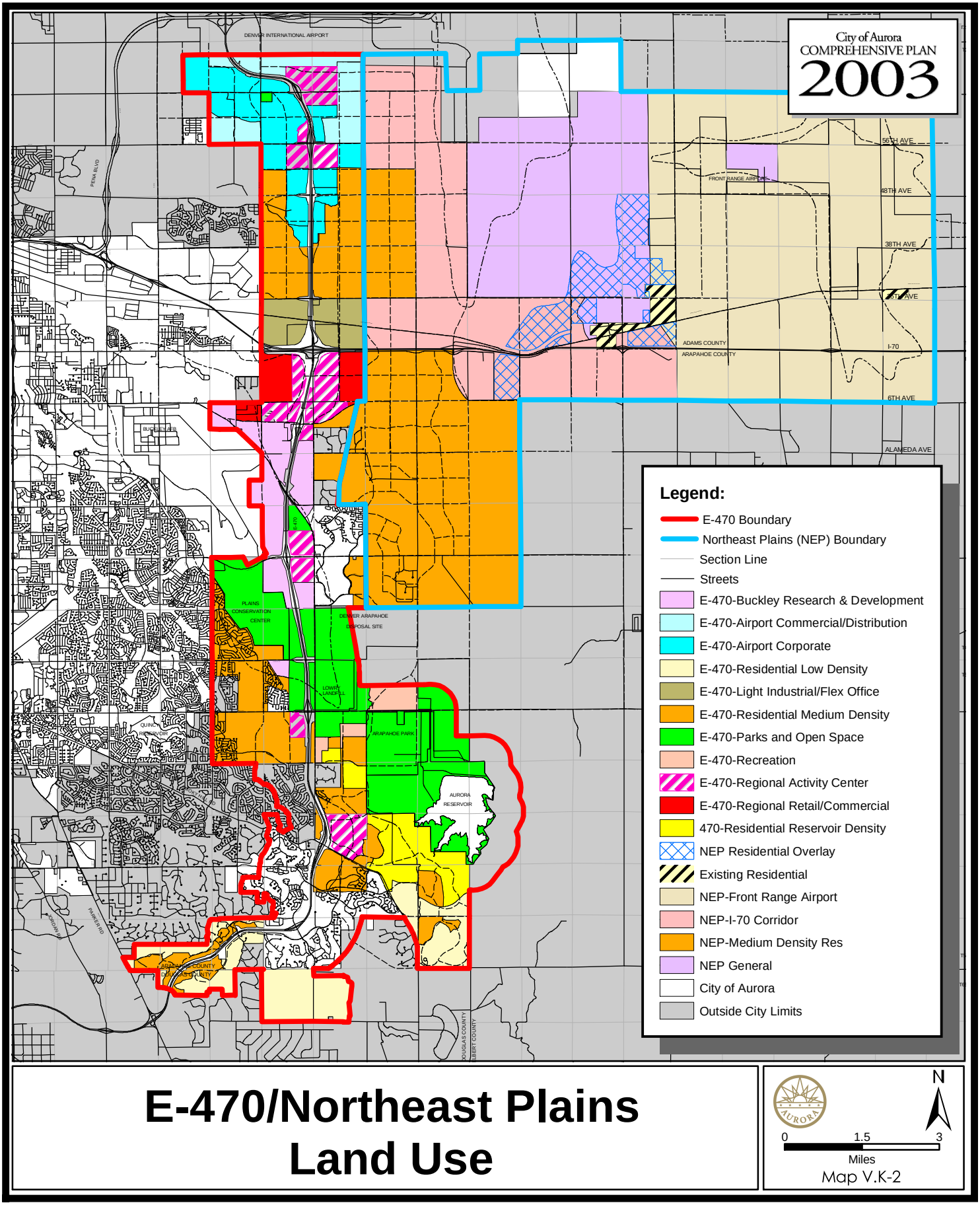
Drew Olson – PB
Mac Callison – Aurora
Curtis Eckhardt – sub to E-470
Monica Pavlic – FHWA

I-70/E-470 INTERCHANGE COMPLEX

Indirect Effects Panel Meeting
November 17, 2004

AGENDA

1. Introductions
2. Purpose of meeting
3. Summary of interchange concepts
4. Summary of research findings – interchange effects
5. DRCOG 2030 land use
6. Development activity in the area
7. Constraints to growth
8. Open discussion/specific panelist input



E-470/Northeast Plains Land Use

N

0 1.5 3

Miles

Map V.K-2

I-70/E-470 INTERCHANGE COMPLEX

Indirect Effects Panel Meeting
November 17, 2004

POTENTIAL CONTRAINTS TO DEVELOPMENT

The following is a discussion of some of the potential constraints to development within the E-470 Corridor. Data was obtained from the City of Aurora 2004 Adopted Budget, the City of Aurora Comprehensive Plan, 2003, the City of Aurora Capital Improvement Program, 2004, and the City of Aurora Utility Department. A summary of the main points of the text is provided in Section V of this document.

I. Water Supply

Aurora's water system has grown from a simple well field to a complex system of reservoirs, pipelines, and treatment plants delivering water from three major river basins and across the Continental Divide. Aurora receives 95% of its water supplies from snowmelt runoff. In 2003, Aurora's water supply was predominantly surface water diversions from the South Platte, Arkansas, and Colorado River basins. A total of 12 reservoirs and lakes serve approximately 300,000 people. Limited amounts of non-renewable, deep groundwater are also used to supplement the renewable surface water supplies during drought periods or as an interim water service before connection with the city's core water system.

The current levels of water demand are approximately 58,000 acre-feet per year. Aurora's water system currently has about 150,000 acre-feet of storage capacity. Water demand is expected to grow proportionally with population increases (1.8 percent per year). Aurora's Master Utility Plan includes future development in its capacity planning. Aurora's goal is to double storage capacity by the year 2030 to 300,000 acre-feet, which would meet projected water demand.

The city's existing water supply program was designed to meet customer demands with an operating reserve under average year hydrologic conditions. In the future, Aurora has chosen to design a system based on the premise that droughts will occur. This approach is better able to respond to multi-year droughts and will require greater investment into the system and additional water rights, storage, and delivery.

Because the city's master utility plan has anticipated the level of investment that will be necessary to support projected corridor development, water supply is not anticipated to constrain growth within the E-470 Corridor.

II. Water Treatment and Distribution

The city has two water treatment plants that deliver potable water that meets or exceeds all water quality standards. Existing facilities are anticipated to meet the water treatment demands of the community to 2010. At this time, the city plans to have a third water treatment plant up and running. Alone, this plant could eventually serve up to 200,000 people. With all three plants, the water treatment system could serve a population of 500,000.

The Metropolitan Wastewater Reclamation District provides a large portion of Aurora's wastewater treatment. Since 1968, the city has operated the Sand Creek Water Reclamation Facility as an advanced treatment plant for reclaimed water. This reclaimed effluent is used on city golf courses, parks, greenbelts, and the Aurora Municipal Center lawns for irrigation. An ongoing program of repair and replacement has kept the sewer system in excellent condition. The city is currently investigating the construction of a second reclamation plant to increase the amount of reclaimed effluent for irrigation. This plant would reduce the demand for potable water for irrigation.

Because the city's master utility and wastewater treatment plans have anticipated the level of investment that will be necessary to support projected corridor development, capacity for water treatment is not anticipated to constrain growth within the E-470 Corridor.

III. Water Plans, Programs, and Projects

The current drought's duration and severity has stressed the yields of the city's water rights portfolio and the storage capacity of the water supply system. Due to the relatively junior makeup of the city's water rights, reservoir storage levels have declined dramatically and reached historic low levels. In response, Aurora's 10-Year Capital Improvement Program includes land acquisition and pre-construction studies for two reclaimed water reservoirs and two treated water storage tanks. The city also intends to develop additional finished water storage reservoirs in the high areas along Smoky Hill Road as well as along the E-470 corridor.

The purchase of additional shares of Rocky Ford Ditch water is budgeted in 2004 and will add 5,100 acre-feet of water to Aurora's water supply portfolio. Other capital improvement projects budgeted in 2004 and beyond include various water acquisition and storage projects, water and sanitary sewer extensions and system improvements, reclaimed water system planning, and system security upgrades.

Aurora's four-point plan – new water supplies, new storage, conservation, and reclamation – is important factor in meeting existing and future water needs.

Aurora has comprehensively planned to meet the water needs of the existing and future population. Expansion of the existing system is provided for in the city's Capital Improvement Plan and thus supports the growth and development that is anticipated within the E-470 Corridor.

IV. Fiscal Considerations

Aurora's 2004 Adopted Budget takes anticipated city growth into account as a major factor for both planning and funding operations, as well as capital improvements. However, Aurora has been significantly affected by the economic downturn that began in 2001. As a consequence, numerous city services and projects have taken budget cutbacks that limit the city's ability to respond to growing demands for services in the face of limited revenue growth.

The Utility Capital Improvement Program provides funding for utility maintenance and expansion and is, therefore, less susceptible to General Fund budget cutbacks. As an "enterprise" fund, utilities are a pay-as-you-go system funded through a mix of user fee and tap fee increases. Revenue bonds are also used. Under this program, developers pay for added capacity and geographic expansion of the system and users pay for system improvements. As long as growth continues to occur as projected, expansion of utility services is likely to occur as planned.

The General Fund is the primary source of funding for most city operations and includes funding for operating costs related to public safety, public works, parks, and libraries. As the City continues to work on its long-term financial plan for 2005 and beyond, staff expects that reductions in these services may continue into the near future. In addition, significant increases in expenditures for any portion of the budget would likely place the City in a position where additional service reductions would be required.

Funding for utility maintenance and expansion is supported by development. As long as growth continues to occur as projected, expansion of utility services is likely to occur as planned. City services other than utilities are dependent upon the General Fund, which has experienced cutbacks in recent years. Outside of general services, therefore, fiscal considerations are not anticipated to constrain growth within the E-470 Corridor.

V. Summary

Aurora's water/sewer systems meet the needs of the existing population in normal years. The system is able to meet the needs of the existing population in abnormal years (drought) with the implementation of substantial conservation and reclamation efforts. Aurora's water program has been designed on the premise that droughts will occur.

Aurora acknowledges that substantial expansion of this system is critical for meeting the demands that will be generated by projected population growth within the city.

Aurora has extensive plans for achieving expansion of the water/sewer system to the year 2030. They have initiated a conservation and on-going drought management program and have included initial efforts for expansion of their system (such as land acquisition and reservoir pre-construction studies) in the 2004 budget and 10-Year Capital Improvement Plan.

While there may be significant fiscal constraints to providing general city services (e.g. libraries, police, parks), the Utility Capital Improvement Plan is an "enterprise" fund, where utilities are pay-as-you-go and are funded through a mix of user fee and tap fee increases. Under this program, developers pay for added capacity and geographic expansion of the system and users pay for system improvements. As long as growth continues to occur as projected, expansion of utility services is likely to occur as planned.

I-70/E-470 INTERCHANGE COMPLEX

Indirect Effects Panel Meeting
November 17, 2004

Summary of Growth along the E-470 Corridor

Historical Condition of the E-470 Corridor

Prior to 1990, the majority of the land along the E-470 corridor was used for agricultural, ranching and low-density residential purposes. The consistent topography in the vicinity of the I-70/E-470 Interchange accommodated predominantly agricultural and ranching activities. There were scattered residential buildings that were inhabited by farmers and ranchers who either owned their agricultural land or had sold or leased back portions to continue farming operations. The roadway network in the vicinity of the I-70/E-470 interchange was relatively undeveloped and consisted primarily of rural unpaved roads that served these low density and agricultural developments.

In 1987, land north of Colfax/I-70 was primarily used for agricultural purposes, with the exception of one farm residence and several farm related structures. Land south of Colfax/I-70 was also primarily used for agricultural purposes, with the exception of a mobile home park. The first segment of the E-470 Tollway opened in 1991 and by 2000, more substantial residential and industrial development had begun to occur in the area.

The Denver Regional Council of Governments (DRCOG) is an association of 51 local governments dedicated to addressing the most pressing issues facing the Denver region. DRCOG has worked closely with local governments to prepare an Urban Growth Boundary (UGB) that would reflect their expectations of growth within the Denver metropolitan regional context. The UGB distinguishes between land identified by local governments as urban, now and into the future, and land that is unimproved or rural. Mapping provided by DRCOG shows that prior to the construction of the E-470 Tollway, in 1980, the UGB included 2% of the land within the indirect effects study area. Following the construction of the E-470 Tollway, in 2000, the amount of land within the study area included in the UGB had increased to 10%. Year 2030 forecasts show 51% of the land within the indirect effects study area included in the UGB.

Existing Conditions of the E-470 Corridor

The predominant land use in the interchange study area is agricultural. About 75 percent of the land immediately adjacent to the I-70/E-470 Interchange is undeveloped. While still used for agricultural purposes, much of the study area consists of large parcels of land that are zoned for mixed-use purposes. There are several parcels of land in the northwest quadrant of the study area that consists of commercial, residential, and agricultural land uses. A portion of Buckley Air Force Base is located in the

southwest quadrant of the study area. One location on the eastside of the study area consists of industrial land uses. There are also several residential developments located outside of the interchange area.

In their comprehensive planning documents, Adams County, Arapahoe County, and the city of Aurora have identified the E-470 area along I-70 as a strong employment growth area. Due to this planned growth along the E-470/I-70 corridor, especially in the interchange area, land use is expected to change from agricultural to a higher intensity of land use including light industrial, regional retail, and regional activity center. These land use changes would most likely lead to an increase in property tax revenues and personal incomes for area residents.

Planned Development

Table 1 below summarizes planned development within the I-70/E-470 indirect effects study area. Data was obtained from the city of Aurora, Arapahoe County and Adams County in July of 2004.

Table 1: Planned Development within the I-70/E-470 Indirect Effects Study Area

Development Name	Type	Total Acres	Status	Description
Adonea	Residential	447.5	Planning stages	NW corner of Alameda Pkwy & Powhaton Rd. 1,545 dwellings.
Airways Park	Commercial/ Industrial	195	Planning stages	Smith Road and Tower Road. An industrial/business park with finished commercial and industrial sites. Platted and fully developed lots are available for immediate construction.
APS Site	Residential	100	N.A.	Between 6th Parkway and future 6th Avenue extension, east of Cross Creek. Site for high school and middle school.
Aurora Commerce Center	Commercial/ Industrial	162	Planning stages	Bordered by 26th Ave, E-470, Smith Rd., and Picadilly Rd. Business and light industrial, distribution. Targeted start date first quarter 2004, build-out over an eight-year time frame. Lauth Properties. Industrial warehousing.
Bounds Sell Coakes	Residential	444	Proposed	West of E-470, south of I-70. 3,263 dwelling units.
Buckboard	Commercial	N.A.	Inactive	South of 6th Ave. & 1/4 mile west of Picadilly Rd. From A-1 to E-470 corridor zone district region retail/commercial sub-area. Initial zoning.
Celtic IV parcel	Residential	323		Between Alameda Ave & future 6th Ave extension, approx. 1 mile east of E-470. Tarco/CLS.
Celtic V parcel	Residential	149		Between 6th Pkwy & future 6th Ave extension, approx. 1.5 miles east of E-470, US Home.
Celtic VI parcel	Residential	149		Between 6th Pkwy & future 6th Ave extension, approx. 1.5 miles east of E-470, US Home.
Cross Creek	Residential	218	Under construction	East of Gun Club Rd, south of 6th Ave. 1,070 dwelling units, commercial development, US Home.
EastGate Business Center	Commercial/ Industrial	295	Planning stages	NW corner of E-470/I-70. Light industrial and distribution warehouse. 3.5 million sq. feet of distribution space. Catellus.
EastPark 70 - Master Plan	Commercial	110	Planning stages	SW corner of Smith Rd & Himalaya Rd. Master plan for industrial park. Site plan for 9.5 acre phase 1 and a 28 lot subdivision plat.

Table 1: Planned Development within the I-70/E-470 Indirect Effects Study Area (continued)

Development Name	Type	Total Acres	Status	Description
Green Valley Ranch	Mixed-Use	2,212	Planning stages	Between 26th & 56th Avenues bounded by Picadilly & Powhaton Roads. In E-470 and NE plains zones, partial annexation and initial zoning. 11,200 residential units; 70% single family; commercial, retail, school, parks. Denver portion golf course community. Oakwood homes.
Majestic Commercenter	Commercial/ Industrial Office	1,000	Planning stages	I-70 and Tower Road. This offers tenants the prime warehouse/distribution location near DIA. Existing buildings total nearly 2 million sq ft and range from 50,000 to 280,000 sq ft and will have more than 15 million sq ft at buildout.
Northeast Plains	Residential	1,674	Proposed	East of Gun Club Rd, between Alameda Ave & I-70. 14,530 dwelling units.
Picadilly Electrical Substation CSP Flg No 1	Commercial	N.A.	Planning stages	East side of Picadilly Road, 300 ft north of Smith Road. CSP to allow the construction of a new electrical substation with waivers.
ProLogis Park 70	Commercial/ Industrial	182	Incomplete	The intersection of E-470 and I-70. Final development plan to revise design standards; Conceptual site plan and plat for a 276,113 sq. ft industrial building. There will be 2.9 million sq ft of distribution and warehouse space at build out. General Motors recently completed its new 404,928 square foot parts and distributiion facility.
Traditions	Residential	290	Planning stages	SE corner of 6th Ave & Harvest Mile Rd; NE corner of Harvest Mile Rd. & Alameda Ave. Conceptual site plan and plats for Single family detached lots. 1,064 Dwellings.
Wal-Mart at Gateway Park IV East	Commercial	N.A.	Planning stages	NW corner of I-70 & Tower Rd. For 212,313 sq ft supercenter including use approval for auto service and 5 pad sites and fuel dispensing use.

Projected Future Growth

Year 2030 population and employment forecasts provided by DRCOG reflect the planned development in the study area. Data comparing existing and forecasted population and employment within the study area is detailed in Table 2 below.

Table 2: Projected Future Population and Employment Within the Study Area

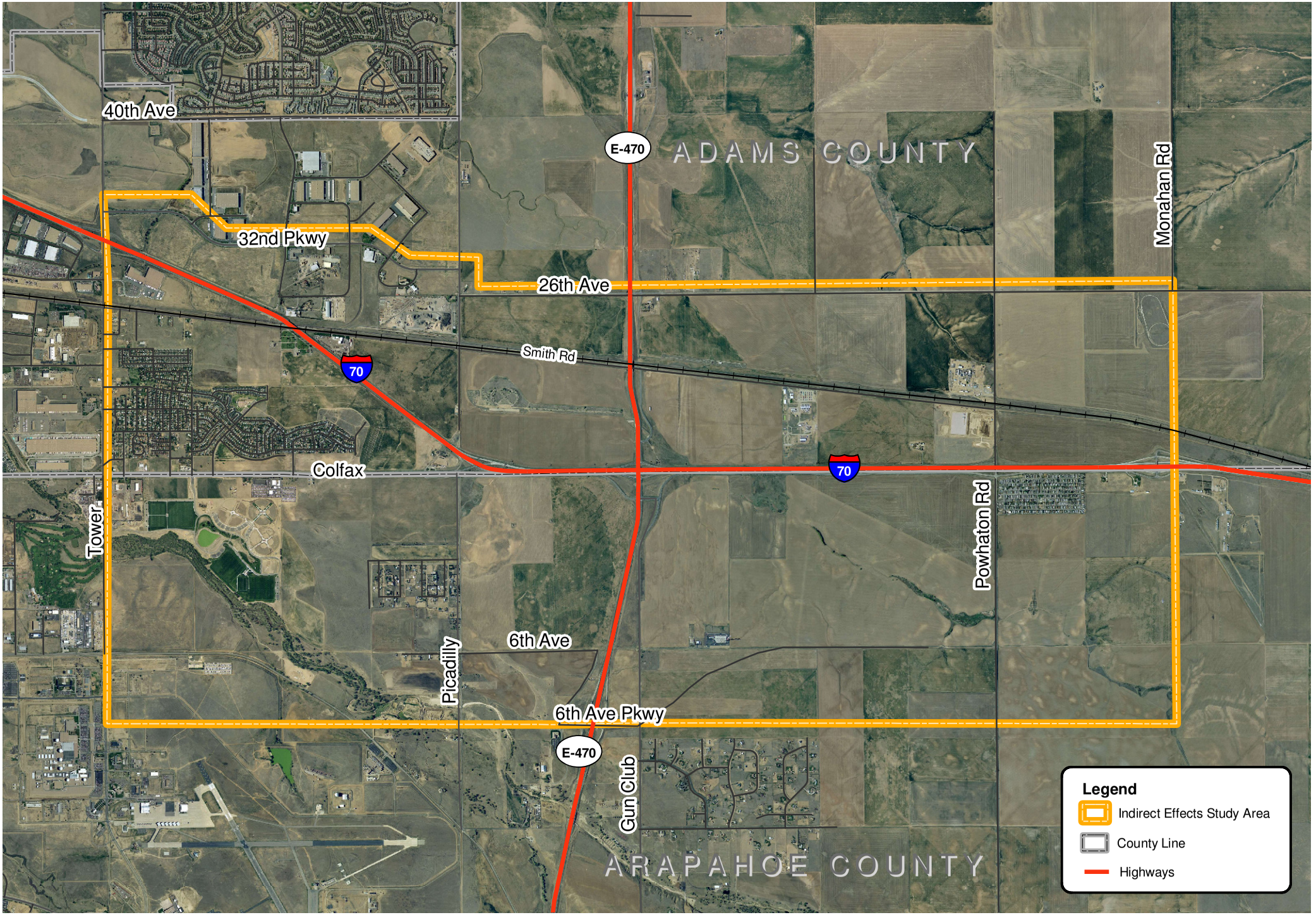
	2001	2030	Difference	% Change
Population	6,096	24,913	18,817	300%
Employment	1,253	28,115	26,862	2100%

Source: DRCOG, 2004

Future Transportation Network

As development occurs in Aurora, Picadilly and Harvest Mile will be built to provide access north and south through the study area. This street network will be built regardless of any interchange with I-70.

I-70/E-470 Interchange: Indirect Effects Study Area



Carter::Burgess

Consultants in Engineering, Architecture,
Planning and the Environment

MEMO

TO: Indirect Effects Panelists **DATE:** September 24, 2004

FROM: Shonna Sam

SUBJECT: Land Use Impacts of Transportation Projects **PROJECT NO:** 071218.302

COPIES: Larry Mugler, Jay Pierce, Sue Conaway, Jim Hayes, Dennis Champine, Deborah Lebow, Wendy Mitchell, Cecilia Joy, Dennis Heap, Gina McAfee, Troy Halouska, Shonna Sam, project file.

In February of 2004, Carter & Burgess conducted informal research regarding the land use impacts of transportation projects. This research involved a review of case studies and literature that addressed the relationship between land use and transportation projects. The impacts of several types of transportation projects were considered in this research including: new highways, highway widening, transit stations, and interchanges. The purpose of this memo is to summarize the findings of this research as they relate to the land use and economic impacts of interchanges.

Introduction

Transportation and land use have been studied together for several decades. Though there is general agreement that there is a correlation between transportation and land use, there are major discrepancies about exactly what that correlation is. Most studies and research projects approach the topic with a unique methodology and consider distinctive variables in their analyses. Some of the factors (other than transportation) that are found to influence land use change and economic development are listed below:

- Distance to a major city
- Distance to another interchange
- Accessibility to other regional markets
- Interchange design
- Traffic volume
- Parcel location
- Timing and completion of construction
- Economy
- Public attitude
- Zoning
- Previous land use
- Land availability
- Infrastructure

Land Use Impacts of Interchanges

The impacts of highway interchanges are highly localized. The extent of these impacts can vary greatly and are dependent upon a number of additional factors (such as those listed above) making it difficult to predict.

The figure that most researches use when studying the impact an interchange may have on an area is one-half mile. The effects of an interchange, however, may be seen miles away. For example, in one case study, a developer said that the decision to build a mall was influenced by the site's proximity to an interchange three miles away (Moses and Weisbrod, 2000).

In *The Development Impacts of Highway Interchanges in Major Urban Areas: Case Study Findings,* 2000, authors Wray, Moses, & Weisbrod describe several case studies -- four areas outside Pennsylvania, and three within the Philadelphia region. Each of these highway interchanges had varying impacts on their surrounding communities. Some were clearly essential in turning around distressed areas and encouraging economic growth, others did little to stimulate growth and revive a struggling economy, and some had a mix of significant positive and negative impacts. Conclusions from the case studies include the following:

- Interchanges between two highways have an effect on an area's access to nearby businesses and commercial markets.
- Improved accessibility can generate development pressures; natural and other land use limitations (zoning) can channel where such development occurs.
- The effects of an interchange in an industrial area can vary. Commercial sites are often redeveloped for commercial and office use if there is a strong demand from nearby communities for space.
- Areas that are distressed will not necessarily experience an economic upswing as a result of an interchange.
- The design of an interchange itself can have important implications for development potential in its vicinity.

Conclusions

While it is generally agreed that transportation investments and economic activity are positively linked, the nature of the relationship remains uncertain. The timing of land use impacts seems largely dependent on general economic conditions. Where capital is available and there is demand for new development in a city, greater impacts are likely to take place. Generally, there is a lack of data to accurately predict future trends in land use due to transportation improvements. The data that does exist varies widely in terms of the methodology that is employed and the variables that are considered.

Attachment C

I-70/E-470 INTERCHANGE COMPLEX

PURPOSE OF AND NEED FOR PROPOSED ACTION

Revised August 10, 2004

The proposed action is to ultimately construct new system-to-system (freeway to freeway) interchange ramps between the E-470 Tollway and I-70 in the metropolitan Denver-Aurora, Colorado area, while maintaining the service-to-system (arterial to freeway) access with I-70 . See Figure 1 for the regional vicinity location and Figure 2 for the project area. The project area includes the I-70 Interchange at E-470 and extends from the I-70/Tower Road Interchange on the West to the I-70/Air Park Road Interchange on the East, and along E-470 from the Sixth Parkway Interchange on the South to the 56th Avenue Interchange on the North. The Federal Highway Administration (FHWA) is the lead Federal agency for the NEPA process. The Colorado Department of Transportation (CDOT) is the lead applicant.

The purpose of the project is to link the freeway and tollway systems, I-70 and E-470, in an efficient and safe manner while maintaining and enhancing local access for the existing and planned roadway system and future travel demand. This will be accomplished while maintaining the integrity of the mainline Interstate roadway, particularly with regard to traffic safety and operations.

The need for the project is three-fold:

- Improve regional mobility-
  - The E-470 Public Highway Authority (PHA) in January 2003 completed the last link in the toll facility from I-25 and C-470 at the southern terminus to I-25 south of 160th Avenue at the northern terminus. E-470 provides a 47-mile tollway around the eastern portion of the Denver metropolitan area and provides major tollway access to Denver International Airport (DIA). E-470 serves the fast-growing Douglas, Arapahoe, and Adams Counties area, as well as major portions of the City of Aurora. I-70 is the major east-west interstate freeway in Colorado and is a strategic link in the nationwide highway network. The I-70 Freeway and the E-470 Tollway are major components of the transportation network serving the Denver metro area. Modifications to the freeway-to-freeway interchange ramp connections are needed to improve regional mobility and safety, and to serve forecasted traffic volumes.
  - Currently the I-70/E-470 ramp movements must pass through one or more of the four closely spaced signalized intersections. It is highly desirable to design an interchange complex that will satisfy both the freeway-to-freeway linkages, local access needs and that will accommodate future travel demands.

- Correct Roadway Deficiencies
  - Currently, E-470 in the project area has ramp movements passing through the closely spaced signalized intersections that do not meet AASHTO standards for

freeway to freeway connections. The planned Fly-By will grade separate the through E-470 roadways, but the substandard ramp connections will not be addressed. I-70 in the project area also has existing interchange deficiencies, including substandard weaving distances, a non-standard two-lane left hand exit ramp from I-70 westbound to Colfax, and substandard ramp acceleration and deceleration lanes at the Gun Club/ E-470 interchange. Presently, I-70/Colfax (US 40) has a partial interchange, missing the westbound entrance ramp. These interchange deficiencies on both E-470 and I-70 will contribute to increased safety risks as traffic volumes increase.

- Enhance Access for the adjacent land uses

    - The Denver Regional Council of Government's (DRCOG's) 2030 Transportation Plan forecasts a substantial amount of new development in the study area and surrounding areas. It is anticipated that the demand on the existing arterial network will be significantly greater than the existing arterial network capacity.
    - Maintaining arterial access and access for the adjacent land uses to the freeway network is critical since the portion of the City of Aurora surrounding the existing I-70 interchange with E-470 and Gun Club Road includes substantial land areas under development. Immediately north of I-70, light industrial uses and distribution centers are developing. The City of Aurora Comprehensive Plan and current zoning depicts major regional retail, commercial and residential development on adjacent properties south of I-70. Aurora's Comprehensive Plan includes major arterial roadways west and east of E-470 at Picadilly Road and Harvest Mile Road, as well as arterials that parallel I-70 on the north and south side of the Interstate highway.
    - The linkages between I-70 and E-470 with the existing and planned arterial network in the project area are also vital to service the existing and proposed commercial and residential developments of Northeast Aurora. To avoid confusion to drivers and complex traffic operations, separation of service access from the freeway-to-freeway interchange is desirable.

Attachment D

I-70 / E-470 Interchange Complex Alternatives

1. No Action (includes Fly-By)
2. Congestion management
3. I-70 / E-470 Interchange reconstruction, retaining Gun Club access
    a. Fully directional connections
    b. Fully directional with a loop connection for east-to-north movement
    c. Colfax ramp modifications
4. I-70 / E-470 Interchange reconstruction, retaining Gun Club / I-70 ramps, adding Picadilly interchange
5. I-70 / E-470 Interchange reconstruction, retaining Gun Club / I-70 ramps, adding Harvest Mile interchange
6. I-70 / E-470 Interchange reconstruction, closing Gun Club and building a new interchange at Picadilly
    a. Concept A – retain Colfax connections to/from East, add Picadilly ramps to/from West (half diamond)
    b. Concept B – close Colfax ramps, add full diamond at Picadilly
    c. Concept C – close Colfax ramps, add partial cloverleaf at Picadilly
7. I-70 / E-470 Interchange reconstruction, closing Gun Club and Building a new interchange at Harvest Mile
    a. Concept A – full diamond at Harvest Mile
    b. Concept B – Partial cloverleaf at Harvest Mile
8. I-70 / E-470 interchange reconstruction, closing Gun Club and Building two new interchanges at Picadilly and Harvest Mile
9. Colfax – Picadilly intersection options
    a. Concept A – realign Colfax into Picadilly North / I-70 interchange (T intersection with Picadilly South, T intersection south frontage road with Picadilly South)
    b. Concept B – realign Colfax as continuous E-W arterial south of I-70

E-470/I-70 Interchange
Indirect Effects Expert Panel

September 24, 2004

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E-470 INTERCHANGE I-70

Project Schedule