9.0 INDIRECT AND CUMULATIVE IMPACTS

This chapter identifies the potential indirect and cumulative impacts that could occur with implementation of the Central Corridor Light Rail Transit (LRT) Project.

Section 9.1 introduces the concepts of indirect and cumulative impacts, and how and why the analysis is done.

Section 9.2 presents the methods used to decide what data was needed, how it was collected, and how it was analyzed. This section also describes some general trends in the study area and provides a table of the significant and reasonably foreseeable future projects in the study area. Finally, this section demonstrates how each topic was selected according to its potential for indirect and cumulative impacts.

Section 9.3 presents a discussion of potential indirect impacts for each topic and a discussion of cumulative impacts.

Section 9.4 summarizes the potential indirect and cumulative effects of the Central Corridor LRT project and lists available mitigation measures that could be applied where indirect and cumulative impacts may occur.

Section 9.5 summarizes the project's approach to assessing potential impacts associated with climate change and discusses future uncertainty associated with climate change.

9.1 Introduction

This section provides an analysis of indirect and cumulative impacts and describes the potential for indirect effects and cumulative impacts from the Preferred Alternative in combination with other past, present, and future actions. Direct impacts of the proposed project are discussed in the previous chapters of this Final Environmental Impact Statement (FEIS). These are defined by the Council on Environmental Quality's (CEQ) regulations (40 Code of Federal Regulations (CFR) 1500–1508) as effects "which are caused by the action and occur at the same time and place (40 CFR 1508.8)." The same section of the CEQ regulations defines indirect effects as those that are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Further:

> 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 and water and other natural systems, including ecosystems.

Examples of indirect effects include new development and land use changes such as residential, commercial, and industrial development (or redevelopment) that could occur due to transit improvements. They also include the associated changes in population density from additional residents and labor, and any effects to natural features from the land use change. When an improvement action enables indirect effects, it does not directly cause the change but, along with other factors, helps to provide more opportunities for change.

Cumulative impacts are not causally linked to the Preferred Alternative, but are the total effect of actions with similar impacts in a broader geographic area. The purpose of a cumulative impacts analysis is to look for impacts that may be minimal and therefore neither significant nor adverse when examined within the context of a single proposed action, but that may accumulate and become both significant and adverse over a large number of actions. The CEQ regulations define cumulative effects as:

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

The Central Corridor LRT project may cause indirect and cumulative impacts through improvements to transit service and mobility. It is important to note that transportation improvements are but one of the many factors that influence land-use decisions and development patterns. Other factors that influence land use include the supply and demand for developable property (which is a fixed resource), institutional factors such as land-use controls (zoning and subdivision regulations for example), and the economic health of the community. For development and redevelopment to occur, demand for developable property, supplies of developable property, and institutional requirements must be compatible and must be present at the same time and place. The Central Corridor study area (Figure 1-1) has demonstrated that this is the case—some redevelopment has occurred.

The following discussion of indirect and cumulative impacts is based on the information presented in previous sections of this FEIS, with implementation of the Preferred Alternative.

9.2 Methodology

9.2.1 Study Area Definition

The FEIS typically uses an area of 0.5 mile on each side of the project alignment to study effects on most resources. The indirect and cumulative impacts analyses, however, require a somewhat broader geographic area to be considered. This allows the indirect effects that occur at a distance from the project and the combined effects of reasonably foreseeable future projects to be considered. These analyses also allow the analyst to take into account political and natural resource boundaries. For this analysis, the study area was expanded to include an area of about one mile on each side of the Preferred Alternative alignment.

9.2.2 Time Frame

Many of the potential impacts considered in this analysis are related to direct effects of changes to and intensification of, land use and associated infrastructure. Cumulative impacts analysis suggests considering past conditions and activities and present day actions, as well as reasonably foreseeable future changes. In general, past conditions and activities have been addressed under existing conditions; therefore, this analysis starts with existing conditions and includes foreseeable developments to the year 2030. The year 2030 represents the current extent of transportation and land-use planning in the Twin Cities metropolitan region, as well as available demographic forecasts and analyses.

9.2.3 Factors Considered

The following factors were taken into account in the analysis of the potential for indirect, and, especially, cumulative impacts:

- Existing condition of each potentially affected resource and how it has been affected by other actions (public or private) described in the previous chapters of the FEIS
- Impacts from the Preferred Alternative on the resources described in the previous chapters of the FEIS
- Present actions and reasonably foreseeable future actions and their possible impacts on the resource
- Potential for indirect impacts on the resource including special designations or standards that relate to the resource, ongoing regulatory authority, policies and plans that afford some measure of protection to the affected resource, and measures that could avoid or minimize negative effects on the resource
- Potential for cumulative impacts on the resource including special designations or standards that relate to the resource, ongoing regulatory authority, policies and plans that afford some measure of protection to the affected resource, and measures that could avoid or minimize negative effects on the resource
- Status/viability and historical context of each potentially affected resource and how these may affect the potential for indirect and cumulative impacts

9.2.4 Existing Conditions and Development Trends

Much of the Central Corridor is being redeveloped and revitalized with a mix of uses—some of the recent and ongoing development has been done in anticipation of the implementation of the proposed Central Corridor LRT (an indirect effect) and in accordance with local plans

that encourage higher density near proposed station locations. As a result, in some areas where once there were only cultural, industrial, and institutional uses and buildings, populations of residents and employees mingle in mixed-use neighborhoods. Buildings that previously had primarily industrial or commercial uses now have numerous multifamily units (condominiums and apartments), which are the result of redevelopment activities. Activities in the development and redevelopment sector can be described as infill, intensification of land use, and integration of commercial and residential uses in revitalized neighborhoods. Some vacant lots in commercial districts are being filled with new businesses, some parking lots are being developed into new retail spaces or parks, and new community gathering places, such as the Rondo Community Outreach Library, are bringing new focus to old neighborhoods.

The Central Corridor is also the home of “hundreds of nonprofits” including Minnesota Health and Housing Alliance, YMCA-Midway Branch, HealthEast Foundation, and Children’s Miracle Network of the Upper Midwest (Minneapolis-St. Paul Business Journal, January 2008).

Since 2000, 12,900 residential units have been completed or are under construction in the Central Corridor and another 7,000 are proposed and approved by the two cities. The University of Minnesota – Twin Cities Campus (U of M) began development of its East Gateway District campus expansion in 2005, and to date has completed or has under construction five new research buildings and TCF Bank Stadium, which will be open by September 2009 (U of M Presentation to Central Corridor Management Committee, December 13, 2006). East Gateway district campus development will continue beyond 2009. Table 9-1 presents the population changes that are expected to take place through 2030 as these business and residential development and redevelopment trends continue, which is indicative of the indirect and cumulative effects of the Central Corridor LRT Project.

Table 9-1 Past and Future Population Growth by Project Segment

Planning Segment	Population				Households			
	1990	2000[a]	Projected 2030[b]	Percent Change From 2000	1990	2000	Projected 2030	Percent Change From 2000
Downtown St. Paul	5,455	7,320	16,060	119	2,509	3,560	8,430	137
Capitol Area	5,915	5,820	7,820	34	2,633	2,580	3,460	34
Midway East	42,826	45,500	51,360	13	16,542	16,630	18,740	13
Midway West	17,816	18,110	23,610	30	7,220	7,330	9,750	33
University	28,901	32,670	37,500	15	10,292	10,940	13,330	22
Downtown Minneapolis	18,601	19,850	31,870	61	11,231	11,040	19,620	78
Total	119,514	129,270	168,220	30	50,427	52,080	73,330	41

[a] State of Minnesota's Department of Administration, Land Management Information Center

[b] Year 2030 population and household projections are derived from Traffic Analysis Zone (TAZ) data provided by the Metropolitan Council, which are based on Census 2000 numbers. In order to project the population and number of households by planning segment, the TAZ within the study area were overlaid with the previously identified planning segments. The existing total and future projected totals for population and households were summed for that area. When overlap with other planning segments occurred, the entire TAZ was allocated to the planning segment that contained the majority of the TAZ land area.

9.2.5 Anticipated (Reasonable Foreseeable Future) Actions

The actions listed in Table 9-2 and discussed in the remainder of this chapter include development currently anticipated in state, county, and city plans, known private development actions, and planned and funded roadway and other infrastructure projects in, or within an area of influence of, the six planning segments. Because specific details about possible land development proposals are not comprehensively available for the geographic area and time period covered by this analysis, a general description of the type and amount of development as anticipated in county and local land use plans is used. Data used in Table 9-2 was obtained from the Metropolitan Council, city and county plans, the State of Minnesota, and from interviews with city, county, and regional officials. Additional information was also obtained from various sections of the Metropolitan Council's *Central Corridor LRT Draft New Starts Application* (September 4, 2008), and internet searches.

The FEIS identifies numerous current and future projects that would contribute to cumulative effects (Table 9-2). The overall effects of these actions are incorporated in the analysis of impacts on individual resources in Section 9.3 and Table 9-3, which presents impacts from the past, present, and reasonably foreseeable future projects that may interact with the project in such a way as to cause cumulative potential effects.

Table 9-2 Reasonably Foreseeable Future Actions

Location and Action	Description of Action
Federal and State Actions	
U.S. Highway 52 Bridge reconstruction	- The Minnesota Department of Transportation (MnDOT) intends to reconstruct the Lafayette Bridge (State Trunk Highway 52). - The structure would be expanded from two lanes in each direction to three lanes in each direction. - Construction is expected to begin in 2010 with completion in 2012.
Washington Avenue Bridge retrofit	- Hennepin County, MnDOT, and the U of M are evaluating the proposed structural strengthening of the outside columns supporting the upper (pedestrian) deck of the Washington Avenue Bridge to make it less prone to catastrophic collapse in the event of a structural failure. - Construction work associated with this project is anticipated to be completed in 2009.
County Actions – Hennepin County	
Target Field ballpark (between 5th Street and 7th Street and southeast of the Burlington Northern Santa Fe (BNSF) Railroad) "North Loop Village" (bounded by the BNSF Railroad and Washington, Glenwood, Royalston, and 3rd Avenues)[q]	- Twins ballpark ($522 million) with 41,875 seats - Multimodal Station served by Hiawatha LRT and Northstar Commuter Rail - Phase A (beginning 2010): North of 5th Street to Washington Avenue: - - 1,250 residential units in nine buildings - A 230-room hotel in one of the buildings - 120,000 sq ft of office space - 45,000 sq ft of retail - Below ground parking for 1,000 cars - Phase B: Between 7th Street and Glenwood/Royalston intersection - - 1,000 residential units - 142,000 square feet of retail - Below ground parking for 2,100 cars
County Actions – Ramsey County	
Union Depot Intermodal Transit Facility	- The Federal Highway Administration (FHWA), MnDOT, and Ramsey County are evaluating the proposed conversion of a portion of Union Depot to serve as a regional intermodal transit facility.
Ramsey County-owned Kellogg and Wabasha site redevelopment[b]	- 6 acres owned by Ramsey County for sale to developers - Redevelopment of adult detention center and former West Publishing sites - Two development proposals under consideration (as of 12-7-07); both propose condominiums, hotel, and office uses
Union Depot redevelopment	- Over the next decade, Union Depot will be transformed into a regional transit hub and focal point of the Lowertown neighborhood

Location and Action	Description of Action
Snelling/University Area Capacity Improvements[t]	- Snelling/University area capacity improvements to accommodate future growth to year 2030. - Cooperative study by Ramsey County Regional Railroad Authority, Ramsey County Public Works, St. Paul Public Works, MnDOT, and Metropolitan Council/Metro Transit.
City Actions – St. Paul	
Hmong Market Garden establishment[a]	- New public square and open space is envisioned between Arundel and Marion streets - Establish the focal point of proposed World Cultural Heritage District
Dale Street Village – active senior housing development	- City of St. Paul redevelopment northeast corner of University and Dale intersection - Will implement the *University-Dale Transit Oriented Development (TOD) Study*—first time a TOD plan will be implemented - Four-story development - Approximately 20,800 sq ft of commercial space - 46 units of affordable housing on second, third, and fourth floors.
Lexington-Chatsworth Block open space development[a]	- Opportunity for open space to provide a focus for infill development - Expected to provide identity to the cluster of cultural uses in the area
Dickerman Park reconstruction[a]	- Reconstruction is proposed for a significant open space and improved meeting place along the Central Corridor at University Avenue and Fairview Avenue - Expected to establish an identity for the area and create a focus for local area residents and workers - Funding received from Dickerman family members; City of St. Paul has recommended $30,000 in Neighborhood Sales Tax Revitalization (STAR) grant funds
Raymond Village Park development[a]	- Potential redevelopment may consider a new open space in the northeast quadrant of the intersection of Raymond and Charles avenues (currently used as a parking lot). - Expected to create an outdoor community meeting place, public art venue, and provide a focus for new buildings that face Charles Avenue
University Avenue Park at Raymond development[a]	- A new green space is envisioned on the north side of University Avenue approximately ½ block west of its intersection with Raymond Avenue. - Venue for public art and open space - Expected to create a focal point for new development
Public spaces in the Marketplace development[a]	- Public spaces internal to the block and along the corridor proposed - Spaces expected to provide a focus for new development

Location and Action	Description of Action
Lexington University Development Block mixed-use development[b]	- The large block located at the southwest corner of University Avenue and Lexington Parkway will be undergoing extensive changes over the next few years. - New retail - Relocation of the Wilder Foundation - Planned new residential
Lexington Park development[a]	- A new green space is envisioned in the vicinity of the intersection of Lexington Parkway and University Avenue - A new green space would act as a focus for new development.
Rondo Square park development[a]	- An opportunity for new open space could be incorporated as part of future redevelopment of Unidale Mall - Across from the Rondo Community Outreach Library - Act as a focus for redevelopment and a gathering place for the community
Fitzgerald Park development[a]	- New open space - Will act as the activity center of the emerging Fitzgerald Park neighborhood - Help focus development
Mears Park development[a]	- Continued investment in Mears Park in Lowertown is expected to provide green space for this growing neighborhood
Episcopal Homes Park development[a]	- Create access from University Avenue to stormwater management pond and related open space
Pierce Butler eastern extension of the Granary Road [s]	- Pierce Butler eastern extension of the Granary Road proposal, - Will help create an industrial parkway district, as well as a greenway/stormwater collector - Part of the St. Paul Central Corridor Study
Kittson Street Connection[r]	- Kittson Street connection between Warner Road and University Avenue in downtown St. Paul - Possibility of connections to 4th and 5th Streets
Minneapolis Park and Recreation Board	
Greenway-Grand Rounds Scenic Byway Connection	- Grand Rounds Missing Link route alignment approved on Sept. 3, 2008[f] - The approved plan will connect East River Parkway with St. Anthony Parkway providing Northeast and Southeast Minneapolis and adjoining communities access to parks, trails, paths and green space[f] - Estimated to be completed over 10 years at a (preliminary) cost of $105 million[e]
East River Parkway extension	- Planned trail reconstruction along East River Parkway - Plans include replacement of the pedestrian pathway south of Franklin Avenue to the south city limits, and reconstruction of both pedestrian and bike trails north of Franklin Avenue to approximately 1,200 ft north of the intersection of East River Parkway and Fulton Street SE[k]

Location and Action	Description of Action
City Actions – Minneapolis	
Urban Partnership Agreement (UPA) Project	- Funding for reconstruction - Dual bus lane operations along 2nd and Marquette avenues in Downtown Minneapolis—both of these avenues intersect with 5th Street LRT operations - To be completed by the end of 2009
Minnesota Vikings Stadium	- May require state, county, city, and private action. Site would include mixed-use office/retail/entertainment complex. Includes blocks around Downtown East station[c]
Southeast Minneapolis Industrial (SEMI) lands redevelopment – mixed-use development	- A mix of residential, commercial, office and light industrial - Focus of intense job growth in partnership with U of M, north of Intercampus Transitway and west towards campus[d]
Washington and Nicollet mixed-use development[b]	- Nicollet hotel block - City Request for Proposal (RFP) out for 1.7-acre site purchased by city - Joint development site
U of M Bike Trail extension	- Extend the U of M Bike Trail across Bridge 9 eastward to Dinkytown[l]
Granary Park development	- SEMI Refined Master Plan recommends developing a major park with ponds and recreational amenities at the natural low elevation point in SEMI[g]
Granary Road development	- Granary Road is part of the plan for the Southeast Minneapolis Industrial/University Research Park (SEMI/URP) plans[h] - Still in the conceptual stages, Granary Road would be located on the south side of the proposed Granary Park. Although it is planned for both trucks and local traffic, it is designed to be narrow – 26 ft wide – and speeds are intended to be kept low[i].
27th Avenue Amenity Link and stormwater management strategies[j]	- SEMI refined master plan recommends extension of existing 27th Avenue SE - Bridal Veil main stem replacement and linear wetlands - 4th Street urban wetlands - Rain gardens and biofiltration systems
University of Minnesota Actions	
TCF Bank Stadium at U of M	- $288 million TCF Bank Stadium - The 50,000-seat on-campus horseshoe-style stadium is under construction and planned to be completed for the 2009 football season - Will be used for classes and administration offices as well as for games

Location and Action	Description of Action
East Gateway District research park development[m] U of M Campus	- 65-acre site (including TCF Bank Stadium)[n] - Eight to 10 new research buildings—one to be built every two years - A total of 750,000 sq ft was authorized in 2006 (including medical biosciences building, which is under construction) - Includes multimodal transportation hub (near Central Corridor LRT station) - $310 million bond - Attracts $20 million/year in new research dollars
Multimodal transportation hub development U of M Campus	- Potential for a mixed used activity center around the station that could incorporate bus transfer, parking, bike center, retail, entertainment, housing, and U of M academic programs including transportation studies[o]
Private Actions	
10th and Minnesota The Penfield mixed-use, condo/hotel development[b]	- Potential for 200 market-rate rental units - 160-room Hyatt Place hotel - 30,000 sq. ft. Lund's Grocery store - Redevelopment of 2-acre Department of Public Safety and St. Paul Police site - $80 million development
69 W. Exchange St. Joseph's Hospital expansion[b]	- Large 5-story expansion of current 401-bed hospital in St. Paul - $100 million expansion on 15-acre site with more patient space, expanded emergency dept., new heart and neuroscience centers - Development from 2005 to 2010 – ongoing
Campus Crossroads mixed-use development[p] Washington Avenue between Oak and Ontario streets	- Eight-story building near U of M East Bank - 175 apartments - 25,000 sq ft of retail space - Includes a fitness center, study and game rooms, and a cyber café - Opus Corporation expects completion by Fall 2010
932 12th Ave. S Project for Pride in Living Housing residential development[b]	- Van Cleve Court (2.93 acres); the site is occupied by a vacant grain elevator, silos, and offices owned by Bunge Elevator Company - The developer intends to demolish the existing buildings and construct 100 homeownership units and 90 rental units - Affordable housing will make up 20 percent of the homeownership units and nearly all of the rental units
4th St. and Marquette mixed-use development[b]	- Redevelopment of Powers/Ritz block with 250 condos and office or hotel with first floor retail - Hiawatha LRT Nicollet station expansion to accommodate redevelopment
219 Third Ave. N Monte Carlo site mixed-use development[b]	- The Pacific – 80 homes on the Monte Carlo block with a 150-room upscale hotel, retail and rentals; 325 to 400 condominiums, 150 to 225 rental apartments, and 60,000 to 80,000 sq ft of retail space - Another 25-story residential tower in future

Location and Action	Description of Action
240 Hennepin Ave. S residential development[b]	- Two high-rise residential towers (24 and 32 stories with 505 dwelling units) and rooftop gardens
Washington/Hennepin/ N. 2nd Street The Market Place – residential development[b]	- Whole Foods grocery, retail space, 1.25-acre green space - 76,000 sq ft grocery; 6,500 sq ft retail - 35-story condo tower, with retail and grocery; includes four- and eight-story buildings. - On Jaguar site northwest corner of Hennepin and Washington avenues
719 Hennepin Ave – Skyway Theater Tower - residential development[b]	- 300 dwelling units
88 S. 10th St., 10th and Nicollet to 1009 Nicollet Avenue The Nicollet residential development[b]	- Street-level commercial (18,000 sq. ft.) with housing above - 50-floor condominium; 1/3 pre-sold by Dec. 2005 – has been put on hold while developers bring in a new partner to study a mixed-use project
1367 Willow and 1368 LaSalle Ave. – Eitel Hospital Site/Allina – mixed-use development[b]	- 275 condos in 39-story building - 215 apartments in 5-story building with street-level retail on park
315 1st Ave. NE Superior Plating Site residential development[b]	- Future residential tower
New mixed-use developments in the Marketplace (Urban Villages)[b]	- Several sites exist where both uses and intensity can be added to the marketplace. These include the site of the former Metro Transit bus barn and the former parking lot of the Target big-box store - This area is adjacent to the site of the new western district police station

[a] Central Corridor Development Strategy, Section 2.4, 90 Initiatives for the Corridor, City of St. Paul, April 2007.

[b] Attachment 11-B, Development Projects – Minneapolis/St. Paul Central Corridor, Constructed or Proposed 2000-2006. Metropolitan Council, January 17, 2008.

[c] Land Use Planning – Central Corridor LRT in Minneapolis: www.metrocouncil.org/transportation/ccorridor/CAC/CACMplsLandUsePlansMay172007.pdf

[d] Land Use Planning – Central Corridor LRT in Minneapolis: www.metrocouncil.org/transportation/ccorridor/CAC/CACMplsLandUsePlansMay172007.pdf

[e] Missing Link Development Study Report, Minneapolis Park and Recreation Board et al, May 21, 2008. http://www.minneapolisparks.org/documents/design/missing/CAC_study.pdf

[f] Minneapolis Parks and Recreation Board Web site: http://www.minneapolisparks.org/default.asp?PageID=996.

[g] City of Minneapolis & Minneapolis Community Development Agency, SEMI Refined Master Plan, May, 2001, pages 32-33.

[h] Southeast Minneapolis Industrial/University Research Park (SEMI/URP), City of Minneapolis Community Planning and Economic Development and Public Works. http://thegrandrounds.com/documents/design/missing/road_development.pdf

[i] City of Minneapolis & Minneapolis Community Development Agency, SEMI Refined Master Plan, May, 2001, pages 32-33.

[j] City of Minneapolis & Minneapolis Community Development Agency, SEMI Refined Master Plan, May, 2001, pages 35.

[k] News from Cam Gordon, Council Member, Second Ward, March 2008. http://www.ci.minneapolis.mn.us/council/ward2/

[l] Second Ward, Minneapolis, http://secondward.blogspot.com/2008/02/bridge-9-extension.html

[m] U of M Twin Cities Campus and the Central Corridor: Upcoming Developments, Preferred Alternatives, and Design Principles, Presentation to Central Corridor Management Committee, December 13, 2006.

[n] UMN news: U of M Regents hear plan for future of Northrop Auditorium, new East Gateway campus district. News Releases 2/9/2007.

[o] www1.umn.edu/pts/graphics/UofM_LRT_Design_050207.pdf, slide 26/30

[p] http://www.startribune.com/business/22796419.html

[q] North Loop Village: A New Urban Development, http://www.twinsballpark.org/vertical/Sites/%7B5C9093EC-4FFF-49F4-90B7-6CBB0269E792%7D/uploads/%7B0AD71CD5-73F0-49A4-9212-62882A149283%7D.PDF

[r] Report of the Diamond Product Task Force, December 16, 2005. http://www.stpaul.gov/DocumentView.asp?DID=3101

[s] Center for Transportation Studies, University of Minnesota, July 2003. St. Paul Central Corridor Study: Pierce Butler Industrial Redevelopment Plan. Pages 1-2.

[t] Metropolitan Council, 2007. Snelling-University Capacity Study. http://www.metrocouncil.org/transportation/ccorridor/CCMC/SnellingUnivStudyMar07.pdf

9.2.6 Resource Identification

Table 9-3 presents brief descriptions of the potential for indirect and cumulative effects of the following environmental resources:

- Land use and socioeconomics
- Neighborhoods, community services, and community cohesion
- Cultural resources
- Parklands and recreation areas
- Visual quality and aesthetics
- Environmental justice populations
- Water resources
- Economic conditions
- Station area development
- Transit effects
- Hazardous/regulated materials
- Roadways
- Other transportation facilities and services
- Greenhouse gas emissions (GHG)
- Section 4(f) properties

9.3 Potential for Indirect Impacts and Cumulative Effects

The resources selected for analysis in the indirect and cumulative impacts chapter met one or more of the factors considered and listed in Section 9.2.3. The potential effects are shown in Table 9-3.

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Table 9-3 Potential for Indirect Impacts and Cumulative Effects

Resource	Existing Condition and How It Has Been Affected by Other Actions	Impacts from Preferred Alternative	Present and Reasonably Foreseeable Future Actions Possible Impacts	Potential for Indirect Impacts	Potential for Cumulative Impacts on the Resource
Land use and socioeconomics	The University Avenue corridor is traditionally nonresidential and, for retail and business use, is often considered first when siting a business. As described above, multiple public and private actions have been undertaken in the corridor. The large stock of old warehouses, however, continues to present redevelopment opportunities not associated with Central Corridor LRT. The large stock of historic buildings such as warehouses and distribution structures has, in part, also spurred development of the Lowertown neighborhood in downtown St. Paul over the last 25 years. Adaptive reuse of the warehouse and distribution structures has led to a mix of housing, offices, retail stores, services, high tech firms, art galleries, and other uses.	Although two nonresidential properties, including a portion of the Diamond Property site to be used for the Operations and Maintenance facility (OMF), will be taken, generally speaking, the Preferred Alternative will not affect existing land uses. No residential relocations will be necessary. A total of 24 access impacts will occur. These include driveway access impacts along 4th Street between Wacouta and Broadway streets, and curb cuts on Cedar Street and on University Avenue between Marion and Robert streets. In addition, the Central Presbyterian Church alley access will be limited. These driveways will be closed unless no other alternative means are available for accessing the property, in which case, vehicles will be allowed to cross the LRT tracks to and from the driveway. See Section 3.3 for further details.	As described in Table 9-2, multiple public and private actions have been planned to take place in the corridor—none of these are part of the Preferred Alternative. Of particular note are U of M development activities, Minneapolis' plans for SEMI lands,[b] and Union Depot redevelopment. The City of St. Paul *Central Corridor Development Strategy* (CCDS) (April 2007) contains a Resources for Implementation Strategy that outlines ways to fund public infrastructure, housing, and other improvements proposed in the plan. Pierce Butler eastern extension of the Granary Road proposal, will help create an industrial parkway district, as well as a greenway/stormwater collector.[g]	Implementation of the Preferred Alternative is expected to encourage the market to continue current development and redevelopment trends in the corridor. In effect, the Preferred Alternative will encourage implementation of Minneapolis and St. Paul land-use plans, TOD proposals, and economic development initiatives. Not all of those plans would be implemented adjacent to the Central Corridor LRT corridor and none of them are part of the Preferred Alternative. The expected changes in intensity and density of land uses around the proposed station sites will be among the long-term effects on the corridor.	The Preferred Alternative's indirect effects, in combination with the multiple public and private developments in the Central Corridor LRT corridor, will have mostly positive cumulative effects including economic and development effects.

Resource	Existing Condition and How It Has Been Affected by Other Actions	Impacts from Preferred Alternative	Present and Reasonably Foreseeable Future Actions Possible Impacts	Potential for Indirect Impacts	Potential for Cumulative Impacts on the Resource
Neighborhood, community services, and community cohesion	The FEIS documents existing development and current opportunities for infill and redevelopment within a half-mile radius of each potential station.[a]	The greatest potential for neighborhood traffic changes is along Washington Avenue through the U of M campus (University/ Prospect Park segment). Median closures proposed in some locations along University Avenue (Midway East, Midway West, University/Prospect Park segments) may make it more difficult, at times, to cross University Avenue in a car. Access to opposite side property will be more circuitous at intersections that allow right turn only. However, overall operation of the roadway may be improved with implementation of the Preferred Alternative. Signalized and unsignalized intersections will be provided with pedestrian crossing amenities to ensure LRT tracks and stations will not divide the neighborhoods/ communities. Illegal pedestrian crossings of University Ave. between legal crosswalks will be strongly discouraged. Traction Power Substations (TPSS) and signal bungalows will introduce a new visual element to the residential and commercial areas of the neighborhoods. Elements would include TPSS buildings, signal bungalows, walls, and fences. Sensitive siting is vital for the TPSS and Signal Bungalows to fit into the community fabric. ADA access and access for specific church functions would be limited at the Central Presbyterian Church. Parking in front of the adjacent St. Louis King of France Church would be removed. The expected changes in intensity and density of land uses around the proposed stations will be among the long-term effects to the neighborhoods, which may experience a change in population composition. In downtown St. Paul, the location of the OMF may affect nearby residential and commercial development due to its reuse of part of the Diamond Products building. Of the 388,838 square feet available, the OMF will use 178,178 square feet; additional acreage east of the building will be used for tracks. This means that about 48 percent of the building and some of the parking lots will not be available for redevelopment in an area where adaptive re-use of buildings has been common. No residents will be displaced or relocated by land acquisition for the Preferred Alternative.	As described in Table 9-2, multiple public and private actions are planned to take place in the corridor—none of these are part of the Preferred Alternative. Of particular note are U of M development activities, City of Minneapolis plans for SEMI lands, and Union Depot redevelopment in St. Paul. In recent years, the Midway area has grown rapidly in minority-owned retail and service businesses.[a] In recent years, the Midway area has experienced growth in multifamily housing and new commercial/office enterprises. These development activities are expected to continue along the corridor in response to market demand.[a] The City of St. Paul CCDS (April 2007) contains an Inclusive Housing strategy that is intended to mitigate the potential displacement of low-income individuals and families from the corridor as property values rise Three specific strategies are identified including home ownership assistance.	The TOD trends around the proposed stations will continue and residential densities will likely increase over time. Underutilized land and buildings near some station areas will become prime development and redevelopment sites.[a] Although more housing opportunities will be available for current residents in the corridor, population and neighborhood character may change as new residents and businesses move into the area.	The TOD around the proposed stations will continue to exist or be developed and densities will increase over time. By 2030, the Twin Cities Metropolitan Area is expected to add nearly 1 million people—560,000 households. Many of these households will occupy the higher intensity development in the two central cities and their downtowns.[a] Underutilized land and buildings near some station areas that are now prime development and redevelopment sites will be built out. More housing opportunities will be available for current residents in the corridor, but population composition and neighborhood character may change as new residents move into the neighborhoods (gentrification) to take advantage of transit.

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Cultural resources	Historic properties are located in the vicinity of the Central Corridor LRT. A number of properties and historic districts have been identified as eligible for the National Register of Historic Places. Some of these properties and districts are already listed. See Section 3.4 for a summary of all listed or eligible historic districts and properties along the Central Corridor.	The Union Depot Station will be constructed on the north side of the Union Depot (NRL) changing the circular access. The diagonal alignment of the 4th and Cedar station will require the removal of one building that falls within the period of significance for the St. Paul Urban Renewal Historic District (NRE). Rice Street Station will be constructed on the edge of Leif Erikson lawn in State Capitol Mall HD (NRE), which converts it to a transportation use. East River Parkway (contributing element to NRE Grand Rounds HD) will require installation of new turn lanes and traffic signals to mitigate traffic impacts. The historic (1965) Washington Avenue Bridge deck would be modified to accommodate LRT and to meet current design requirements for bridges. Station design and locations, and placement of power poles and overhead lines, would change the visual setting of some cultural resources. During construction, temporary vibration, noise, traffic, and visual impacts would be experienced at cultural resources throughout the corridor.	As described in Table 9-2, multiple public and private actions have been planned to take place in the corridor—none of these are part of the Preferred Alternative. Of particular note are U of M development activities, Minneapolis plans for SEMI lands, and Union Depot redevelopment. Land value increases have been uneven in the St. Paul segment, with a general upward trend. Overall, such increases have not been appreciably higher to-date than in other commercial corridors in St. Paul. Both cities have enacted zoning ordinances that encourage TOD along transit corridors.[a]	The expected changes in intensity and density of land uses around the proposed stations will be among the long-term indirect effects to the corridor—these changes may affect the context of the cultural resources, land values, and redevelopment potential. It is not uncommon for projects of this type to increase the awareness of the importance of preserving historic properties and to stimulate private parties to strengthen protective actions.	The expected changes in intensity and density of land uses around the proposed stations may be among the long-term effects to the corridor—these changes may affect the context of the cultural resources. Land values will continue to increase, which may cause redevelopment rather than preservation, of cultural resources. Redevelopment is likely to occur and continue, particularly in the areas surrounding the proposed station sites. Between the stations, redevelopment is most likely to occur and continue on properties immediately facing the alignment. Combined with the visual effects of the LRT components, these anticipated developments may affect the visual context of the cultural properties.
Parklands and recreation areas	A number of parks are located in the vicinity of the Central Corridor LRT, including the Mississippi National River and Recreation Area, and the Mississippi Gorge Regional Park (see Chapter 3).	Eight parks are located within 350 feet of the proposed project. These parks may experience short-term effects due to construction, although it is unlikely that they will experience long-term effects. Changes in traffic patterns and routes will affect the NRL University of Minnesota Old Campus Historic District and the NRE Prospect Park Residential Historic District. East River Parkway will require installation of new turn lanes and traffic signals to mitigate traffic impacts. Rice Street Station will be constructed on the edge of Leif Erikson lawn, which converts it to a transportation use.	As described in Table 9-2, St. Paul and Minneapolis have plans for the creation of new parks in the corridor, including those that could act as community focal points or redevelopment catalysts that will enhance transit stations—none of these are part of the Preferred Alternative.	Underutilized land and buildings near some station areas will become prime development and redevelopment sites.[a] With more housing opportunities available in the corridor, more demand for parkland and recreation facilities is likely.	By 2030, the Twin Cities Metropolitan Area is expected to add nearly 1 million people—560,000 households. Many of these households will occupy the higher intensity development in the two central cities and their downtowns.[a] Demand for parks and recreation facilities will increase. Underutilized land and buildings near station areas will continue to be prime development and redevelopment sites. With more housing opportunities available in the corridor, increased demand for parkland and recreation facilities will continue.

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Visual quality and aesthetics	The visual character of the corridor is urban, composed of vehicle (bus and automobile) oriented streets, with a mix of commercial/retail, industrial, and multi-unit residential buildings (old, rehabilitated old, and modern). Areas of visual interest include parks, the Mississippi River, Union Depot, the Capitol and associated government facilities, and the U of M campus. Other elements include a small number of single family residences and a large number of surface parking lots. The development of TCF Bank Stadium will change the visual character of that part of the U of M campus.	The Preferred Alternative and associated elements would introduce a visual change of LRT vehicles, associated tracks, overhead lines, TPSS, and multiple stations. Downtown St. Paul would have visual impacts with the installation of the Diagonal at Cedar/4th Streets Alternative, which would create new access points to downtown. The At-Grade Transit/Pedestrian Mall Alternative at the U of M would change the visual environment from a car and bus dominated avenue to an area of pedestrians and transit users.	The cities of St. Paul and Minneapolis are instituting processes to guide TOD, including the adoption of a zoning overlay district in St. Paul, which could result in changes to the visual character around transit stations. The Union Depot in St. Paul is under consideration for use as a transportation hub. Changes to its visual qualities are likely. Continuing development of research buildings near the new TCF Bank Stadium and in the vicinity of the SEMI lands will continue to change the visual character of those U of M areas.	With an increased interest in the development of areas surrounding the LRT comes a heightened interest from residents to make improvements in community aesthetics—more emphasis will be placed on parks, community art, and a clean, well-lighted environment. It is possible that a variety of development types will create a series of distinct and diverse visual environments.	Market forces in the Central Corridor are likely to attract more developers in search of development sites. This may result in a reduction of vacant auto dealership lots and similar underutilized parcels, which now give a sense of openness and longer views into neighborhoods along the eastern and central section of University Avenue. Viewsheds from the roadway are likely to be reduced as infill development occurs and urban development uses minimum setbacks from the street.
Water resources	The quality of water resources within the corridor has been negatively impacted by previous development. Paving and construction have increased the volume of stormwater runoff by changing ground surfaces from a pervious to impervious condition. Additionally, these same activities negatively impact water quality because pollutants, deposited on impervious surfaces, are readily transported to receiving waters. Water quantity and quality regulations have been developed and have undergone steady change over the past 50 years. The current regulations require water resource improvements for development and redevelopment projects.	The Preferred Alternative and associated elements would be required to install best management practices (BMPs) that would improve water quality as compared to existing conditions. These improvements would be limited in scope because they would be constrained by the space available and would only affect a small portion of the watershed.	As described in Table 9-2, multiple public and private actions have been planned to take place in the corridor—none of these are part of the Preferred Alternative. Of particular note are U of M development activities, Minneapolis' plans for SEMI lands, and Union Depot redevelopment. The City of St. Paul CCDS (April 2007) contains a Resources for Implementation Strategy that outlines ways to fund public infrastructure, housing, and other improvements proposed in the plan.	Most redevelopment activities would be subject to current water quality regulations, and would require installation of BMPs to improve water quality. Water quality improvements over a broad area of the Central Corridor watershed will have positive indirect impacts on the receiving waters. In this case, the Mississippi River is the receiving water.	Cumulative impacts to the Mississippi River include reduced sediment load and reduced pollutant load. Because the area of improvement is still small compared to the Mississippi River watershed, however, the improvements will not be measurable within the Mississippi River.

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Environmental justice	Environmental justice populations, specifically low-income and minority populations, live in the Central Corridor. The study area is predominantly inhabited by non-Hispanic Whites. Ethnic minority populations, however, comprise a significant portion of study area population (22 percent), and account for a higher total minority population percentage than Hennepin County (19 percent) and slightly less than Ramsey County (23 percent). Within the study area, the Asian population represents the greatest ethnic minority group next to non-Hispanic Whites. The Central Corridor includes the Rondo neighborhood—the heart of St. Paul's African-American community. The percentage of people at poverty level for the Central Corridor (one-half mile from the alignment) is estimated to be nearly three times greater than the region's percentage. Incomes are lowest in the areas surrounding the U of M, and on campus, where many students reside in dormitories. These students do not comprise a "population" of low-income residents because a college student population is not necessarily "low income."	The Environmental Justice analysis identified several Census blocks near the proposed Western Avenue Station that would experience a decrease in transit levels of service. Reduced access by car to businesses along University Ave. Will be off-set by increased access via transit. However, some local bus service will be reduced. The Preferred Alternative did not entirely offset this adverse impact for these blocks. Initial results of the noise analysis indicated that 11 severe noise impacts were anticipated in the environmental justice community between Rice Street and Lexington Avenue as a result of a track crossover. Working with neighborhood residents and area businesses, along with project engineers, the crossover was moved out of this area. Therefore, no severe noise impacts are anticipated. Two Category 2 and three Category 3 vibration impacts from track crossovers will occur in environmental justice communities. As a vibration mitigation measure, the Metropolitan Council relocated crossovers that were originally proposed to be installed in the EJ neighborhoods. As a result of the relocation, vibration impacts are no longer predicted to occur in the environmental justice neighborhoods.	As described in Table 9-2, multiple public and private actions have been planned to take place in the corridor—none of these are part of the Preferred Alternative. Of particular note are U of M development activities around the new stadium, City of Minneapolis' plans for SEMI lands, and Union Depot redevelopment in St. Paul. The City of St. Paul CCDS (April 2007) contains an Inclusive Housing strategy that is intended to mitigate the potential displacement of low-income individuals and families from the corridor as property values rise. Three specific strategies are identified including supply-side financial incentives, supply-side regulatory incentives, and home ownership assistance. The Metropolitan Council has committed to mitigating the identified adverse impacts addressed in this FEIS as determined under the FTA Title VI Circular. The Metropolitan Council has also committed to working toward resolution of community concerns that don't rise to the level of state or federal standards of adverse impacts.	The TOD trends around the proposed stations will continue and residential densities will likely increase over time. Underutilized land and buildings near some station areas will become prime development and redevelopment sites.[a] Land values will continue to increase and such increases could be higher than the county average in some areas, particularly in the Westgate area.	The TOD trends around the proposed stations will continue and residential densities will likely increase over time. This development will further the goals outlined in the CCDS – including the provision of and mitigation for mixed income housing opportunities. The retail and service market is beginning to follow the housing market around proposed Central Corridor Stations. By 2030, the Twin Cities Metropolitan Area is expected to add nearly 1 million people—560,000 households. Many of these households will occupy the higher intensity development in the two central cities and their downtowns.[a] Improved transit mobility and connectivity could result in reduced dependence on private motor vehicles for low income and minority populations.

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Economic conditions	The Twin Cities market is responding favorably to the Hiawatha LRT corridor, with new transit-supportive development in several locations. The Central Corridor has a unique economic environment—it is anchored on both ends in downtowns that are thriving, and it serves the University of Minnesota and the Capitol Complex—areas of high employment and strong economic activity. The corridor between the cities is at the cusp of redevelopment and revitalization. The Central Corridor, the cities of Minneapolis and St. Paul, and the region are experiencing significant population and employment growth, which is expected to continue through 2030. Although the office market in both downtowns has slowed, it is expected to recover fully in time. The retail and service market is beginning to follow the increased housing market, which is pursuing developments in anticipation of Central Corridor LRT Stations' implementation. Post-graduate educational institutions have had rapid increases in enrollment.[a]	Implementation and construction, continuing operation, and market reaction to the Preferred Alternative would influence economic activity in the local economy. The Preferred Alternative would provide increased mobility to both residents and businesses within the Central Corridor and is expected to contribute to economic growth. New transportation capacity could create competitive advantages for businesses located along the alignment. Construction of the Preferred Alternative would expand local earnings for the duration of the project's construction cycle. The new jobs required to operate and maintain the Central Corridor LRT would be a long-term recurring benefit of the project. The earnings of new construction and transit workers would translate into a proportional increase in consumer demand as these workers purchase goods and services in the region.	As described in Table 9-2, multiple public and private actions have been planned to take place in the corridor—none of these are part of the Preferred Alternative. Of particular note are U of M development activities around the new stadium, Minneapolis' plans for SEMI lands, and Union Depot redevelopment. Although land values have increased in the corridor, land value increases have been uneven in the St. Paul segment, with a general upward trend. Overall, such increases have not been appreciably higher to-date than in other commercial corridors in St. Paul. Both cities have enacted zoning ordinances that encourage TOD along transit corridors.[a] It is expected that new development in this Study Area would capture an increasing share of residential and employment growth as densities increase.	A further increase of new employment across a wide variety of industrial sectors and occupational classifications is expected as employers hire to meet increases in local consumer demand. This type of hiring represents the project's indirect impact. The Preferred Alternative is anticipated to have positive effects on commercial and residential development located near transit stations, and would contribute economic benefits by encouraging and supporting higher-density residential and commercial land uses around proposed transit stations.	The TOD around the proposed stations will continue to exist or be developed and densities will increase over time. Underutilized land and buildings near some station areas will become prime development and redevelopment sites.[a] Focused development in areas with existing infrastructure accrues benefits to the taxing jurisdictions by using existing infrastructure.
Station area development	The FEIS documents ample areas for infill and redevelopment within a half-mile radius of each potential station.[a] In recent years, the Midway section of the corridor has seen rapid growth in minority-owned retail and services businesses, particularly Asian-owned businesses, as well as construction of multi-family housing and new commercial/ office enterprises.	The TOD trends around the proposed stations will continue and residential densities will likely increase over time. Underutilized land and buildings near some station areas will become prime development and redevelopment sites.[a] Although more housing opportunities will be available for current residents in the corridor, population and neighborhood character may change as new residents and businesses move into the area. Access to several properties will be altered, and loss of on-street parking will occur.	As described in Table 9-2, multiple public and private actions have been planned to take place in the corridor—none of these are part of the Preferred Alternative. Of particular note are U of M development activities, Minneapolis' plans for SEMI lands, and Union Depot redevelopment. Plans for redevelopment of Union Depot to a multimodal hub for passenger buses, commuter rail, and light rail are underway, and implementation is likely by 2030.	The TOD around the proposed stations will continue to exist or be developed and densities will increase over time. Underutilized land and buildings near some station areas will become prime development and redevelopment sites.	The TOD around the proposed stations will continue to exist or be developed and densities will increase over time. By 2030, the Twin Cities Metropolitan Area is expected to add nearly 1 million people—560,000 households. Many of these households will occupy the TOD—higher intensity—developments being encouraged by the two cities.[a]

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Transit effects	The Central Corridor is currently served by Routes 16 and 50, and Express service on Interstate 94 (I-94). The success of the Hiawatha LRT has inspired the development community to respond to the market for more residential and commercial development in the corridor. Ridership continues to grow as more jobs are added—especially in the downtowns—and as residential buildings are developed in the corridor.	Ridership is likely to increase as more residents, employers, and employees use transit for work and personal trips. Overall transit capacity in the corridor will increase. Mobility along the corridor will be improved, particularly for transit-dependent populations.	As described in Table 9-2, multiple public and private actions have been planned to take place in the corridor—none of these are part of the Preferred Alternative. Of particular note are U of M development activities, Minneapolis plans for SEMI lands, and Union Depot redevelopment. Plans for redevelopment of Union Depot to a multimodal hub for passenger buses, commuter rail, and light rail are underway, and implementation is likely by 2030. Under the Council's plan, additional transitways will be built by 2020. The Southwest Transitway is a proposed high frequency light rail transit line connecting Eden Prairie, Minnetonka, Hopkins, St. Louis Park, Minneapolis neighborhoods, and the Minneapolis downtown area. The Transitway intends to provide a connection or interline with the Central Corridor LRT. The Northstar Commuter Rail project is being constructed along a 40-mile transportation corridor that runs along Highway 10 from Big Lake to downtown Minneapolis using the BNSF Railroad right-of-way. Project planners hope to extend the line to the full 82-mile corridor in the future. The Red Rock Corridor analyzed the potential for commuter rail passenger service between downtown Minneapolis, downtown St. Paul (Union Depot Station), and Hastings, Minnesota. Several Transit Corridors are in various stages of planning and development, including the Cedar Avenue Corridor, Bottineau Corridor, and Interstate 35W (I-35W). The Central Corridor will serve as a distributor for these corridors. An additional corridor of note is the line southeast from downtown St. Paul toward Hastings and Red Wing, which will contain the Upper Midwest High Speed Rail connection from Chicago.	The implementation of LRT in the Central Corridor is likely to reduce reliance on single occupancy vehicles for work and recreation trips for choice riders, and thus help to improve air quality and congestion. There will be an increase in demand on connecting bus service, especially on major north/south arterials. Ridership would continue to increase as TOD, particularly around stations, continues to be developed and encouraged by both cities, thus increasing density and the number of potential choice riders.	Combined with planned future LRT service in the region, the implementation of LRT in the Central Corridor is likely to reduce reliance on single occupancy vehicles for work and recreation trips for choice riders in the region, and thus improve regional air quality and congestion. Improved mobility for transit dependent populations would give them access to employment, which would improve the overall economy in the corridor and the region. Linking the Central Corridor LRT to the proposed multimodal station at Union Depot will increase its chances of success. Ridership would continue to increase as TOD, particularly around stations, continues to be developed and encouraged by both cities, thus increasing density and the number of potential choice riders. Additionally, as the demand for homes and businesses increases and is satisfied by the development community, more transit service will be in demand. Additional transportation uses would strengthen the role of the Union Depot as a regional transportation hub and contribute to its economic viability. Additional transit connectivity, including Union Depot, would improve mobility for area residents and intercity travelers.

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Hazardous/regulated materials	The Central Corridor is urban, composed of vehicle (bus and automobile) oriented streets, with a mix of commercial/retail, industrial, and multi-unit residential buildings (old, rehabilitated old, and modern). The University Avenue corridor is traditionally nonresidential and, for retail and business use, is often considered first when siting a business. As described above, multiple public and private actions have been undertaken in the corridor—much of it in anticipation of the building of Central Corridor LRT. The large stock of old warehouses continues to present redevelopment opportunities not associated with Central Corridor LRT, and the Alternatives Analysis/Draft Environmental Impact Statement (AA/DEIS) and the Supplemental Draft Environmental Impact Statement (SDEIS) document ample areas for infill and redevelopment within a half-mile radius of each potential station.[a] A total of 1,070 hazardous/regulated materials sites that could potentially affect the Central Corridor LRT Study Area, and the private or public development of adjacent lands, were identified in October 2007 in the Phase I Environmental Site Assessment (ESA) completed for the Central Corridor LRT project.	The Central Corridor LRT roadways would be rehabilitated, new crosswalks and sidewalks would be constructed, and new signals (where needed) would be installed. The implementation of LRT would disturb areas where known and unknown hazardous/regulated materials contaminate the construction sites and adjacent land areas. The expected changes in intensity and density of land uses around the proposed stations will be among the long-term effects to the neighborhoods, which may experience a change in population composition. As the land near the LRT is redeveloped, areas of known and unknown contamination would be disturbed and reclaimed.	As described in Table 9-2, multiple public and private actions have been planned to take place in the corridor—none of these are part of the Preferred Alternative. Of particular note are U of M development activities, Minneapolis' plans for SEMI lands, and Union Depot redevelopment. Although land values have increased substantially in the corridor, land value increases have been uneven in the St. Paul segment, with a general upward trend. Overall, such increases have not been appreciably higher to-date than in other commercial corridors in St. Paul. Both cities have enacted zoning ordinances that encourage TOD along transit corridors.[a] It is expected that new development in this Study Area would capture an increasing share of residential and employment growth, and that densities would increase. Continuing development of research buildings near the new TCF Bank Stadium and in the vicinity of SEMI lands will continue. The Tax Base Revitalization Account (TBRA) helps cities clean up contaminated urban land for subsequent commercial and industrial development, thus restoring tax base and jobs near existing housing and services. This program is conducted in coordination with the Minnesota Department of Trade and Economic Development. Recent projects funded in the corridor include: - Carleton Place Lofts – I and II – asbestos and lead-based paint abatement, and addressing four underground storage tanks, petroleum impacted soil, and contaminated ground water - Mai Village – Phase II investigation, asbestos abatement, soil corrections, tank removal, and some cleanup management costs - Schnitzer/Watkins redevelopment site - remove lead, PCBs, asbestos, batteries, fluorescent lights, and soil contaminated with petroleum derivatives and lead - Specialty Manufacturing Co. building restoration/redevelopment - Lead paint and asbestos abatement	TOD around the proposed stations will continue to exist or to be developed and densities will increase over time. Development sites with known and unknown hazardous/regulated materials contamination will be cleaned up as development occurs. Underutilized land and buildings near some station areas will become prime development and redevelopment sites[a] and those with known and unknown hazardous/regulated materials contamination will be cleaned up as redevelopment occurs. The Preferred Alternative is anticipated to have positive effects on contaminated land and buildings with the development and redevelopment of commercial and residential sites located near transit stations, and would contribute to the overall remediation of such sites all along the Central Corridor. It is not uncommon for projects of this type to increase the awareness of the importance of preventing contamination and remediating contaminated sites, and to stimulate and strengthen preventive and clean up actions. Use of TBRA and similar funds if available will continue for rehabilitation, restoration, and remediation of property along the Central Corridor.	TOD around the proposed stations will continue to exist or be developed and hazardous/regulated materials clean up will also continue to take place. Underutilized land and buildings near some station areas that are now prime development and redevelopment sites will be built out and associated hazardous/regulated materials will be cleaned up. The project's indirect effects, in combination with the multiple public and private developments in the Central Corridor LRT corridor will have mostly positive cumulative effects in the remediation of hazardous/regulated materials sites. Use of TBRA funds and similar funds if available will continue for rehabilitation, restoration, and remediation of property along the Central Corridor.

Resource	Existing Condition and How It Has Been Affected by Other Actions	Impacts from Preferred Alternative	Present and Reasonably Foreseeable Future Actions Possible Impacts	Potential for Indirect Impacts	Potential for Cumulative Impacts on the Resource
Effects on roadways	The Metropolitan Council 2030 Transportation Policy Plan has been adopted and includes all regional transportation projects. An updated version was developed and distributed for public comment in late fall (November) 2008 and is anticipated to be adopted by the Metropolitan Council in early 2009. Two projects affecting existing conditions in the corridor have occurred since the AA/DEIS: the collapse and replacement of the I-35W bridge (the new bridge opened September 18, 2008) and construction of the TCF Bank Stadium.	Any street/road in which the Central Corridor LRT operates would be rehabilitated, new crosswalks and sidewalks would be constructed, and new signals, where needed, would be installed. The implementation of LRT would modify driving lanes. On-street parking spaces along portions of the alignment will be removed. Access will be affected for some properties. The greatest potential for traffic changes is along Washington Avenue through the U of M, especially with the implementation of an At-Grade Transit/Pedestrian Mall (University/Prospect Park segment). The Transit Mall will change traffic circulation patterns in the area, and eight intersections will experience significant additional delay and unacceptable levels of service (LOS) as a result of construction of the Transit/Pedestrian Mall. Along University Avenue in the Midway section, five intersections will experience an unacceptable LOS as a result of the Preferred Alternative. In downtown Minneapolis, one intersection will experience an unacceptable LOS due to implementation of the Preferred Alternative. Specific roadway treatments were developed to mitigate these traffic impacts; see Chapter 6 of this FEIS for further details. Delivery vehicles will be required to gain access to businesses along the proposed At-Grade Transit/Pedestrian Mall through alternative means. Median closures are proposed in some locations along University Avenue (Midway East, Midway West, University/Prospect Park segments).	Greenway-Grand Rounds Scenic Byway Connection Routes (the "missing link") is proposed connect East River Parkway with St. Anthony Parkway providing Northeast and Southeast Minneapolis and adjoining communities access to parks, trails, paths and green space.[f] Lafayette Bridge is slated for reconstruction. Plans for redevelopment of Union Depot to a multimodal hub for passenger buses, commuter rail, and light rail are underway, and implementation is likely by 2030. East River Parkway extension plans include replacement of the pedestrian pathway south of Franklin Avenue to the south city limits, reconstruction of both pedestrian and bike trails north of Franklin Avenue to approximately 1,200 feet north of the intersection of East River Parkway and Fulton Street SE,[c] and connection to Bridge 9, which consists of a long-planned bike trail that will follow the railroad line into Dinkytown and link to the planned Granary Road bike trail.[d] Granary Road is part of the plan for SEMI/URP.[e] It would be located on the south side of the proposed Granary Park. As described in Table 9-2, U of M development activities and Minneapolis plans for SEMI lands are underway. These developments will affect traffic patterns in and around the U of M and nearby neighborhoods. Pierce Butler eastern extension of the Granary Road proposal, will help create an industrial parkway district, as well as a greenway/stormwater collector.[g] Snelling/University area capacity improvements to accommodate future growth to year 2030.[h] Kittson Street Connection on the eastern edge of downtown to connect Warner Road with University Avenue.4th and 5th streets are extended through the Diamond Products site.	I-94 congestion may grow at a less rapid rate with implementation of the Central Corridor LRT. The expected changes in intensity and density of land uses around the proposed station sites will be among the long-term effects to the corridor and will affect traffic on surrounding roadways. TOD may slow the growth of automobile traffic on roadways in the vicinity of the Central Corridor LRT because riders may choose to live in proximity to LRT to take advantage of transit service. U of M development activities and Minneapolis plans for SEMI lands are expected to continue. These developments will continue to affect traffic patterns in and around the U of M and nearby neighborhoods. Loss of on-street parking on University Avenue to accommodate the Central Corridor LRT could affect parking in adjacent neighborhoods and along adjacent side streets.	The Preferred Alternative should provide beneficial long-term impacts on corridor roadway facilities because LRT riders will use vehicles less often. Additionally, demand for capacity improvements to local roadways may be reduced.

Resource	Existing Condition and How It Has Been Affected by Other Actions	Impacts from Preferred Alternative	Present and Reasonably Foreseeable Future Actions Possible Impacts	Potential for Indirect Impacts	Potential for Cumulative Impacts on the Resource
Effects on other transportation facilities and services	Many miles of bike paths and sidewalks are available in the study area. Both cities have extensive skyway systems in the downtowns. The Capitol Area and U of M also have extensive pedestrian facilities. *Downtown Action Plan – Access Minneapolis*, completed in 2008, contains a bicycle transportation plan. St. Paul has a draft bicycle plan that calls for bicycle lanes throughout the city, and has completed a plan for downtown. These plans propose improvements for alternate transportation modes and connections to transit. Plans are being developed to connect the Grand Rounds, which include bicycle facilities. Streets along the Central Corridor alignment are lined with public parking spaces.	Approximately 121 on-street parking spaces would be removed in downtown St. Paul. Access to several off-street parking lots and structures would be reconfigured, but maintained. In the Capitol Area, approximately 28 on-street parking spaces would be removed. The loss of these spaces will not substantially change the parking availability in this area. University Avenue will retain 175 of its 1,150 on-street parking spaces. All 79 on-street parking spaces along Washington Avenue at the U of M will be removed. A bike trail on the north side of the Hiawatha LRT (Cedar/Riverside) would be relocated to accommodate the connection to the Central Corridor LRT; see Chapter 2 for a description of this impact. Eastbound traffic from the Washington Avenue Bridge would be diverted to East River Parkway and Delaware Street SE. Emergency service access to the U of M medical facilities will be unchanged from present conditions with conversion of Washington Avenue to a transit/pedestrian mall. Vehicle lanes will be open only to transit vehicles and emergency service vehicles and maintenance equipment when required.	The Union Depot is being considered for redevelopment as a multimodal transportation hub, where new transit lines, including the Central Corridor, Rush Line, and Red Rock, would connect to Amtrak trains and High Speed Rail to Chicago. As described in Table 9-2, multiple public and private actions have been planned to take place in the corridor—none of these are part of the Preferred Alternative. Of particular note are U of M development activities, Minneapolis' plans for SEMI lands, and Union Depot redevelopment.	Implementation of the Preferred Alternative is expected to encourage the market to continue current development and redevelopment trends in the corridor. As the population grows along the corridor, additional demand for pedestrian and bicycle facilities should be anticipated. In effect, the Preferred Alternative will encourage implementation of Minneapolis and St. Paul land use plans, TOD proposals, and alternate transportation mode plans—not all of those plans are adjacent to the Central Corridor LRT corridor, and none of them are part of the Preferred Alternative.	Access by alternate transportation modes—bicycles and pedestrians—would strengthen the role of the Union Depot as a regional transportation hub. Additional transit connectivity through Union Depot would improve mobility for area residents and intercity travelers. Combined with planned future LRT service in the region, the implementation of LRT in the Central Corridor is likely to reduce reliance on single occupancy vehicles for work and recreation trips for choice riders in the region, and encourage the use of alternate modes. No cumulative effects to emergency services are expected.
Effects on Greenhouse Gas Emissions	Transportation vehicles that burn gasoline and diesel fuel produce GHG emissions that may contribute to global warming. Carbon dioxide is the primary GHG emitted by fossil-fuel-burning transportation vehicles.	LRT transportation does not directly contribute to GHG emissions because it does not burn gasoline or diesel fuel, provided that the electric source is not produced from burning fossil fuels. LRT provides an alternative to automobiles, and has the potential to reduce GHG production from these vehicles. Overall, the Preferred Alternative would result in a small increase in GHG emissions.	Many factors contribute to the use of fossil fuels for transportation, such as fuel prices, government regulations, vehicle technology, and alternative energy sources. Reasonably foreseeable future actions include new fuel standards that require higher fuel efficiency for automobiles, potential development of other LRT facilities, increased ridership of public transportation (as evidenced by current local and national trends), increased use of automobiles (particularly in developing countries), and increased use of all types of energy due to global development. Future carbon emissions are difficult to project because of the many contributing factors. Factors that reduce the use of fossil fuel, such as higher fuel standards, high fuel prices, and development of alternative energy would reduce GHG emissions. Factors that increase the use of fossil fuel, such as increasing use of automobiles worldwide and global development would increase GHG emissions. The long-term trends indicate that emissions will continue to increase for the foreseeable future.	In comparison to the major activities that contribute directly or indirectly to GHG emissions, the Central Corridor LRT project will be insignificant. Depending on the source of electricity used to operate the LRT, the Preferred Alternative may have a positive or neutral effect, overall.	In comparison to the major activities that cumulatively contribute to GHG emissions, the Central Corridor LRT project will be insignificant. Depending on the source of electricity used to operate the LRT, the Preferred Alternative may have a positive or neutral cumulative effect, overall. Although not regionally significant, the No-Build Alternative could produce 0.07 percent more GHG emissions by 2030 compared to the Preferred Alternative, and the Baseline Alternative could produce 0.05 percent more GHG emissions by 2030 compared to the Preferred Alternative.

Resource	Existing Condition and How It Has Been Affected by Other Actions	Impacts from Preferred Alternative	Present and Reasonably Foreseeable Future Actions Possible Impacts	Potential for Indirect Impacts	Potential for Cumulative Impacts on the Resource
Section 4(f) resources	Of the many Section 4(f) protected properties in the study area, 14 may experience temporary or permanent impacts that may constitute a use of 4(f) property. Section 106 consultation is ongoing.	Several long-term impacts to 4(f) resources would occur with implementation of the Preferred Alternative. The Union Depot Station will be constructed on the north side of the Union Depot (NRL) changing the circular access. The diagonal alignment of the 4th and Cedar station will require the removal of one building that falls within the period of significance for the St. Paul Urban Renewal Historic District (NRE). Rice Street Station will be constructed within the Capitol Mall Historic District on the edge of the Leif Erikson lawn in State Capitol Mall HD (NRE), which converts a minor amount of park land in this location to a transportation use. Tenth Street Station will be constructed within the Capitol Mall Historic District, which converts three blocks of lawn panels in the median of Cedar Avenue into LRT tracks and the LRT station at Tenth Street. East River Parkway (contributing element to NRE Grand Rounds HD) will require installation of new turn lanes and traffic signals to mitigate traffic impacts. Section 106 consultation is ongoing. A Programmatic Agreement (PA) is in development by FTA, MnDOT, Minnesota SHPO, and the Metropolitan Council. The PA outlines a number of compensatory mitigation measures for historic properties (see the PA in Appendix G).	The Union Depot in downtown St. Paul is currently being evaluated by the FHWA and Ramsey County as a location for a future intermodal transit station. As described in Table 9-2, St. Paul and Minneapolis plan for new parks in the corridor, including those that could act as community focal points, community redevelopment catalysts, and that will enhance transit stations—none of these are part of the Preferred Alternative. As described in Table 9-2, multiple public and private actions have been planned to take place in the corridor—none of these are part of the Preferred Alternative. Of particular note are U of M development activities, Minneapolis' plans for SEMI lands, and Union Depot redevelopment. Both cities have enacted zoning ordinances that encourage TOD along transit corridors.[a]	With more housing opportunities available in the corridor, more demand for parkland and recreation facilities is likely.	The expected changes in intensity and density of land uses around the proposed stations may be among the long-term effects to the corridor—these changes may affect the context of the historic property in the corridor. Land values will continue to increase, which may stimulate the conversion or replacement, rather than preservation, of historic property. Redevelopment is likely to occur and continue, particularly in the areas surrounding the proposed station sites. Between the stations, redevelopment is most likely to occur and continue on properties immediately facing the alignment. Combined with the visual effects of the LRT facilities, these anticipated developments may affect the visual context of the historic properties. Underutilized land and buildings near station areas will continue to be prime development and redevelopment sites. With more housing opportunities available in the corridor, more demand for parkland and recreation facilities will continue.

[a] Metropolitan Council, 2006. Central Corridor LRT Draft New Starts Application – 29 June 2006. Pages L-1-71.
[b] City of Minneapolis & Minneapolis Community Development Agency, SEMI Refined Master Plan, May, 2001, pages 30-31.
[c] News from Cam Gordon, Council Member, Second Ward, March 2008. http://www.ci.minneapolis.mn.us/council/ward2/
[d] Second Ward, Minneapolis, http://secondward.blogspot.com/2008/02/bridge-9-extension.html
[e] Southeast Minneapolis Industrial/University Research Park (SEMI/URP), City of Minneapolis Community Planning and Economic Development and Public Works. http://thegrandrounds.com/documents/design/missing/road_development.pdf
[f] Minneapolis Park & Recreation Board, http://www.minneapolisparks.org/default.asp?PageID=996
[g] Center for Transportation Studies, University of Minnesota, July 2003. St. Paul Central Corridor Study: Pierce Butler Industrial Redevelopment Plan. Pages 1-2.
[h] Metropolitan Council, 2007. Snelling-University Capacity Study. http://www.metrocouncil.org/transportation/ccorridor/CCMC/SnellingUnivStudyMar07.pdf

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9.4 Long-Term Effects

9.4.1 Indirect and Cumulative Effects

9.4.1.1 No-Build Alternative

Under the No-Build Alternative, current development patterns would continue as the market demands. Traffic congestion associated with trips that have both origins and destinations in the Central Corridor would not be improved.

The No-Build Alternative would not result in any project-related cumulative impacts.

9.4.1.2 Preferred Alternative

The primary sources of potential indirect and cumulative effects, as described above in Table 9-3, would be the increased development and redevelopment in the proposed station areas for the Central Corridor LRT project, and the potential indirect impacts to roadways such as those in the vicinity of the proposed At-grade Transit/Pedestrian Mall at the U of M. The addition of LRT would not directly cause development and redevelopment activities, but many are being proposed or are underway in the corridor. Responding to the demand for new housing and commercial development in the corridor, and given the opportunity to direct it in the most beneficial manner, Minneapolis and St. Paul are instituting plans and regulatory guidance that will control the location and quality of the housing and ensure that they are compatible with their surroundings and suitable for the existing neighborhoods. Traffic analysis, potential impacts, and potential traffic mitigation in the vicinity of the U of M and surrounding neighborhoods is presented in Chapter 6.2. All impacts related to the Preferred Alternative and mitigation commitments are evaluated and documented in this FEIS.

As described in Table 9-3, the likely changes in density and land use intensity, particularly in the vicinity of the proposed stations, are the most likely indirect and cumulative effects anticipated. These changes will be the result of natural market forces that strive to meet the demand for convenient housing and businesses where transit riders board and alight from LRT vehicles. These changes are already occurring in areas where underutilized land and buildings are available.

As the Twin Cities' population grows and people are attracted to the residential areas surrounding the Central Corridor LRT, continued development and redevelopment will result in increased density around stations, and possibly a change in the ethnic, racial, and income characteristics of some neighborhoods.

Changes in visual character due to denser development would occur, but because this is already an urban environment, the changes would not be considered a negative indirect or cumulative effect. In most cases, the reuse and redevelopment of underutilized land will also increase the attractiveness and safety of the neighborhoods along the Central Corridor alignment, bring new and improved services, and, with increased mobility, enhance cohesiveness and neighborhood identity.

An increased attraction to the neighborhoods surrounding the Central Corridor LRT alignment is likely to instill a heightened interest in the residents and local governments to make improvements in community aesthetics—more emphasis on parks, community art, and a clean, well-lighted environment, which would be expected to be positive indirect and cumulative effects. It is also possible that as developers reuse vacant auto dealership lots

and similar underutilized parcels that a variety of development types will create a series of distinct and diverse visual environments along the corridor.

An improved tax base and economic development are positive expected indirect and cumulative effects. The Preferred Alternative is anticipated to have positive effects on commercial and residential development located near transit stations, and would contribute economic benefits by encouraging and supporting higher-density residential and commercial land uses around the proposed transit stations.

The implementation of LRT in the Central Corridor is likely to reduce reliance on single occupancy vehicles for work and recreation trips for choice riders, and reduce traffic congestion associated with trips that have both origins and destinations in the Central Corridor.

9.4.2 Mitigation

9.4.2.1 Land use

Indirect and cumulative effects associated with the Central Corridor LRT project are related primarily to population and job growth anticipated under the No-Build Alternative and development attracted to underutilized land and buildings, especially near proposed stations, along the Central Corridor LRT alignment.

As discussed above, in many respects the cities are addressing the expected population growth and attractiveness of the LRT station areas with plans and regulatory guidance that will control the location and quality of the developments and ensure that they are compatible with their surroundings (see Section 3.1). The indirect and cumulative effects of the Central Corridor LRT project for land use impacts are, thus, planned for, expected, and in most cases desired by the cities. No mitigation for the expected indirect and cumulative impacts to land use of the Preferred Alternative is proposed; however, the Metropolitan Council will continue to work with communities in the Central Corridor LRT study area through their comprehensive planning staff who manage the development of Council required Community Plans to ensure consistency of local plans with broader regional development goals.

9.4.2.2 Cultural resources

Adverse indirect or cumulative effects can occur when the intensity and density of surrounding land uses (see Sections 3.1, and 9.4.3.1, above) results in changes to a property's setting (visual and land-use context) or its use affects the National Register characteristics of the property in a manner that diminishes the integrity of the property's location, feeling, or association. Methods for avoidance, minimization, or mitigation of indirect and cumulative impacts to historic property (any prehistoric or historic district, site, building, structure, or object included in, or eligible for, inclusion in the NRHP) will be developed in coordination under the Section 106 consultation process.

9.4.2.3 Effects on Greenhouse Gas Emissions

See Section 9.5, below. Measures to reduce the emission of GHG have been outlined by the State of Minnesota.

9.4.2.4 Other resources

No indirect or cumulative impacts have been identified to date, thus requiring no mitigation.

9.5 Greenhouse Gas Emissions

This section summarizes the project's approach to assessing potential impacts associated with climate change and discusses future uncertainty associated with climate change. Although there is uncertainty about the climate impacts of anthropogenic GHG emissions, the following assessment of the Central Corridor LRT project is provided to compare the GHG emissions of the proposed project and alternatives, given the potential for cumulative impacts on climate.

If the Twin Cities metro area becomes very transit-oriented, it may be possible to realize substantial GHG reductions with Central Corridor LRT implementation. According to the report "Reducing Greenhouse Gas Emissions From Transportation Sources in Minnesota" by the Center for Transportation Studies at the U of M (June 2008), commuter and light rail can yield GHG reductions of 40 percent and 75 percent, respectively.

9.5.1 Legal and Regulatory Context

The Energy Independence and Security Act, signed on December 19, 2007, by President Bush, has the following provisions related to transportation:

- Increases Corporate Average Fuel Economy (CAFE) to 35 miles per gallon by the year 2020 (Sec. 102).
- Requires a minimum standard of 27.5 miles per gallon (mpg) for domestic passenger vehicles (Sec. 102).
- Requires an increase in the production of renewable fuels from 4.0 billion gallons to 36.0 billion gallons by 2022 (Sec. 202).
- Stipulates that all renewable fuel refineries built after enactment of this bill reduce GHG by at least 20 percent of the current baseline (Sec. 202).

The 2007 Minnesota Next Generation Energy Act established statewide GHG reduction goals of 15 percent by 2015, 30 percent by 2025, and 80 percent by 2050 compared with 2005.

9.5.2 Methodology

Future carbon dioxide (CO_2) emissions for the Central Corridor LRT project are difficult to estimate precisely because a wide variety of factors could influence CO_2 emissions. Some of these factors include government regulations, price and availability of fuel and alternative energy sources, and vehicle technology (such as electric hybrid or fuel cell vehicles). The following methodology was used to compare GHG emissions produced in the study area with and without the Central Corridor LRT project in the year 2030.

9.5.2.1 Assumptions:

- Daily vehicle miles traveled (VMT) for the No-Build, Baseline, and Preferred Alternative were calculated using projections from the Metropolitan Council's Travel Demand Model (see Chapter 6).
- In addition to CO_2, gasoline contains other GHGs, including CH_4 (methane) and N_2O (nitrous oxide). The ratio of CO_2 emissions to total GHG emissions was assumed to be 0.971, according to EPA guidelines (2007b). Total GHG emissions in this analysis are expressed as CO_2 equivalents (CO_2E).

- The 35 miles per gallon (mpg) fuel economy factor comes from the Energy Independence and Security Act. The fuel efficiency factor of 35 mpg required for new cars by 2020 was used for the fleet average of cars and Sport Utility Vehicles (SUVs) in 2030. The vast majority of the fleet in 2030 will likely be less than 10 years old, and thus, subject to the 35 mpg standard. Any further improvements in automobile efficiencies would improve (reduce) total GHG calculated emissions for all scenarios.
- Gallons of gasoline consumed
    - Average heat content of conventional motor gasoline is 5.22 million British Thermal Units (BTUs) per barrel (EPA 2007a). Average carbon coefficient of motor gasoline is 19.33 kilograms (kg) carbon per million BTUs (EPA 2007a). Fraction oxidized to CO_2 is 100 percent (IPCC 2006).
    - CO_2 emissions per barrel of gasoline were determined by multiplying heat content times the carbon coefficient time the fraction oxidized times the ratio of the molecular weight ratio of CO_2 to carbon (44/12). A barrel equals 42 gallons.
- No discussion has been included to account for the GHG emissions which would be produced to provide the electricity required to power the LRT. Any fossil fuels (i.e., coal) used in the generation of the electricity would lessen the GHG benefit of LRT.

9.5.2.2 Calculation

5.22 mmBtu/barrel * 19.33 kg C/mmBtu * 1 barrel/42 gallons * 44 g CO_2/12 g C * 1 metric ton/1000 kg = $8.81*10^{-3}$ metric tons CO_2/gallon of gasoline

Note: Due to rounding, performing the calculations given in the equations below may not return the exact results shown. $8.81 * 10^{-3}$ metric tons of CO_2/ gallon of gasoline (http://www.epa.gov/solar/energy-resources/calculator.html).

No-Build Alternative

109,168,370 mi/day * 8.81*10-3 metric tons CO2/gal * 1 gal/35 mi * 1 CO_2, CH_4, and N_2O/0.971 CO_2 = 28,300 metric tons CO_2E/day

Baseline

109,141,230 mi/day * 8.81*10-3 metric tons CO_2/gal * 1 gal/35 mi * 1 CO_2, CH_4, and N_2O/0.971 $_{CO2}$ = 28,293 metric tons CO_2E/day

Preferred Alternative

109,091,260 mi/day * $8.81*10^{-3}$ metric tons CO_2/gal * 1 gal/35 mi * 1 CO_2, CH_4, and N_2O/0.971 CO_2 = 28,280 metric tons CO_2E/day

9.5.2.3 Sources

EPA (2007a). Inventory of U.S. Greenhouse Gas Emissions and Sinks: Fast Facts 1990-2005. Conversion Factors to Energy Units (Heat Equivalents) Heat Contents and Carbon Content Coefficients of Various Fuel Types. U.S. Environmental Protection Agency, Washington, DC. USEPA #430-R-07-002 (PDF) (2 pp, 216K, About PDF).

IPCC (2006). 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Intergovernmental Panel on Climate Change, Geneva, Switzerland.

EPA (2007b). Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005. U.S. Environmental Protection Agency, Washington, DC. USEPA, Table 3-7 (p.3-9) (PDF) (59 pp, 1.47MB, About PDF) and Table A-108 (p.A-127) (PDF) (169 pp, 1.27MB, About PDF)

9.5.3 Existing Conditions

Transportation is a substantial source of GHG emissions through the burning of petroleum-based fuel. Any process that burns fossil fuel releases CO_2 into the air. Because the Central Corridor LRT is a transportation project, and CO_2 is the primary GHG emitted by vehicles, it is the focus of this analysis.

Changes in CO_2 emissions from fossil fuel combustion are influenced by many long-term and short-term factors—some of which change daily—including fuel prices, future VMT, future federal regulations and international agreements, estimates of carbon emissions from current and future fuels, timeframes for phasing in standards, land use development patterns, economic impacts of changing fuel, food, and crop prices, seasonal temperatures, consumer response to regulations, price increases, lifestyle changes, and new vehicle technology and fuel. On an annual basis, the overall consumption of fossil fuels in the United States generally fluctuates in response to changes in general economic conditions, energy prices, weather, and the availability of nonfossil alternatives (Center for Transportation Studies, University of Minnesota, June 2008).

Transportation currently accounts for an estimated 24 percent of Minnesota's CO_2 emissions (about 55 percent is attributable to coal use for the utility sector). Passenger cars account for nearly two-thirds of this amount and commercial vehicles powered by diesel engines account for about 16 percent. The remainder comes from aviation rail, marine, and off-road vehicles. Vehicle CO_2 emissions are predicted to increase by 2025 because VMT is expected to increase annually at the rate of 0.9 percent, as projected by MnDOT. Historically, Minnesota's VMT growth trend has been close to 2.3 percent, but growth has been flat over the past several years (Center for Transportation Studies, University of Minnesota, June 2008).

To support the 2007 Minnesota Next Generation Energy Act, the legislature funded a study to evaluate potential strategies for the transportation sector to help the state meet the legislated goals—Reducing Greenhouse Gas Emissions From Transportation Sources in Minnesota, by the Center for Transportation Studies at the U of M—which was released in June 2008. Some key findings of the study include the following:

- The study estimates that the federal CAFE standards or the California standards could contribute between 61 percent and 64 percent of the target emissions reductions for the transportation sector in 2015. In 2025, assuming no further efficiency improvements past 2020 (the final year for each standard), CAFE standards could contribute about 66 percent and California standards about 80 percent for the transportation reduction goal.
- The study encourages low-interest loans to Minnesota-based truckers to help implement GHG reduction strategies.

- The study shows that if Minnesota adopts a low-carbon standard requiring low-carbon biofuels and alternatives fuels, CO_2 emissions would fall by 10 percent by 2020 and 12 percent by 2025. This policy, according to the study, could contribute 27 percent of Minnesota's transportation reduction goals in 2015 and 40 percent in 2025.
- The amount of travel has a huge effect on the success of the state's GHG goals, but it is the area with greatest uncertainty, particularly with rising gas prices. The team conducting the study researched a range of policies that reduce VMT—alternative travel modes, improved urban form, mixed land-use, population densification, pricing, telecommuting, pay-as-you-drive insurance, improved freight efficiency, and process alteration (such as creating an office of sustainability in MnDOT. Each implemented VMT reduction policy reduces total VMT between 0.1 percent and 5.3 percent in 2025. Combined, they would represent up to 14 percent of the transportation sector's goal for reduction in 2025.
- An important step in meeting the 2050 target is to develop infrastructure to shift the long-distance transport of freight and passengers to more efficient modes, such as rail. The study notes that recent data show that, on average, buses produce 16 percent less GHG per passenger-mile than personal vehicles. Commuter and light rail can yield GHG reductions of 40 percent and 75 percent, respectively, while choosing rail rather than air for long-distance passenger travel reduces emissions up to 28 percent.

9.5.4 Long-Term Effects

If historic and recent transportation trends continue, CO_2 emissions will continue to increase. By 2030, CO_2 emitted from vehicles on all regional (7 country metropolitan planning area) roadways, including I-94, are expected to increase over existing conditions. For example, the population is expected to increase in the study area by 30 percent between 2000 and 2030, which could have a dramatic effect on the vehicle miles traveled in the region.

Without the Central Corridor LRT improvements (the No-Build Alternative), traffic in the corridor could produce 0.07 percent more GHG emissions by 2030 compared to the Preferred Alternative, and the Baseline Alternative could produce 0.05 percent more GHG emissions by 2030 compared to the Preferred Alternative.

9.5.5 Short-Term Construction Effects

As described in Section 4.5.5 Short-term Construction Effects, short-term emissions of GHG that could potentially affect climate change in the long-term due to construction of the Preferred Alternative would include emissions from vehicles due to traffic detours implemented, and construction vehicles within the construction site.

9.5.6 Mitigation

Emissions of GHG due to construction operations for the Preferred Alternative would be mitigated by implementation of BMPs including the following:

- A construction traffic control plan would be developed prior to construction to minimize the amount of additional vehicle emissions due to traffic issues as a result of the project's construction

- Construction, operation, and maintenance vehicles would be routinely maintained to make sure that engines remain tuned and emission-control equipment is properly functioning as required by law
- No unnecessary idling of vehicles or construction equipment will be allowed.

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