4.0 ENVIRONMENTAL EFFECTS

This chapter of the FEIS for the Central Corridor Light Rail Transit (LRT) Project describes the existing conditions of the natural and built environments. The Study Area was analyzed to determine the potential effects for the No-Build and Preferred Alternatives on natural resources, its habitats, and effects of byproducts of the built environment, such as noise, hazardous materials, and energy consumption.

Each section describes the Study Area defined for each topic, the methods used to make the assessments, the existing conditions of each resource, and long- and short-term effects anticipated as well as mitigation of effects.

Section 4.1 provides a description of the geologic resources along and adjacent to the Central Corridor LRT Study Area including the geology, soils, and groundwater of the Central Corridor LRT Study Area, and the likelihood of impacts from implementation of the Project.

Section 4.2 discusses the streams, floodplains, wetlands, and critical areas that make up the surface waters in the Central Corridor LRT Study Area, and the likelihood of impacts from implementation of the Project.

Section 4.3 presents descriptions of aquatic and terrestrial habitats in the Central Corridor LRT Study Area and conclusions about potential impacts.

Section 4.4 identifies and discusses plant or animal species that are classified as rare, threatened, or endangered by federal and state agencies, and that exist in the Central Corridor LRT Study Area; and the likelihood of impacts from implementation of the Project.

Section 4.5 describes the air quality impact analysis conducted for the Project. The potential air quality impacts of the Central Corridor LRT Project related to emissions from motor vehicle traffic associated with the Project were evaluated.

Section 4.6 includes an introduction to basic noise concepts, including noise descriptors, the prediction methodologies and modeling assumptions used to analyze the noise impacts of the Project. The results of the ambient noise monitoring program and the evaluation of potential impacts of the alternatives along the Central Corridor LRT Study Area are also presented.

Section 4.7 introduces some basic ground-borne vibration concepts, including the prediction methodologies and modeling assumptions. The results of the evaluation of potential impacts of the Project are presented.

Section 4.8 describes the potential for discovering hazardous or contaminated materials during construction of the Project, and summarizes the extent of any suspected contamination and appropriate mitigation measures.

Section 4.9 presents an assessment of the impact of the Project on electromagnetic fields and utilities in the Central Corridor LRT Study Area. This analysis was conducted to assess the likelihood of impacts due to implementation of the Project.

Section 4.10 presents the quantitative assessment of the impact of the Project on the transportation-related energy consumption in the Central Corridor LRT Study Area. This analysis was conducted to assess the likelihood of substantial increases in energy consumption due to implementation of Project.

4.1 Geology, Groundwater Resources, and Soils

This section discusses the existing geology and potential impacts on soils and groundwater resources within the Central Corridor Light Rail Transit (LRT) Study Area. Table 4.1-1, below, provides a summary of the impacts for the Preferred Alternative.

None of the project activities would have long-term impacts to soils or groundwater resources in the Central Corridor LRT Study Area. The existing soils resources are mostly disturbed and covered with pavement or other impervious surfaces. The existing surfaces that are not paved or impervious are, nonetheless, highly disturbed. The project would not require changes to groundwater, because permanent dewatering is not necessary. No long-term impacts to soil and groundwater resources are anticipated.

Short-term impacts are primarily related to construction activities that cause soil disturbance, dewatering, or potential groundwater contamination because of accidental spills. Best Management Practices (BMPs) will be used to minimize potential short-term impacts.

Table 4.1-1 Groundwater Resource Sensitivity to Construction Activity*

Planning Segment	Central Corridor LRT Elements and Potential Impacts			
	Guideway and Catenary System	**Stations**	**Traction Power Substations (TPSS)**	**Operation and Maintenance Facility (OMF)**
Downtown St. Paul	Very high sensitivity to pollution; potential dewatering	Very high sensitivity to pollution; potential dewatering	Very high sensitivity to pollution; potential dewatering	Very high sensitivity to pollution; potential dewatering
Capitol Area	Very high sensitivity to pollution; potential dewatering	Very high sensitivity to pollution; potential dewatering	Very high sensitivity to pollution; potential dewatering	N/A
Midway East	Very high sensitivity to pollution; potential dewatering	Very high sensitivity to pollution; potential dewatering	Very high sensitivity to pollution; potential dewatering	N/A
Midway West	Very high sensitivity to pollution; potential dewatering	Very high sensitivity to pollution; potential dewatering	Very high sensitivity to pollution; potential dewatering	N/A
University/Prospect Park	Potential dewatering	Potential dewatering	Potential dewatering	N/A
Downtown Minneapolis	Potential dewatering	Potential dewatering	Potential dewatering	N/A

N/A - Not Applicable. Indicates that the activity is not relevant to the particular planning segment.

* Refer to Figure 4.1-3 for pollution sensitivity ratings

4.1.1 Methodology

Surficial geology, bedrock geology, and groundwater resources within the proposed Central Corridor LRT Study Area were identified using the Geologic Atlas of Hennepin County, Minnesota, and the Geologic Atlas of Ramsey County, Minnesota (MGS, 1989 and 1992, respectively). For the purposes of this evaluation, the Study Area included a half-mile wide corridor on each side of the alignment. The proposed short term and long term activities associated with the project were evaluated against existing geologic and groundwater resources and their relative sensitivities, as defined in the county atlases. Impacts were derived using available maps and information.

Soils data were obtained from digital soil surveys of Hennepin and Ramsey counties (NRCS, 2005 and 2006, respectively). The Study Area for the soils analysis included a half-mile wide corridor on each side of the alignment.

4.1.2 Existing Conditions

4.1.2.1 Surficial Geology

The surficial sediments of Hennepin and Ramsey counties were deposited primarily by glacial ice and meltwater during the last glaciation (Wisconsinan Stage). Sediments along the major portion of the proposed project can be attributed to the advance and retreat of the Superior lobe and Grantsburg sublobe of the Des Moines lobe, and meltwater from these lobes. The St. Paul Sand Flats (map units sg and tmg on Surficial Geology Map for the Study Area Figure 4.1-1), a broad sandy outwash plain deposited by the Glacial River Warren, dominates this region and extends over most of St. Paul from southwest to northeast. Sediments ranging from gravel and sand to some silt and clay are also deposited along the terraces of the former glacial river. In Hennepin County, surficial geology along the proposed alignment is composed of middle terrace deposits, upper terrace deposits, sandy floodplain alluvium, and outwash. The following summarizes the composition of each deposit type:

- **Middle and Upper Terrace:** Deposits consist of sand, gravelly sand, and loamy sand overlain by thin deposits of silt, loam, or organic sediment.
- **Sandy Floodplain Alluvium:** Consists of loamy sand, sand, and gravelly sand interbedded with and overlain by thin beds of finer sediment and organic matter.
- **Outwash:** Consists of sand, loamy sand, and gravel, overlain by less than 4 feet of loess.

In Ramsey County, surficial geology along the proposed project is composed of buried coarse meltwater stream sediment, meltwater stream sediment, till with stream-modified surface, glacial river stream sediment, and stream sediment.

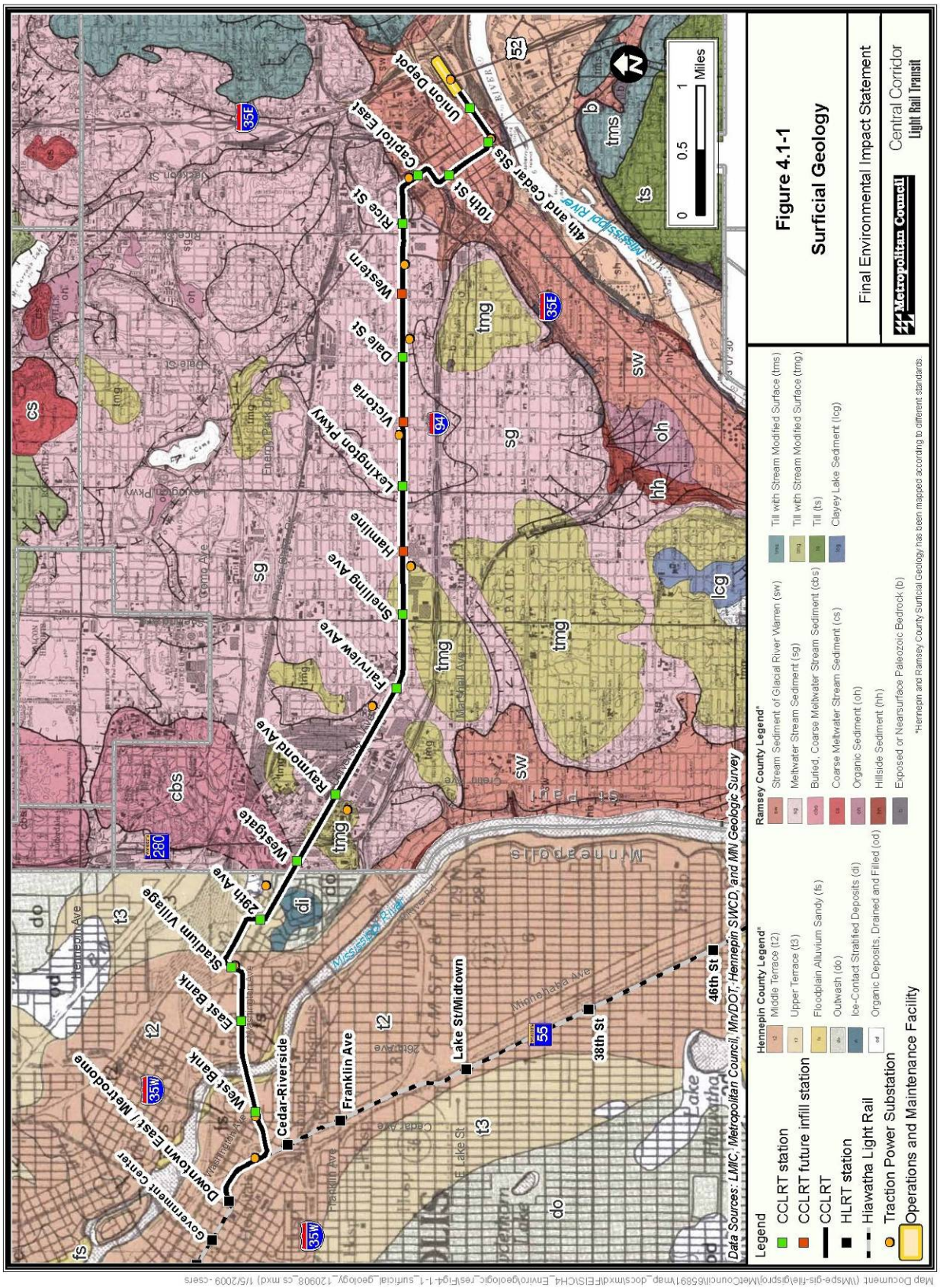
Figure 4.1-1
Surficial Geology
Final Environmental Impact Statement
Central Corridor
Light Rail Transit
Metropolitan Council
Legend
CCLRT station
CCLRT future infill station
CCLRT
HLRT station
Hiawatha Light Rail
Traction Power Substation
Operations and Maintenance Facility
Hennepin County Legend*
Middle Terrace (t2)
Upper Terrace (t3)
Floodplain Alluvium Sandy (fs)
Outwash (do)
Ice-Contact Stratified Deposits (di)
Organic Deposits, Drained and Filled (od)
Ramsey County Legend*
Stream Sediment of Glacial River Warren (sw)
Meltwater Stream Sediment (sg)
Buried, Coarse Meltwater Stream Sediment (cbs)
Coarse Meltwater Stream Sediment (cs)
Organic Sediment (oh)
Hillside Sediment (hh)
Exposed or Nearsurface Paleozoic Bedrock (b)
Till with Stream Modified Surface (tms)
Till with Stream Modified Surface (tmg)
Till (ts)
Clayey Lake Sediment (lcg)
*Hennepin and Ramsey County Surficial Geology has been mapped according to different standards.
Data Sources: LMIC, Metropolitan Council, Mn/DOT, Hennepin SWCD, and MN Geologic Survey
Miles
Union Depot
4th and Cedar Sts
10th St
Capitol East
Rice St
Western
Dale St
Victoria
Lexington Pkwy
Hamline
Snelling Ave
Fairview Ave
Raymond Ave
Westgate
29th Ave
Stadium Village
East Bank
West Bank
Downtown East / Metrodome
Government Center
Cedar-Riverside
Franklin Ave
Lake St/Midtown
38th St
46th St
Minneapolis
St. Paul
Mississippi River

The following paragraphs summarize the composition of each deposit type:

- **Buried coarse meltwater stream sediment:** Buried by up to 40 feet of Grantsburg till, which consists of gray, loam-textured till, ranging from loamy sand to clay and commonly banded with reddish-brown Superior lobe till or sand, and thick yellow-brown or gray bands with thin red stringers near the land surface.
- **Meltwater Stream Sediment:** Consists of medium to coarse sand with pebbles. The sand is predominantly quartz with Cretaceous shale, limestone, and rare lignite grains.
- **Till with Stream-Modified Surface:** Consists of gray, loam-textured till, ranging from loamy sand to clay and commonly banded with reddish-brown Superior lobe till or sand, and thick yellow-brown or gray bands with thin red stringers near the land surface. The till topography has been modified by running water and is covered in some places with thin, discontinuous sand and gravel.
- **Stream Sediment of Glacial River Warren:** Consists of sand and gravel with some fine sediment (silt and clay).
- **Stream Sediment:** Consists of sand and gravel with areas of fine sediment and organic material.

4.1.2.2 Bedrock Geology

The uppermost bedrock along the Central Corridor LRT Study Area consists of (from youngest to oldest) Decorah Shale (shale), Platteville (dolostone and limestone) and Glenwood (shale) Formations, St. Peter Sandstone (sandstone), and Prairie du Chien Group (dolostone). A Bedrock Geology Map for the Study Area is shown in Figure 4.1-2.

The following paragraphs summarize the composition of each formation:

- **Decorah Shale:** Consists of green calcareous shale with thin limestone interbeds.
- **The Platteville and Glenwood Formations:** Consist of fine-grained dolostone and limestone of the Platteville Formation underlain by thin, green, sandy shale (3- to 5.5-feet thick) of the Glenwood Formation.
- **St. Peter Sandstone:** Consists of fine- to medium-grained quartz sandstone, massive- to thick-bedded, underlain by multicolored beds of mudstone, siltstone, and shale with interbeds of very coarse sandstone.
- **The Prairie du Chien Group:** Consists of sandy or oolitic, thin-bedded dolostone with thin beds of sandstone, chert, and intraclastic dolostone underlain by massive- or thick-bedded dolostone. The lower part of the Prairie du Chien dolostone is not oolitic or sandy with the exception of a thin, sandy transitional zone at the base. The upper part of the Prairie du Chien dolostone may contain karst solution cavities, particularly where the overlying St. Peter Sandstone has been removed by erosion.

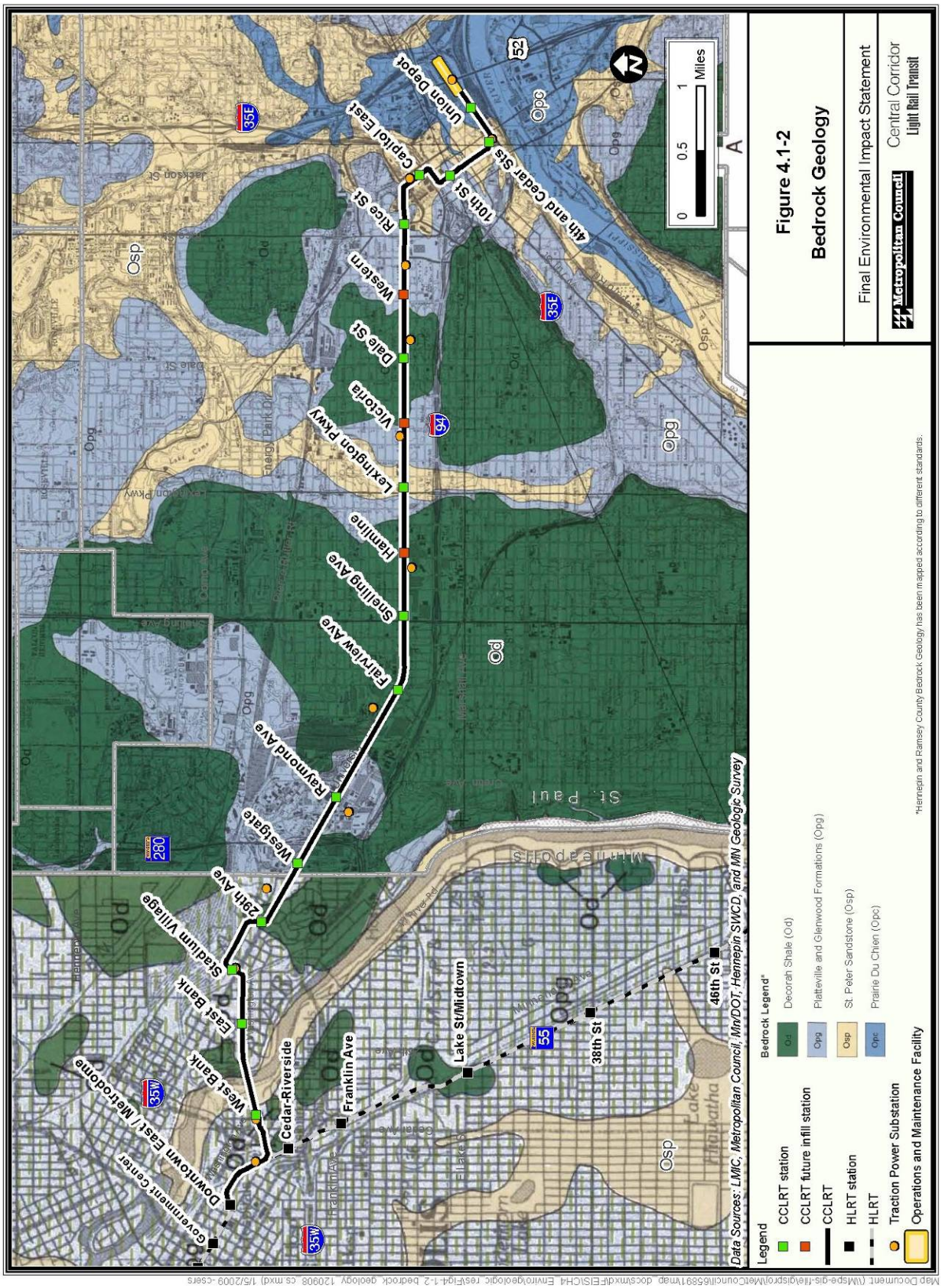
Figure 4.1-2
Bedrock Geology
Final Environmental Impact Statement
Metropolitan Council
Central Corridor
Light Rail Transit
Legend
CCLRT station
CCLRT future infill station
CCLRT
HLRT station
HLRT
Traction Power Substation
Operations and Maintenance Facility
Bedrock Legend*
Od Decorah Shale (Od)
Opg Platteville and Glenwood Formations (Opg)
Osp St Peter Sandstone (Osp)
Opc Prairie Du Chien (Opc)
*Hennepin and Ramsey County Bedrock Geology has been mapped according to different standards.
Data Sources: LMIC, Metropolitan Council, Mn/DOT, Hennepin SWCD, and MN Geologic Survey
Union Depot
Capitol East
10th St
4th and Cedar Sts
Rice St
Western
Dale St
Victoria
Lexington Pkwy
Hamline
Snelling Ave
Fairview Ave
Raymond Ave
Westgate
29th Ave
Stadium Village
East Bank
West Bank
Cedar-Riverside
Franklin Ave
Lake St/Midtown
38th St
46th St
Government Center
Downtown East / Metrodome
St. Paul
Minneapolis
0 0.5 1 Miles

4.1.2.3 Groundwater Resources

The water table is the boundary between geologic materials completely saturated with water and the unsaturated zone above. The depth to the water table/groundwater depends on a variety of factors, including the elevation of nearby surface water features, the permeability of the geologic materials, and surface topography. The depth of the water table varies across the Study Area from less than 20 feet to greater than 100 feet below-grade.

The regional groundwater flow direction in the Study Area varies with location. West of the Mississippi River, the groundwater flows east toward the Mississippi. The groundwater in the central portion of the Study Area generally flows east or west from a groundwater divide located approximately at Snelling Avenue. West of that street, the groundwater generally flows west, then southwest, as it approaches the Mississippi River. East of Snelling Avenue, the groundwater generally flows east until it nears the intersection of Rice Street and University Avenue. Near the proposed Rice Street Station site and throughout the extreme eastern portion of the Study Area, the groundwater generally flows southeast toward the Mississippi River.

In the vicinity of the Mississippi River, particularly near the Washington Avenue Bridge, groundwater seeps and springs are observable along the river bluff face. These seeps and springs vary in elevation and occurrence depending on the time of year. The seeps and springs typically occur immediately above a layer of low permeability geologic materials or where fractures are present. Seeps and springs are most likely near such elevations as the Decorah-Platteville contact or Platteville-Glenwood contact. Contacts of varying members of the Platteville may also produce seeps and springs.

In areas where the Mississippi River may cut deeply into the Prairie Du Chien unit, perched groundwater systems have been known to exist where the Platteville and/or Glenwood formations act as a confining unit and parts of the St. Peter Sandstone may be unsaturated.

4.1.2.4 Potable Water Supply

Shallow groundwater in the unconsolidated geologic materials is not used as a major source of potable groundwater within the Study Area. Groundwater resources found in the deeper bedrock aquifers beneath the unconsolidated sediments may be used as a source of potable water in the Study Area. These include the following aquifers:

- St. Peter aquifer
- Prairie Du Chien-Jordan aquifer
- Franconia-Ironton-Galesville aquifer
- Mt. Simon-Hinckley aquifer

These four bedrock aquifers are beneath the Study Area and are described in Table 4.1-2, below, from upper to lower aquifer (shallower to deeper).

Table 4.1-2 Bedrock Aquifers

Aquifer	Use	Description	Yield
St. Peter Formation	Least used in Study Area	Fine to medium grained sandstone; the base of the St. Peter is less permeable and is considered a confining unit.	250 gallons per minute (gpm) when the aquifer is not confined, such as near the Mississippi River in the eastern portion of the Study Area, and greater than 250 gpm where the aquifer is confined.
Prairie Du Chien-Jordan	Most heavily used in Study Area	Consists of approximately 120 feet of Prairie Du Chien dolostone and 100 feet of Jordan sandstone. No regional confining unit separates the two geologic units; therefore they are considered a single aquifer.	Potential yield of the aquifer is generally greater than 2,000 gpm. Seasonal fluctuations of the potentiometric surface can occur depending on the amount of pumping in the western and eastern portions of the Study Area. Water level declines can be as much as 30 feet during heavy pumping periods.
Franconia-Ironton-Galesville	Not highly used in Study Area	The upper part is Franconia Formation sandstone, which is approximately 1,140 feet thick. The lower portions of the Franconia are less permeable and are considered a confining unit. The middle part consists of Ironton sandstone, which is approximately 20 feet thick. The bottom part consists of Galesville sandstone that is approximately 40 feet thick.	Potential yields are generally less than 1,000 gpm
Mt. Simon-Hinckley	Highly used in Study Area	The aquifer is comprised of Mt. Simon and Hinckley sandstone. These units total approximately 125 to 250 feet of thickness.	Potential yields are generally between 1,000 and 2,000 gpm.

Source: Minnesota Geologic Survey: Geologic Atlas of Hennepin County (1989)
Minnesota Geologic Survey: Geologic Atlas of Ramsey County (1992)

Municipal potable water is supplied to the entire Study Area; numerous groundwater wells are located within the Study Area, however, and are used for non-potable purposes. Suppliers of potable water are the City of Minneapolis Water Works and St. Paul Regional Water Services. These suppliers derive the majority of their water supplies from surface water sources, although the St. Paul Regional Water Services operates some groundwater wells located outside of the study area. No wellhead protection areas, drinking water supply management areas, or source water assessment areas are located along the proposed corridor.

4.1.2.5 Groundwater Pollution Sensitivity

The susceptibility of an aquifer to surface pollutants is based on the degree of protection provided by geologic materials overlying it. This is dependent on the vertical travel time required for a waterborne contaminant release at or near the land surface to enter the groundwater. Vertical travel time is primarily controlled by the permeability of the sediments and their thickness. Several areas along the Central Corridor LRT Study Area lie within zones of very high sensitivity of pollution to the water table system (MGS, 1989 and 1992). This specific rating occurs where the unsaturated zone is less than 20 feet thick and underlying geology consists of sandstone bedrock, carbonate bedrock (limestone or dolostone), sand and gravel, or organic deposits. Estimated travel times for surface water to travel vertically to the water table in very high sensitivity areas range from a few hours to a few months. A Groundwater Pollution Sensitivity Map of the proposed project corridor is shown in Figure 4.1-3.

Areas of very high sensitivity were identified in portions of all three planning segments along the Central Corridor LRT Study Area. These are:

- Downtown St. Paul (from the Mississippi River to the Capitol Commons)
- Midway East (along University Avenue between Avon Street and Lexington Avenue)
- Midway West (along University Avenue between Snelling Avenue and Raymond Avenue)

The majority of the remaining Central Corridor LRT Study Area lies within the high sensitivity classification. These are areas where the unsaturated zone is more than 20 feet thick and where confining units of moderate or low permeability are not present. The travel times estimated for these areas range from weeks to years. Areas of high sensitivity were determined at a gross regional level. If factors such as the geology and thickness of the unsaturated zone differ at a local level from the factors determined in the county atlases, the pollution sensitivity rating may increase or decrease in some project areas. The sensitivity ratings discussed relate to the water table system only—the point at which there is a continuous saturation of soil and bedrock. By definition, this does not include local perched systems that have been known to exist along the Study Area.

Karst terrains are also highly sensitive to groundwater pollution. Groundwater flow in karst areas occurs primarily within fractures in the bedrock. Over time, the flow of water dissolves the carbonate rock, enlarging the fractures into cavities. These conduits are capable of moving large amounts of water or contamination over long distances in short periods.

Gao, Alexander, and Tipping (2001) have categorized areas of potential for karst development in southeast Minnesota. The entire alignment for the Central Corridor LRT lies in one of the two areas of highest potential.

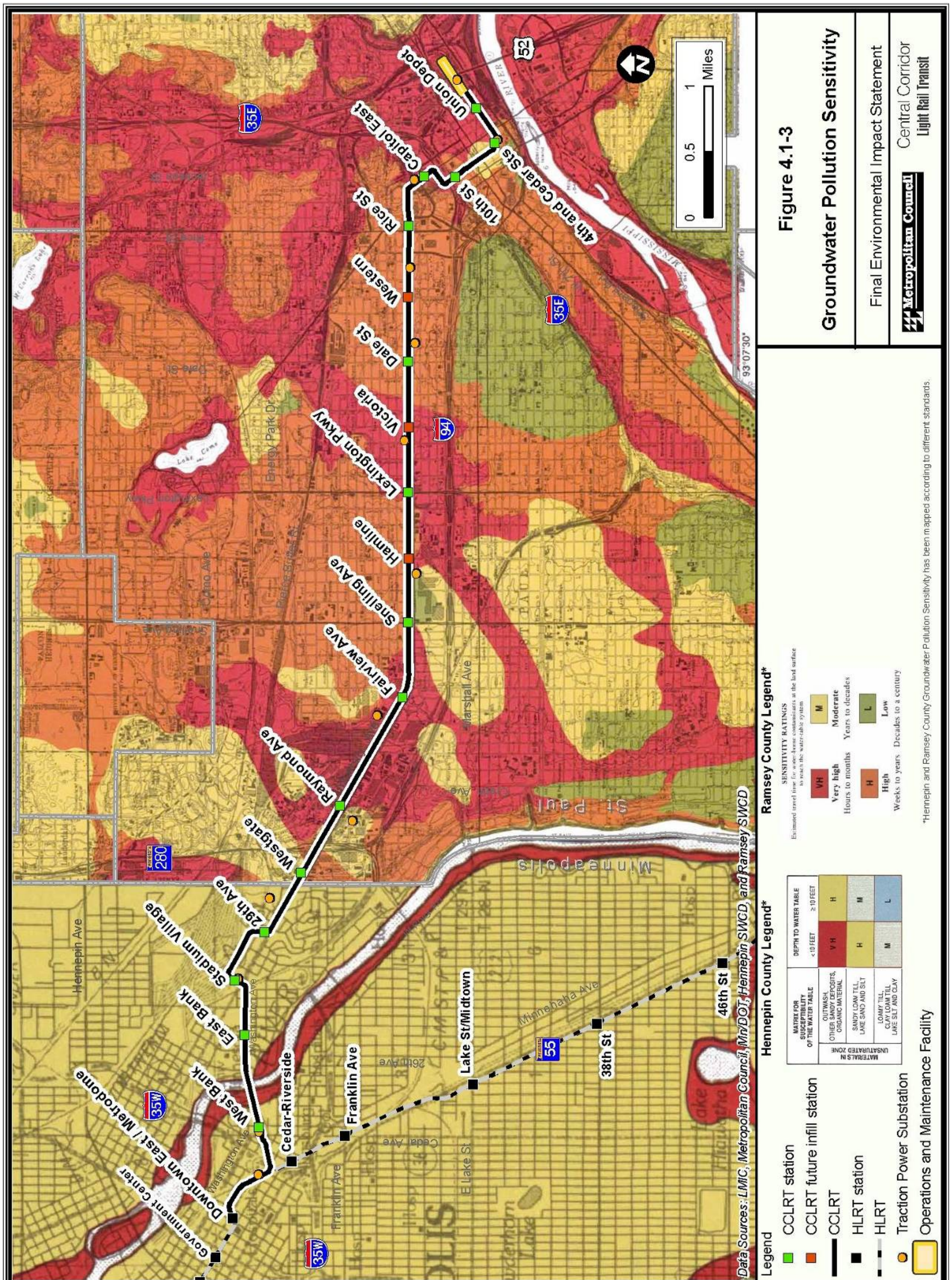
Figure 4.1-3
Groundwater Pollution Sensitivity
Final Environmental Impact Statement
Central Corridor
Light Rail Transit
Metropolitan Council
Legend
CCLRT station
CCLRT future infill station
CCLRT
HLRT station
HLRT
Traction Power Substation
Operations and Maintenance Facility
Hennepin County Legend*
Ramsey County Legend*
Very high
Hours to months
High
Weeks to years
Moderate
Years to decades
Low
Decades to a century
*Hennepin and Ramsey County Groundwater Pollution Sensitivity has been mapped according to different standards.
Data Sources: LMIC, Metropolitan Council, Mn/DOT, Hennepin SWCD, and Ramsey SWCD
0
0.5
1
Miles
Union Depot
Capitol East
10th St
4th and Cedar Sts
Rice St
Western
Dale St
Victoria
Lexington Pkwy
Hamline
Snelling Ave
Fairview Ave
Raymond Ave
Westgate
29th Ave
Stadium Village
East Bank
West Bank
Cedar-Riverside
Downtown East / Metrodome
Government Center
Franklin Ave
Lake St/Midtown
38th St
46th St
Minneapolis
St Paul
Map Document: (\\Mspe-gis-file\gisprojMetCouncil\65891\map_docs\mxd\FEIS\CH4_Enviro\geologic_res\Fig4-1-3_groundwater_sensitivity_120908_cs.mxd) 1/5/2009 -- csears

4.1.2.6 Soil Resources

The Study Area includes approximately 20 soil map units, (NRCS, 2005 and 2006) (Figure 4.1-4). The following paragraphs provide a summary of the five primary soils that may be affected by the Central Corridor LRT Project:

- **Urban Land/Urban Soil Complex and Udorthents**—These soil map units make up the majority of the Central Corridor LRT Study Area and are the primary soils crossed by the Central Corridor LRT Project. These soil classifications are generally characterized as highly disturbed because of human activities. Much of the soils have been altered through grading, paving, excavation, or fill.
- **Chetek Sandy Loam**—The Chetek series consists of very deep, somewhat excessively drained soils which are shallow-to-sandy outwash. They formed mostly in loamy alluvium and in the underlying sandy and gravelly outwash. Typically, they are on outwash plains and stream terraces, but some are on moraines or kame terraces. Permeability is moderate or moderately rapid in the loamy mantle and rapid or very rapid in the sandy outwash. Slopes range from 0 to 45 percent.
- **Dorset Sandy Loam**—The Dorset series consists of very deep, somewhat excessively drained soils formed in a thin loamy mantle and in underlying sandy and gravelly outwash sediments. They are on outwash plains, valley trains, stream terraces, and moraines. They have moderately rapid permeability in the upper mantle and rapid permeability in the lower sediments. Slopes range from 0 to 35 percent.
- **Hubbard Loamy Sand**—The Hubbard series consists of very deep, excessively drained soils that formed in sandy glacial outwash on outwash plains, valley trains, and stream terraces. Slopes range from 0 to 35 percent.
- **Sandberg Loamy Coarse Sand**—The Sandberg Series consists of very deep, excessively drained soils that formed in coarse or moderately coarse glacial outwash sediments or glacial beach deposits with or without a thin loamy mantle. These soils are on outwash plains, glacial lake beaches, stream terraces, valley trains, and glacial moraines. Permeability is moderately rapid or rapid in the upper part and very rapid in the lower part. Slopes range from 0 to 45 percent.

4.1.3 Long-Term Effects

4.1.3.1 No-Build Alternative

There are no positive or negative impacts to geology, groundwater, or soils anticipated as a result of the No-Build Alternative.

4.1.3.2 Preferred Alternative

Because permanent dewatering is not required, none of the proposed project activities, including the work on the Washington Avenue Bridge, would have long-term effects on groundwater resources within the Central Corridor LRT Study Area.

The existing soil resources within the project area are mostly disturbed and covered with pavement or other impervious surfaces. The existing surfaces that are not paved or impervious are, nonetheless, highly disturbed. No long-term impact to soil resources is anticipated.

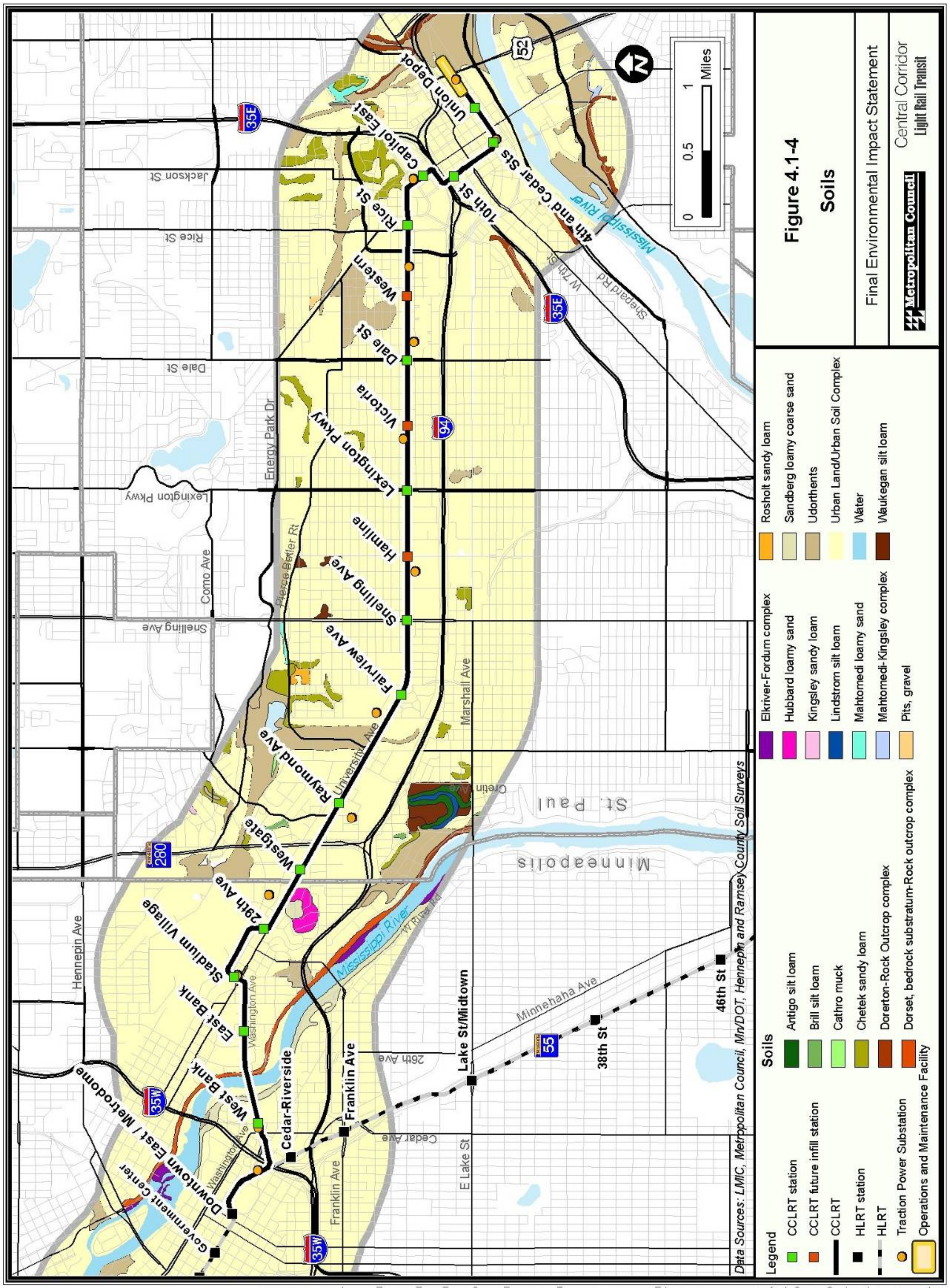
Figure 4.1-4
Soils
Final Environmental Impact Statement
Metropolitan Council
Central Corridor Light Rail Transit
Legend
CCLRT station
CCLRT future infill station
CCLRT
HLRT station
HLRT
Traction Power Substation
Operations and Maintenance Facility
Soils
Antigo silt loam
Brill silt loam
Cathro muck
Chetek sandy loam
Dorerton-Rock Outcrop complex
Dorset, bedrock substratum-Rock outcrop complex
Elkriver-Fordum complex
Hubbard loamy sand
Kingsley sandy loam
Lindstrom silt loam
Mahtomedi loamy sand
Mahtomedi-Kingsley complex
Pits, gravel
Rosholt sandy loam
Sandberg loamy coarse sand
Udorthents
Urban Land/Urban Soil Complex
Water
Waukegan silt loam
0 0.5 1 Miles
Data Sources: LMIC, Metropolitan Council, Mn/DOT, Hennepin and Ramsey County Soil Surveys
Union Depot
Capitol East
4th and Cedar Sts
10th St
Rice St
Western
Dale St
Victoria
Lexington Pkwy
Hamline
Snelling Ave
Fairview Ave
Raymond Ave
Westgate
29th Ave
Stadium Village
East Bank
West Bank
Downtown East / Metrodome
Government Center
Cedar-Riverside
Franklin Ave
Lake St/Midtown
38th St
46th St
Minneapolis
St. Paul
Mississippi River
Map Document: (\\Mspe-gis-file\gispro\MetCouncil\65891\map_docs\mxd\FEIS\CH4_Enviro\soil_res\Fig4-1-4_soils_120908_cs.mxd) 1/5/2009 -- csens

4.1.4 Short-Term Construction Effects

4.1.4.1 Geology

The proposed project would not result in short-term construction impacts related to the geology of the Central Corridor LRT Study Area.

4.1.4.2 Groundwater

As indicated in the Environmental Protection Agency (EPA) comments on the Central Corridor Alternatives Analysis and Draft Environmental Impact Statement (AA/DEIS) and Supplemental Draft Environmental Impact Statement (SDEIS), the project may have short-term impacts on groundwater. Elevation profiles along the alignment, however, indicate no areas where the surface elevation will be lowered by more than a few feet. As a result, extensive dewatering is not expected. Dewatering of pits or small excavations is possible.

Impacts relating to construction dewatering will be temporary. Local potable water is supplied by the municipalities. Impacts from construction dewatering to the surface and groundwater sources for potable supply will be insignificant, if any occur at all. Key project areas where dewatering may occur include all sites selected for TPSS, and the following:

- Downtown St. Paul
    - Operations and Maintenance Facility (OMF)
    - Downtown St. Paul Alignment and Station Modifications
- Capitol Area
    - Capitol Area Station
- Midway East
    - Future Stations at Western Avenue, Victoria Street, and Hamline Avenue
- University/Prospect Park
    - University of Minnesota (U of M) Alignment

Groundwater contamination from construction-related spills is most likely to impact the water table in areas of high sensitivity as identified in Section 4.1.3.5. Several project activities are located within areas of high sensitivity. Therefore, spills relating to construction at the following project planning segments have the potential to impact groundwater resources:

- Downtown St. Paul
    - OMF
    - Downtown St. Paul Alignment and Stations
    - TPSS
- Capitol Area
    - Capitol Area Alignment and Stations
    - TPSS

- Midway East
    - Future Station at Victoria Street
    - TPSS

When detailed construction activities have been identified, further consideration will be given to potential spill impacts and best management practices (BMPs) to be used during work activities on the Washington Avenue Bridge.

4.1.4.3 Soils

Short-term construction impacts to soil resources are limited to those project activities that would disturb unpaved or permeable surfaces. Construction activities may further degrade soils through compaction and erosion.

4.1.5 Mitigation

4.1.5.1 Geology

The proposed project activities would have no impact related to the geology in the Central Corridor LRT Study Area; therefore, no mitigation is proposed. Prior to construction, additional geotechnical data would be collected through soil borings, particularly in areas where stations and the Operations and Maintenance Facility are proposed. This data would assist with the development of detailed design and construction plans.

4.1.5.2 Groundwater

Potential impacts to the local groundwater relating to the project would be mitigated by employing the following steps:

- Limiting the amount and duration of dewatering activities.
- Employing engineering controls and safety measures as described in Section 4.8 to limit spills of petroleum or hazardous substances that could potentially impact groundwater, particularly in areas identified as having high sensitivity to pollution.
- Developing, as part of the final design and permitting, a Stormwater Pollution Prevention Plan and spill prevention plan for the project.

As noted in Section 4.1.2.5, the potential for karst features exists along the entire alignment. This changes the potential ramifications of spills of hazardous materials. Standard operating procedures and BMPs will be developed to minimize spills and expeditiously and appropriately respond to spill events in light of this karst potential.

4.1.5.3 Soils

BMPs, such as sub-soiling in compacted areas and establishing permanent vegetation in areas where erosion may be a concern, would be used to mitigate construction impacts to soil resources.