5 Physical and Environmental Analysis

This chapter presents results from the analysis of impacts on the physical environment in the project study area. Results are presented for the No-Build Alternative and the proposed METRO Blue Line Light Rail Transit (BLRT) Extension project. Operating-phase (long-term) and construction-phase (short-term) impacts are identified for the alternatives. The No-Build Alternative and the proposed BLRT Extension project are described and illustrated in **Chapter 2 – Alternatives**.

Changes to This Chapter since the Draft Environmental Impact Statement Was Published

This chapter updates the discussion in the *Bottineau Transitway Draft Environmental Impact Statement* (Draft EIS) (March 2014) on impacts to a number of physical and environmental resources: utilities; floodplains; wetlands and other aquatic resources; geology, soils, and topography; hazardous materials; noise; vibration; the biological environment; water quality and stormwater; air quality; and energy. Changes from the Draft EIS to these resources are highlighted as follows:

- **Section 5.1** – This section includes general information about existing public and private utilities and describes the potential effects of the No-Build Alternative and the revised definition of the proposed BLRT Extension project.
- **Section 5.2** – This section describes the existing floodplains in the study area and describes several factors that have caused floodplain impacts to change in the study area since publication of the Draft EIS. These factors include refinements to the footprint of the proposed BLRT Extension project and modifications to the mapping of the 100-year floodplain in the Bassett Creek area. This section also describes the impacts of the No-Build Alternative and the revised definition of the proposed BLRT Extension project on floodplains. Additional considerations responding to US Department of Transportation (USDOT) Order 5650.2, *Floodplain Management and Protection*, and Executive Order 13690, *Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input* are included in this section.
- **Section 5.3** – This section describes the wetland types and wetland boundaries that have been identified and field delineated since publication of the Draft EIS in the study area according to the standards of the US Army Corps of Engineers (USACE) and the Minnesota Board of Water and Soil Resources (BWSR) and describes the impacts of the No-Build Alternative and the proposed BLRT Extension project on wetlands and other aquatic resources. Impacts to wetlands have been decreased through design refinements for the Operations and Maintenance Facility (OMF) and the crossing of Grimes Pond and the ponds north of Golden Valley Road. This section also includes the USACE and Wetlands Conservation Act (WCA) jurisdictional determinations and a discussion of the Section 404 permit application to USACE.
- **Section 5.4** – This section describes the existing geology, soils, and topography in the study area and the short-term impacts on geology, soils, and topography from constructing the proposed BLRT Extension project in light of additional geotechnical investigation that has occurred since the publication of the Draft EIS.

- **Section 5.5** – This section describes the properties in the study area that potentially contain hazardous or regulated materials based on the Modified Phase I Environmental Site Assessment (ESA)conducted since the publication of the Draft EIS. This section also describes the potential for encountering contaminated soil and/or groundwater during the construction of the proposed BLRT Extension project.
- **Section 5.6** – This section describes the existing noise environment in the study area and the long-term (operating-phase) and short-term (construction-phase) noise impacts of the No-Build Alternative and the revised definition of the proposed BLRT Extension project. Additional noise testing was conducted since the publication of the Draft EIS.
- **Section 5.7** – This section describes the existing vibration environment in the study area and the long-term (operating-phase) and short-term (construction-phase) vibration impacts of the No-Build Alternative and the revised definition of the proposed BLRT Extension project.
- **Section 5.8** – This section describes the preferred habitats of rare, threatened, and endangered species in the study area (including the northern long-eared bat) and the expected impacts to plants and animals and their habitat from the No-Build Alternative and the revised definition of the proposed BLRT Extension project.
- **Section 5.9** – This section describes the existing water quality and stormwater conditions in the study area and the stormwater impacts of the No-Build Alternative and the revised definition of the proposed BLRT Extension project in terms of changes to impervious surfaces.
- **Section 5.10** – This section describes the existing air quality in the study area and analyzes the air quality impacts of the No-Build Alternative and the revised definition of the proposed BLRT Extension project on criteria pollutants—a group of common air pollutants regulated by the US Environmental Protection Agency (EPA) on the basis of information on health and/or environmental effects of pollution. A discussion greenhouse gases (GHGs) has been added since the publication of the Draft EIS.
- **Section 5.11** – This section reports the estimated changes in regional energy consumption caused by the No-Build Alternative and the revised definition of the proposed BLRT Extension project.

The study area represents a geographic area used to identify resources, and it varies based on the resource being evaluated. The basis for each study area begins with the limits of disturbance (LOD), which is defined as the estimated area where construction would occur for the proposed BLRT Extension project. In some cases, the Metropolitan Council (Council) has extended the study area beyond the LOD in order to understand the extent of impacts on adjacent resources (for example, a wetland or waterway might extend beyond the LOD).

The study areas for each resource evaluated in this chapter are summarized in **Table 5.0-1**. More detail is provided in each section of this chapter. For reference, conceptual engineering plans, which include a depiction of the proposed BLRT Extension project's LOD, are provided in **Appendix E**.

Table 5.0-2 summarizes the effects of the proposed BLRT Extension project on the built and natural environment, as well as the Council's minimization and mitigation commitments that are a part of the proposed BLRT Extension project.

Table 5.0-1. Defined Study Areas for the Physical and Environmental Analysis

Resource Evaluated	Study Area Definition	Basis for Study Area
Utilities	Within or directly adjacent to the LOD	Captures utilities within the LOD as well as adjacent utilities that could also be affected
Floodplains	Within ¼ mile of the LOD	Captures floodplain impacts to upstream and downstream waters for a distance outside the LOD
Wetlands and Other Aquatic Resources	Within ¼ mile of the LOD	The distance captures the wetlands that are within and directly adjacent to the proposed BLRT Extension project; physical impacts to wetlands are not expected to extend beyond this distance
Geology, Soils, and Topography	Within and adjacent to the LOD	Estimated area where construction would occur for the proposed BLRT Extension project
Hazardous Materials Contamination	500 feet on either side of the proposed BLRT Extension project alignment	ASTM standards (E1527-13 and 40 CFR Part 312), as modified by the Minnesota Department of Transportation (MnDOT) for transportation corridors
Noise and Vibration	Based on the screening distances provided in Chapters 4 and 9 of the Federal Transit Administration (FTA) guidance manual *Transit Noise and Vibration Impact Assessment* (May 2006)	Based on the screening distances provided in Chapters 4 and 9 of the FTA guidance manual *Transit Noise and Vibration Impact Assessment* (May 2006)
Biological Environment (Wildlife Habitat and Endangered Species)	Within ¼ mile of the LOD	The distance captures the habitat that is directly adjacent to the footprint of the proposed BLRT Extension project and the wildlife that could be affected by the alternative
Water Quality and Stormwater	1 mile on either side of the proposed BLRT Extension project alignment for impaired waters; within the LOD for stormwater	National Pollutant Discharge Elimination System (NPDES) requirements for identifying impaired waters within or sensitive resources within 1 mile of a project
Air Quality/Greenhouse Gas Emissions	All roadway segments adjacent to and crossing the proposed BLRT Extension project including the proposed OMF	Established in cooperation with the Minnesota Pollution Control Agency (MPCA)
Energy	Anticipated changes in travel patterns and bus operations resulting from the proposed BLRT Extension project	Total energy consumption of the proposed BLRT Extension project measured in British thermal units (BTU) (industry standard)

Table 5.0-2. Summary of Effects and Minimization and Mitigation – Physical and Environmental Analysis

Category		Summary of Impacts and Mitigations
Utilities (Section 5.1)	Operating-Phase (Long-Term) Direct Impacts	■ Protective measures from stray current might be needed for some underground utilities; no other long-term impacts identified
	Construction-Phase (Short-Term) Impacts	■ Minor utility service disruptions would occur throughout construction to facilitate utility relocations ■ Potential unintentional damage causing service disruptions could occur during construction
	Mitigation Measures	**Construction-Phase (Short-Term):** ■ Relocate all conflicting utilities to avoid utility impacts to and to maintain utility service, in accordance with the proposed BLRT Extension project Utility Relocation and Management Plan ■ Include measures to minimize stray current and reduce amount of corrosion due to stray current ■ Prior to construction, determine necessary improvements to the electrical transmission systems along the corridor through consultation with Xcel Energy; necessary improvements will likely involve upgrading existing transmission facilities ■ Utility location excavations and preconstruction surveys will be performed ■ Utility contractors will be required to notify affected businesses and residences of any planned disruption of service due to construction activities; temporary service will be provided as appropriate ■ If previously unidentified lines are encountered, work will be discontinued, and appropriate utility companies and agencies will be contacted to identify the line(s); businesses and residents will be notified before line(s) are disturbed ■ Any wells, known or discovered during construction, within the proposed permanent right-of-way will be abandoned and sealed according to state and local regulations ■ Wells outside, but near, the proposed BLRT Extension project right-of-way will be avoided ■ For those locations where impacts to wells will interfere with the necessary supply of potable water or with monitoring groundwater conditions at a site, well replacement or other water supply provisions will be considered ■ Minnesota Department of Health guidance will be used to evaluate the feasibility of stormwater infiltration practices located in vulnerable Wellhead Protection Areas ■ Temporary dewatering during construction could require Minnesota Department of Natural Resources (DNR) groundwater appropriation permits

Table 5.0-2. Summary of Effects and Minimization and Mitigation – Physical and Environmental Analysis

Category		Summary of Impacts and Mitigations
Floodplains (Section 5.2)	Operating-Phase (Long-Term) Direct Impacts	■ Two floodplain areas would be affected by the construction of the proposed BLRT Extension project: • Bassett Creek: 16,800 cubic yards • Grimes Pond: 200 cubic yards
	Construction-Phase (Short-Term) Impacts	■ No temporary construction-phase (short-term) impacts to floodways or floodplains are anticipated since long-term floodplain mitigation sites will be constructed in advance of any filling in existing floodplains
	Mitigation Measures	**Operating-Phase (Long-Term):** ■ Develop appropriate plans and obtain applicable permits for floodplains, as well as implement best management practices (BMPs) ■ Bassett Creek Floodplain: • A floodplain mitigation area has been identified in Theodore Wirth Regional Park (TWRP) between the Bassett Creek main stem and the proposed BLRT and BNSF Railway (BNSF) rail corridor • Mitigation will include excavating adjacent ground below the elevation of the Bassett Creek 100-year floodplain to provide compensatory floodplain storage for the fill placed in the floodplain ■ Grimes Pond Floodplain: • Some excavation of adjacent ground below the Grimes Pond 100-year floodplain elevation will provide compensatory floodplain storage for the fill placed in the floodplain • Impacts to floodplains associated with Grimes Pond were reduced with a design that elevates the light rail transit (LRT) tracks on a structure rather than on an embankment
Wetlands and Other Aquatic Resources (Section 5.3)	Operating-Phase (Long-Term) Direct Impacts	■ The proposed BLRT Extension project would impact about 13.19 acres of wetlands, about 9.96 acres of permanent impact and about 3.23 acres of temporary impact. About 4.16 acres of impacted wetlands under USACE jurisdiction (pursuant to Section 404 of the Clean Water Act) require compensatory mitigation. About 6.28 acres of the impacted wetlands under WCA jurisdiction require compensatory mitigation (note that some of the impacted wetlands are under both USACE and WCA jurisdiction). • Seasonally flooded basin (Type 1) ○ Total wetland impacts: 6.59 acres ○ WCA jurisdictional impacts requiring compensatory mitigation: 4.28 acres ○ USACE jurisdictional impacts requiring compensatory mitigation: 2.52 acres • Deep marsh (Type 4) ○ Total wetland impacts: 2.49 acres ○ WCA jurisdictional impacts requiring compensatory mitigation: 0.1 acre ○ USACE jurisdictional impacts requiring compensatory mitigation: 1.01 acres

Table 5.0-2. Summary of Effects and Minimization and Mitigation – Physical and Environmental Analysis

Category		Summary of Impacts and Mitigations

		• Open water (Type 5)
		  ○ Total wetland impacts: 3.61 acres
		  ○ WCA jurisdictional impacts requiring compensatory mitigation: 1.69 acres
		  ○ USACE jurisdictional impacts requiring compensatory mitigation: 0.42 acre
		• Shrub-carr (Type 6)
		  ○ Total wetland impacts: 0.50 acre
		  ○ WCA jurisdictional impacts requiring compensatory mitigation: 0.21 acre
		  ○ USACE jurisdictional impacts requiring compensatory mitigation: 0.21 acre
		■ A portion of Bassett Creek, a stream reach of 450 feet total length near the Plymouth Avenue bridge would be relocated to accommodate the proposed BLRT Extension project

	Construction-Phase (Short-Term) Impacts	■ Construction-related wetland impacts typically associated with access roads needed to construct portions of the proposed BLRT Extension project are anticipated to be less than 2.5 acres
	Mitigation Measures	**Operating-Phase (Long-Term):** ■ The OMF was designed to avoid wetland impacts ■ The proposed BLRT Extension project design accommodates the trackage on an elevated structure in the segment that bisects Grimes Pond/North Rice Pond ■ Compensatory wetland mitigation will be accomplished through a combination of on-site wetland mitigation and purchases of private wetland credits from existing mitigation banks in suitable major watersheds and bank service areas. An estimated 12 to 14 acres of compensatory wetland mitigation credit will be required **Construction-Phase (Short-Term):** ■ Appropriate BMPs will be implemented to protect wetlands and other aquatic resources that are downslope or downstream from areas disturbed as a result of earthmoving ■ Minimization of impact through use of BMPs followed by restoration to pre-construction conditions will be required for wetland areas disturbed during construction ■ Temporary disturbance of WCA-jurisdictional wetlands for longer than 180 days may require additional mitigation

Table 5.0-2. Summary of Effects and Minimization and Mitigation – Physical and Environmental Analysis

Category		Summary of Impacts and Mitigations
Geology, Soils, and Topography (Section 5.4)	Operating-Phase (Long-Term) Direct Impacts	■ No operating-phase (long-term) impacts are anticipated as a result of the proposed BLRT Extension project
	Construction-Phase (Short-Term) Impacts	■ Extensive soil correction would be required in areas of poor soils; primarily between Olson Memorial Highway and 36th Avenue ■ Short-term dewatering would be needed for open-trench subsurface work in areas of high groundwater
	Mitigation Measures	**Construction-Phase (Short-Term):** ■ Construction activity will follow appropriate standards and applicable permitting requirements of MPCA, MnDOT, and Hennepin County for grading and erosion control ■ Dewatering permits, if required, will be obtained from DNR ■ A Spill Prevention, Control and Countermeasures plan developed for the proposed BLRT Extension project by the construction contractor will include measures to avoid impacts to potential karst features ■ For areas of poor soils, the proposed BLRT Extension project design will incorporate geotechnical elements (load transfer platforms and lightweight fill) to provide a stable base for project components and to avoid differential settlement of soils
Hazardous Materials Contamination (Section 5.5)	Operating-Phase (Long-Term) Direct Impacts	■ None identified
	Construction-Phase (Short-Term) Impacts	■ The Modified Phase I ESA identified 271 parcels, 24 of which have a high potential for contamination and 135 of which have a medium potential in the proposed BLRT Extension project corridor; construction activities in these areas may encounter contaminated soil and/or groundwater ■ Potential spills of regulated materials during construction
	Mitigation Measures	**Construction-Phase (Short-Term):** ■ Conduct a Phase II ESA, in which a subsurface investigation will be conducted and soil and groundwater samples will be collected and then analyzed by a certified laboratory ■ Develop a Response Action Plan (RAP) to address proper handling of contaminated soil and groundwater encountered during construction ■ A Construction Contingency Plan will be developed as part of the RAP that will include proper handling and treating of contaminated soil and/or groundwater that could not be avoided during construction ■ The construction contractor will develop a Spill Prevention, Control and Countermeasures Plan to minimize the impact to surface water or groundwater in the event of a spill ■ Perform assessments for asbestos and other regulated materials prior to demolition of structures; develop a plan for management of asbestos and regulated materials

Table 5.0-2. Summary of Effects and Minimization and Mitigation – Physical and Environmental Analysis

Category		Summary of Impacts and Mitigations
Noise (Section 5.6)	Operating-Phase (Long-Term) Direct Impacts	■ Without mitigation: • 366 moderate and 618 severe noise impacts ■ With implementation of Quiet Zones: • 176 moderate and 120 severe noise impacts ■ With mitigation, the residual impacts would be: • 5 moderate and 2 severe noise impacts
	Construction-Phase (Short-Term) Impacts	■ Elevated noise levels from construction equipment ■ For residential land use, at-grade track construction noise impacts can extend 120 feet from the construction site ■ If nighttime construction is conducted, noise impacts from at-grade construction can extend 380 feet from the construction site
	Mitigation Measures	**Operation-Phase (Long-Term):** ■ The proposed BLRT Extension project will include the infrastructure required to make all at-grade freight rail and LRT crossings Quiet Zone ready ■ Interior testing to determine appropriate mitigation: • Olson Memorial Highway to Oak Park Avenue North (northbound [NB]) • Oak Park Avenue North to Plymouth Avenue North (NB) • Plymouth Avenue North to 16th Avenue North (NB) • 16th Avenue North to Golden Valley Road (NB) • 34th Avenue North to 36th Avenue North (southbound [SB]) • 42nd Avenue North to MN-100 (NB) ■ Noise barrier: • Golden Valley Road to 26th Avenue North (NB) • 26th Avenue North to 31½ Avenue North (NB) • 31½ Avenue North to 34th Avenue North (NB) • 34th Avenue North to 36th Avenue North (SB) • 36th Avenue North to 38th Avenue North (NB) • 36th Avenue North to 38th Avenue North (SB) • 38th Avenue North to 40½ Avenue North (NB)

Table 5.0-2. Summary of Effects and Minimization and Mitigation – Physical and Environmental Analysis

Category		Summary of Impacts and Mitigations
		■ Noise Barrier and interior testing to determine appropriate mitigation: • 38th Avenue North to 40th Avenue North (SB) ■ Wayside device and noise barrier: • 40½ Avenue North to 42nd Avenue North (NB) ■ Wayside device and interior testing to determine appropriate testing: • 40th Avenue North to 42nd Avenue North (SB) • MN-100 to 47th Avenue North (SB) ■ Wayside device, noise barrier, and interior testing to determine appropriate testing: • MN-100 to 47th Avenue North (NB) • 47th Avenue North to freight tracks (NB) **Construction-Phase (Short-Term):** ■ Contractors will prepare a detailed Noise Control Plan for the proposed BLRT Extension project's construction duration. A noise control engineer or acoustician will work with the contractor to prepare a Noise Control Plan in conjunction with the contractor's specific equipment and methods of construction. Key elements of this plan will include: • Contractor's specific equipment types • Schedule and methods of construction • Maximum noise limits for each piece of equipment with certification testing • Prohibitions on certain types of equipment and processes during the nighttime hours without local agency coordination and approved variances • Identification of specific sensitive sites where near construction sites • Methods for determining construction noise levels • Implementation of noise control measures where appropriate • Include a 24-hour construction hotline

Table 5.0-2. Summary of Effects and Minimization and Mitigation – Physical and Environmental Analysis

Category		Summary of Impacts and Mitigations
Vibration (Section 5.7)	Operating-Phase (Long-Term) Direct Impacts	■ The proposed BLRT Extension project would cause 28 vibration impacts at residential land uses
	Construction-Phase (Short-Term) Impacts	■ With the exception of impact pile driving, the potential for damage would be limited to buildings within 20 feet of construction activities ■ The distance for the potential for damage to buildings from impact pile driving is up to 40 feet.
	Mitigation Measures	**Operating-Phase (Long-Term):** ■ 36th Avenue North to 38th Avenue North: 700-foot-long ballast mat ■ 38th Avenue North to 40½ Avenue North: 300-foot-long ballast mat ■ 47th Avenue North to BNSF freight tracks: 300-foot-long ballast mat **Construction-Phase (Short-Term):** ■ To mitigate vibration impacts from construction activities, the following measures will be applied, where feasible: • Limit high-vibration activities at night • Include limits on vibration in the construction specifications, especially at locations where high-vibration activities will occur • Minimize the use of impact and vibratory equipment, where possible and appropriate • Use truck haul routes that minimize exposure to sensitive receptors and minimize damage to roadway surfaces, where appropriate • Perform preconstruction surveys to document the existing conditions of the structures in the vicinity of sites where high-vibration construction activities will be performed • If a construction activity could exceed the damage criteria at any building, the contractor will be required to conduct vibration monitoring, and, if the vibration exceeds the limit, the activity must be modified or terminated

Table 5.0-2. Summary of Effects and Minimization and Mitigation – Physical and Environmental Analysis

Category		Summary of Impacts and Mitigations
Biological Environment (Wildlife Habitat and Endangered Species) (Section 5.8)	Operating-Phase (Long-Term) Direct Impacts	**Threatened and Endangered Species:** ■ "No Effect" on the Higgins eye pearlymussel and the Snuffbox mussel ■ "May Affect, Incidental Take Not Prohibited" on the northern long-eared bat (NLEB) ■ With adherence to DNR guidelines, no impacts to the Blanding's turtle are anticipated **Migratory Birds:** ■ With implementation of acceptable measures to minimize impacts, no impacts are anticipated from the proposed BLRT Extension project to species covered under the Migratory Bird Treaty Act (MBTA) **Habitat:** ■ The proposed BLRT Extension project would involve constructing physical barriers that could restrict the crossing of portions of the corridor by wildlife ■ Disturbed soils within the limits of disturbance could create conditions where infestation of noxious and invasive species can increase ■ Clearing of approximately 28 acres of forested lands
	Construction-Phase (Short-Term) Impacts	■ Construction-related physical and noise disturbances could temporarily disrupt wildlife habitat use; no effects on threatened and endangered species or migratory birds anticipated
	Mitigation Measures	**Operating-Phase (Long-Term):** ■ Identify opportunities, where practicable, to facilitate wildlife crossings of the corridor through enhanced culvert crossings or other appropriate designs ■ Threatened and Endangered Species, Migratory birds: • None required ■ Habitat: • Infestations of noxious and invasive species can be controlled throughout the operating phase of the proposed BLRT Extension project through spot-spraying appropriate herbicides and the development and adherence to a vegetation management plan • Mitigation for tree impacts within the LOD of the proposed BLRT Extension project will be based on relevant city ordinances • Mitigation for unavoidable impacts to aquatic habitat will be accomplished through a combination of on-site wetland mitigation and purchasing suitable wetland credits from an established wetland mitigation bank

Table 5.0-2. Summary of Effects and Minimization and Mitigation – Physical and Environmental Analysis

Category		Summary of Impacts and Mitigations
		• Mitigation for unavoidable impacts to notable terrestrial habitat will be accomplished through tree plantings in and around TWRP and a few selected areas throughout the LOD of the proposed BLRT Extension project, as well as vegetation restoration in temporarily disturbed areas • Where effective and feasible, suitable wildlife crossings will be accommodated within proposed culverts to allow some wildlife species to cross from one side of the proposed BLRT Extension project/freight rail tracks to the other **Construction-Phase (Short-Term):** ■ To minimize wildlife habitat impacts, the proposed BLRT Extension project will use a bridge to cross Grimes Pond and ponds north of Golden Valley Road; pre-treat storm BMPs; on-site mitigation areas will be designed that will minimize impacts to forested areas and existing aquatic resources ■ Threatened and Endangered Species • Seasonal restrictions are placed on tree removal that is less than 0.25 mile from a known hibernacula entrance or less than 150 feet from a known maternity roost tree. • Implement DNR recommendations to avoid direct impacts to the Blanding's turtle ■ Migratory birds: • Bald eagle nest surveys will be conducted during the final design of the proposed BLRT Extension project to determine whether any nests are present at that time; if so, the standard guidelines will be followed, which include limiting construction activity within at least 330 feet from the nesting site, and limiting clearing of vegetation within 660 feet of the nest site during the nesting season (late January to July) • In compliance with the MBTA, perform bridge work before May 15 or after September 1 ■ Habitat: • Temporary construction access roads and construction staging areas will be restored to the pre-construction grade and replanted with suitable vegetation • Tree impacts in the proposed BLRT Extension project LOD will be minimized to the extent practicable

Table 5.0-2. Summary of Effects and Minimization and Mitigation – Physical and Environmental Analysis

Category		Summary of Impacts and Mitigations
Water Quality and Stormwater (Section 5.9)	Operating-Phase (Long-Term) Direct Impacts	■ The proposed BLRT Extension project would cause an 83 percent increase in the impervious area within the LOD
	Construction-Phase (Short-Term) Impacts	■ Construction activities would disturb soils and cause runoff that could erode slopes and drainageways, form gullies, and deposit sediment in storm drain systems and receiving waterbodies; these effects could destabilize slopes and reduce water quality if temporary BMPs, required through the permitting process, are not in place prior to a storm event
	Mitigation Measures	**Operating-Phase (Long-Term):** ■ Long-term mitigation measures will include designing and constructing permanent BMPs, such as detention and infiltration facilities, which will control and treat stormwater runoff caused by an increase in impervious surfaces as a result of the proposed BLRT Extension project **Construction-Phase (Short-Term):** ■ An NPDES Construction Stormwater Permit from MPCA will be required, and the NPDES Construction Stormwater Permit application must be submitted to MPCA at least 30 days prior to the start of construction ■ A Stormwater Pollution Prevention Plan, which must be submitted at the time of the permit application, will be developed and implemented during construction ■ Short-term mitigation measures will include developing erosion- and sediment-control plans to control runoff and reduce erosion and sedimentation during construction, and limiting the amount of sediment carried into lakes, streams, wetlands, and rivers by stormwater runoff

Table 5.0-2. Summary of Effects and Minimization and Mitigation – Physical and Environmental Analysis

Category		Summary of Impacts and Mitigations
Air Quality/ Greenhouse Gas Emissions (Section 5.10)	Operating-Phase (Long-Term) Direct Impacts	■ No impacts anticipated; annual regional vehicle-miles traveled with the proposed BLRT Extension project would be essentially the same as with the No-Build Alternative ■ No violations of air quality standards are predicted
	Construction-Phase (Short-Term) Impacts	■ During construction, traffic volumes and operations on roads in the proposed BLRT Extension project would be impacted resulting in traffic detours to parallel roads and temporarily increase in emissions and concentrations of air pollutants near homes and businesses ■ Construction equipment powered by fossil fuels emits the same air pollutants as highway vehicles ■ Exposed earthen materials can also produce increased particulate matter when they are moved or disturbed by wind ■ Construction phase greenhouse gas emissions estimated at 21,191 metric tons of carbon dioxide (CO_2) equivalents per year over a 3-year period
	Mitigation Measures	**Construction-Phase (Short-Term):** ■ Where applicable and prudent, implement EPA-recommended measures to reduce short-term construction impacts to air quality ■ BMPs will be implemented during construction to control dust, including: • Minimize land disturbance during site preparation • Use watering trucks to minimize dust • Cover trucks while hauling soil/debris off site or transferring materials. • Stabilize dirt piles if they are not removed immediately • Use dust suppressants on unpaved areas • Minimize unnecessary vehicle and machinery idling • Revegetate any disturbed land post-construction ■ Traffic-control measures will be developed in subsequent stages of the proposed BLRT Extension project to address detours and the flow of traffic

Table 5.0-2. Summary of Effects and Minimization and Mitigation – Physical and Environmental Analysis

Category		Summary of Impacts and Mitigations
Energy (Section 5.11)	Operating-Phase (Long-Term) Direct Impacts	■ None identified
	Construction-Phase (Short-Term) Impacts	■ Compared to the energy consumption of the entire Twin Cities metropolitan area, the construction of the proposed BLRT Extension project would not have a substantial impact on regional energy consumption
	Mitigation Measures	■ No mitigation has been identified or recommended

5.1 Utilities

The Council's design of the proposed BLRT Extension project included evaluating potential utility conflicts and determining what utilities could be affected by the proposed BLRT Extension project.

This section includes general information about existing public and private utilities and describes the potential effects of the No-Build Alternative and the proposed BLRT Extension project. Major utility[1] owners that service the proposed BLRT Extension project area were contacted for existing utility information. This section is not intended to identify every utility that provides service in the proposed BLRT Extension project area, but it does address those that could be affected by the proposed BLRT Extension project.

5.1.1 Regulatory Context and Methodology

5.1.1.1 Legal and Regulatory Context

The following is a representative summary of the laws, regulations, and guidelines that are associated with utility relocation and accommodation.

Federal

- US Code, Title 23, Sections 123 and 109(l)(1)
- US Code, Title 23, Code of Federal Regulations 645, Chapter I, Subchapter G, Part 645, Subparts A and B (Federal Highway Administration [FHWA] 2003)
- FTA's Project and Construction – Management Guidelines (2011), Appendix C – Utility Relocation Agreements

Railway

- BNSF Railway Utility Accommodation Policy

State

Minnesota Department of Transportation (MnDOT)

- MnDOT Policies – Utility Accommodation on Highway Right-of-Way
- MnDOT's Wireline Accommodation Policy and Procedures

Minnesota State Constitution

- Article 1, section 13, addresses just compensation associated with private property that is taken, destroyed, or damaged for public use.

[1] Major utilities include public potable water; wastewater and stormwater collection and distribution facilities; private wells and Wellhead Protection Areas; private electric transmission and distribution lines; telecommunications copper and fiber optic data (hardware and conduit) lines and facilities; and private energy (fuel) transmission and distribution lines.

Minnesota Statutes

- Section 161.20, subdivision 1, addresses the general powers of the commissioner to carry out the provisions of Article 14, section 2, of the Minnesota State Constitution regarding the public highway system. Subdivision 2 addresses the commissioner's power regarding acquisition of property.
- Section 161.45 addresses utilities within highway rights-of-way that require relocation. This section describes rulemaking authority and utility owner interests when real property is conveyed.
- Section 161.46 addresses reimbursement of utility owners for the relocation of facilities. The section includes definitions and reimbursement requirements and describes provisions associated with a lump-sum settlement, acquisition of substitute property in which to relocate a utility, and relocation work by the state.
- Section 222.37, subdivision 2, addresses pipeline relocations.
- Section 216D.04, addresses the Department of Public Safety's notice, plan, and locating requirements for excavation projects involving underground facilities.
- Section 216B, Public Utilities, addresses utilities that are located within right-of-way that is owned by cities. These utilities might be subject to an individual franchise agreement, which provides the terms for which the utility companies may operate in the public right-of-way.

Minnesota Rules

- Parts 8810.3100 through 8810.3600 address the utility permit process, standards for work conducted under permit, aerial lines, and underground lines.
- Chapter 4720.5100–4720.5590 sets standards for wellhead protection planning, which is administered by the Minnesota Department of Health's Well Management Program.

5.1.1.2 Methodology

The Council inventoried existing utilities in the study area using information provided by the utility owners (identified below) and field investigations. All underground utilities were field located to a Subsurface Utility Engineering (SUE) Quality Level B.

Information for sanitary sewer, storm sewer, and water mains was provided (in the form of geographic information systems [GIS] database files and engineering drawings), field surveyed, and compared to the alignment to identify conflicts for the following utility owners:

- City of Minneapolis
- City of Golden Valley
- City of Robbinsdale
- City of Crystal
- City of Brooklyn Park
- Hennepin County
- Metropolitan Council Environmental Services (MCES)
- MnDOT
- BNSF Railway

Private utility information was obtained directly from the following utility owners and compared to the proposed BLRT Extension project alignment to identify conflicts:

- Arvig
- AT&T Transmission
- Center Point Energy
- CenturyLink
- Comcast
- Enventis
- Integra Telecom Holdings
- NuStar Energy
- Rogers Telecom
- Sprint
- TDS Metrocom
- TTM Operating Corporation
- TW Telecom
- Verizon (MCI)
- Windstream
- Xcel Energy
- XO Communications
- Zayo

Wells in the project vicinity were identified from the Minnesota County Well Index database.

5.1.2 Study Area

The study area for utilities is defined as the area within and directly adjacent to the LOD for the proposed BLRT Extension project. The LOD are defined as the estimated area where construction would occur for the proposed BLRT Extension project.

5.1.3 Affected Environment

Several public and private utilities are present in the study area. The general locations of several of these utilities in relation to the proposed BLRT Extension project are shown in **Figure 5.1-1**.

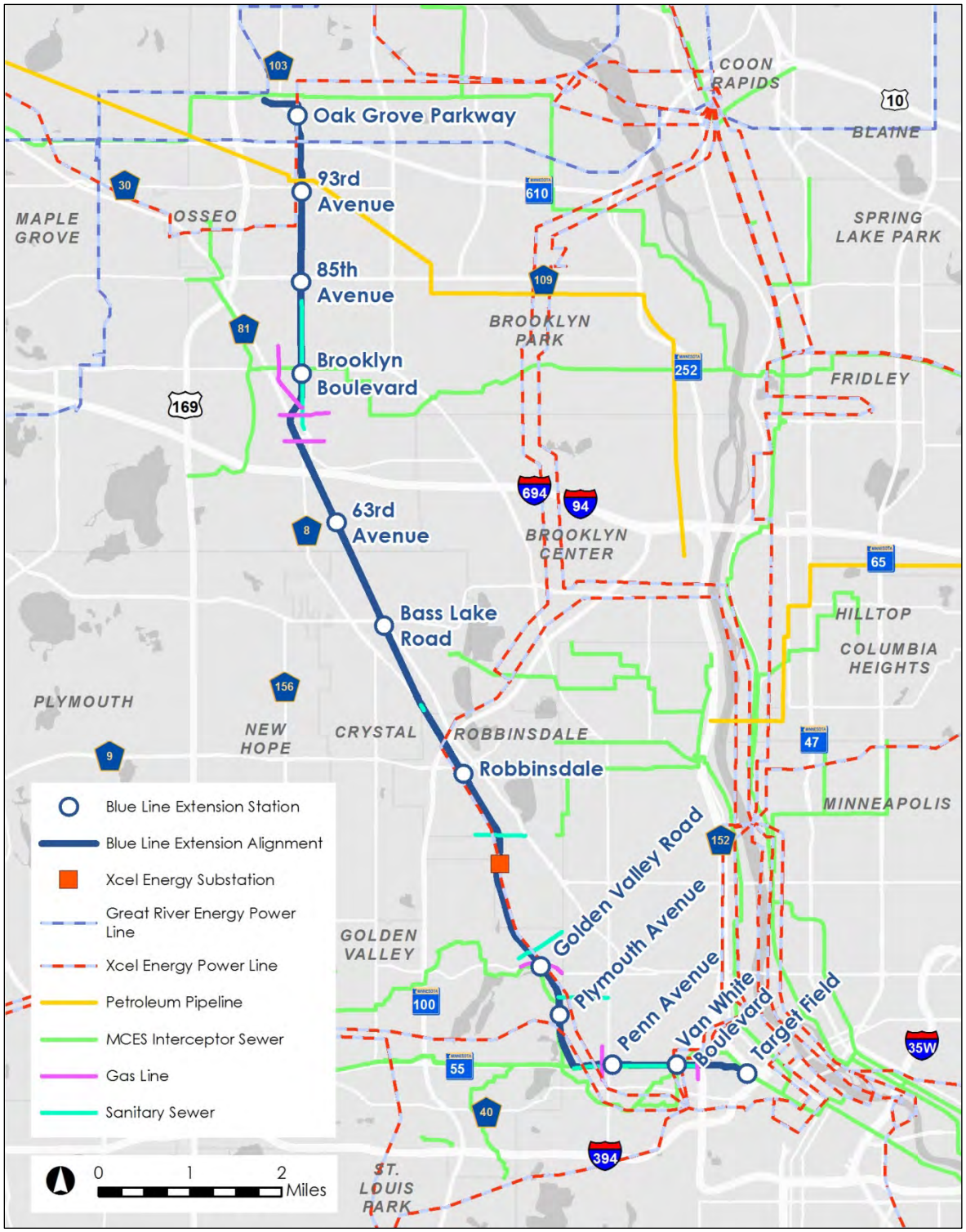
Existing Water Service

Existing water service in the study area is provided, maintained, and owned by the following entities:

- City of Minneapolis
- City of Golden Valley
- City of Robbinsdale
- City of Crystal
- City of Brooklyn Park
- Joint Water Commission[2]

[2] The cities of Crystal, Golden Valley, and New Hope formed a joint powers board in 1963 to manage drinking water supply for the three cities. Each of the three cities maintains its own distribution system, utility billing, meter reading, and water sampling functions.

Figure 5.1-1. Locations of Major Utilities



Sources: Metro Transit, Metro GIS; Minnesota Electric Transmission Mapping Project, modified based on field data

Water mains in the study area typically range from 6 to 16 inches in diameter. At some locations, including the following, a 24-inch or 48-inch water main crosses or runs parallel to the study area:

- 24-inch water main on West Broadway Avenue (County State-Aid Highway 103) at 89th Avenue and Maplebrook Parkway
- 24-inch water main on West Broadway Avenue south of 85th Avenue, parallel to the roadway
- 48-inch steel pipe water main north of Golden Valley Road, crossing under the existing BNSF rail corridor

Six private wells[3] are located in the study area. These wells are identified in **Table 5.1-1** and in **Figure 5.1-2**. Portions of the proposed BLRT Extension project are also located in Drinking Water Supply Management Areas and Wellhead Protection Areas, as shown in **Figure 5.1-3**.[4] Per the federal Homeland Security Act of 2002, the locations of wells that supply public water systems cannot be mapped.

Table 5.1-1. Known Private Wells in the Study Area

Minnesota Unique Well Number	Address	Well Type
415896	8249 101st Avenue North Brooklyn Park, MN 55445	Domestic water supply
405810	8924 West Broadway Avenue Brooklyn Park, MN 55445	Domestic water supply
203500	6221 56th Avenue North Crystal, MN 55429	Commercial water supply
203566	4900 West Broadway Avenue Crystal, MN 55429	Commercial water supply
461018	5421 Lakeside Avenue North Crystal, MN 55429	Monitoring well
727425	4522 Toledo Avenue North Robbinsdale, MN 55422	Monitoring well

Source: Minnesota Geological Survey, County Wells Index, 2011

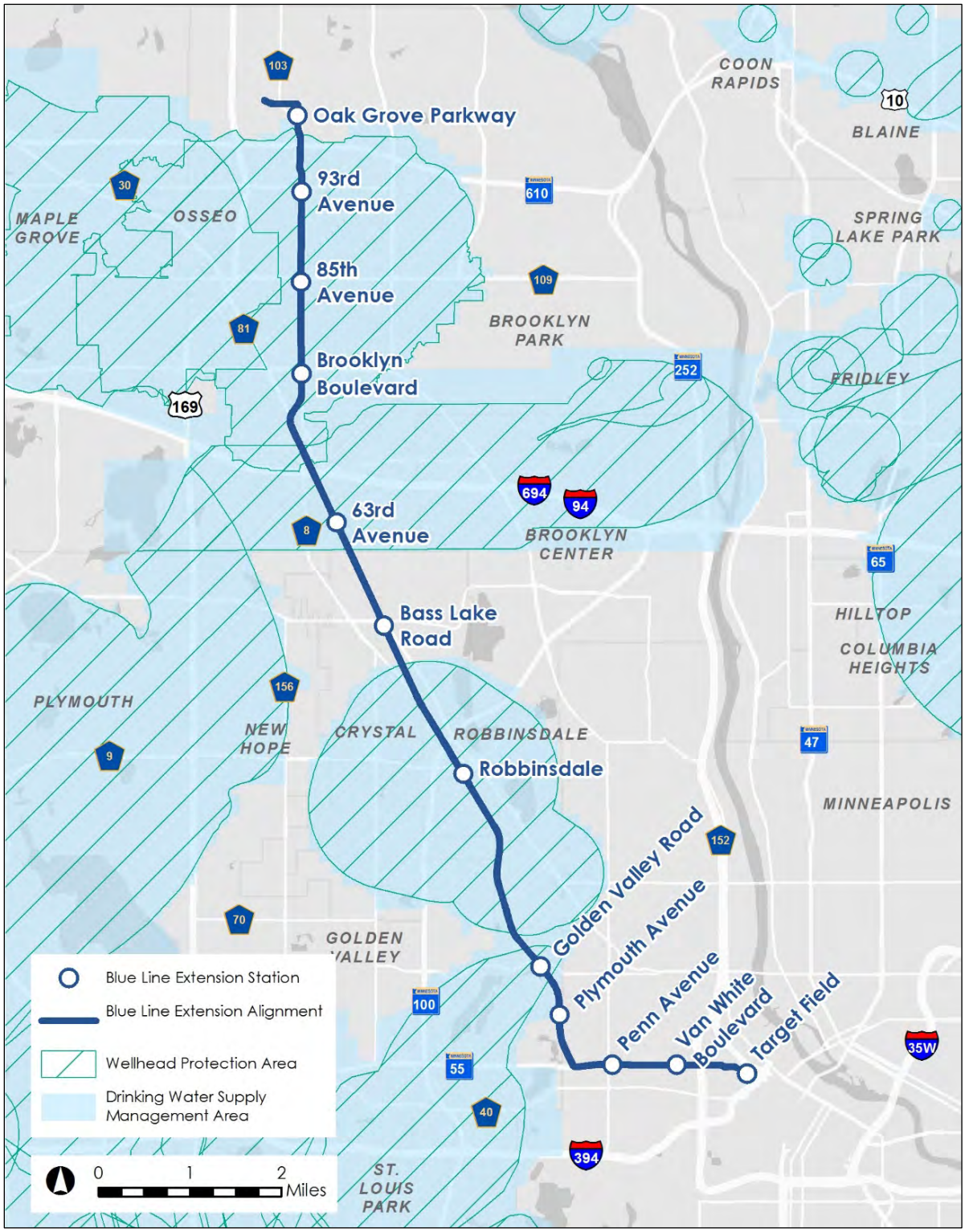
[3] Private wells are those that do not supply the public water system.

[4] The Drinking Water Supply Management Area is the Minnesota Department of Health–approved surface and subsurface area surrounding a public water supply well that completely contains the scientifically calculated Wellhead Protection Area and is managed by the entity identified in a wellhead protection plan. The boundaries of Drinking Water Supply Management Areas are delineated by identifiable physical features, landmarks, or political and administrative boundaries. A Wellhead Protection Area is the recharge area to a public well and is the area managed by the public water supplier, as identified in the wellhead protection plan, to prevent contaminants from entering public wells.

Figure 5.1-2. Private Well Locations

Source: Minnesota Geological Survey, County Wells Index, 2011

Figure 5.1-3. Drinking Water Supply Management Areas and Wellhead Protection Areas



Source: Minnesota Department of Health, 2015

Existing Sanitary and Storm Sewer Service

Sanitary and storm sewer services are owned and maintained by the public works divisions of the areas in which they are located, including:

- Cities of Minneapolis, Golden Valley, Robbinsdale, Crystal, and Brooklyn Park,
- Hennepin County
- MCES

In addition, the BNSF rail corridor includes multiple culverts to convey stormwater across the rail embankment. Many of the BNSF culverts have been identified; culvert locations would be verified during the project design process.

Several publicly owned sanitary and storm sewer services run parallel to and intersect the proposed BLRT Extension project alignment. The sanitary sewers range in size from 8 to 86 inches in diameter, and storm sewers range in size from 9 to 144 inches in diameter, all varying in depth. An MCES interceptor sewer is also located in the study area.

Table 5.1-2 lists the sanitary sewer and MCES interceptor sewers in the study area. Existing storm sewers in the study area are described in detail in the *Preliminary Stormwater Management Plan Technical Memorandum* (Council, 2016a).

Existing Electric and Gas Lines

Xcel Energy provides electrical service in the study area using overhead and underground distribution power lines. Xcel Energy and Great River Energy have electric transmission lines that intersect and run parallel to the proposed BLRT Extension project. **Table 5.1-3** lists the overhead power lines that are in or adjacent to the LOD.

CenterPoint Energy owns several underground gas line utilities in the study area; many of these lines are part of the Belt Line, which supplies natural gas to distribution lines. These lines were reviewed by the Council using utility maps that were provided by CenterPoint Energy. A 12-inch gas line runs beneath Jolly Lane to the east of Bottineau Boulevard (County Road 81), and another 12-inch gas line runs east to west beneath 73rd Avenue as it crosses the BNSF rail corridor. A 24-inch gas line, which is part of the Belt Line, crosses under Bottineau Boulevard about 1,200 feet north of Interstate Highway 94 (I-94). A 20-inch gas line, which is part of the Belt Line, is located south of Golden Valley Road. A 24-inch gas line runs parallel to Queen Avenue, crossing under Olson Memorial Highway. A 16-inch gas line, which is part of the Belt Line, runs north to south and crosses Olson Memorial Highway just west of I-94. The Belt Line also crosses the existing BNSF rail corridor near Golden Valley Road and north of I-94.

One 8-inch steel pipe petroleum pipeline is located in the study area. It crosses West Broadway Avenue just north of 93rd Avenue, and then crosses 93rd Avenue east of West Broadway Avenue. This pipeline, which is owned by NuStar Energy, distributes refined petroleum.

Table 5.1-2. Sanitary and MCES Interceptor Sewers in the Study Area

Utility Type	Utility Location
Sanitary sewer	Sanitary sewer lines are located on the east side of West Broadway Avenue, south of 83rd Avenue, parallel to the roadway.
MCES interceptor sewer	54-inch MCES interceptor sewer located on the south side of 101st Avenue, running parallel to the roadway. 48-inch MCES interceptor sewer crosses West Broadway Avenue at Brooklyn Boulevard.
Sanitary sewer	A sanitary sewer line is located on the east BNSF right-of-way line between 48th Avenue and Byron Avenue, parallel to the freight rail tracks. Some sanitary sewer lines cross under the LRT and freight rail tracks.
Sanitary sewer	Sanitary sewer lines are located parallel to and cross the freight rail corridor at multiple locations, specifically near Kewanee Way, Manor Drive, and 16th Avenue.
MCES interceptor sewer	A 36-inch MCES interceptor sewer is located west of the freight rail corridor near TWRP, adjacent to the study area. South of 14th Avenue, continuing past Olson Memorial Highway, the interceptor runs north-south on the west side of the BNSF rail corridor.
Sanitary sewer	A sanitary sewer line is located on the south side of Olson Memorial Highway/ 6th Avenue.
MCES interceptor sewer	A 30-inch force main and a 42-inch force main are located on the south side of Olson Memorial Highway. At Dupont Avenue, the two force mains combine into one 84-inch pipe and then cross Olson Memorial Highway west of the Bassett Creek tunnel. A separate sanitary line of box culvert, 8 feet 6 inches by 6 feet, crosses Olson Memorial Highway under the Bassett Creek tunnel. This box carries only the city sanitary sewer and converges with the 84-inch pipe on the north side of Olson Memorial Highway.

Table 5.1-3. Overhead Power Lines in the Study Area

Owner	Type	Location
Xcel Energy	Distribution	South of 93th Avenue, west side of West Broadway Avenue and east side north of Trunk Highway (TH) 610.
Xcel Energy	Transmission	West side of West Broadway Avenue, north of 89th Avenue.
Great River Energy	Transmission	North side of TH 610, running parallel to TH 610 and crossing over the West Broadway Avenue/TH 610 interchange.
Xcel Energy	Distribution	East side of BNSF rail corridor, north of Bass Lake Road.
Xcel Energy	Transmission	West side of BNSF rail corridor, north of Lowry Avenue to TH 100, east side of freight rail corridor on steel lattice towers south of Lowry Avenue to Olson Memorial Highway. An electric power substation fed by both transmission lines is adjacent to the BNSF rail corridor near 34th Avenue.
Xcel Energy	Distribution	In the BNSF rail corridor between 36th Avenue and 40th Avenue on east side.
Xcel Energy	Distribution	In BNSF rail corridor between Canadian Pacific Railway crossing and Bass Lake Road on east side.

Existing Long-Distance Communication Service

TDS Metrocom has a fiber optic line that runs parallel to the BNSF rail corridor. At the Robbinsdale Station, the fiber optic line transitions from the east to the west side of the BNSF rail corridor. At Plymouth Avenue, the fiber optic line transitions back to the east side of the rail corridor.

5.1.4 Environmental Consequences

5.1.4.1 Operating-Phase (Long-Term) Impacts

Coordination with local and state agencies might be required to relocate specific utilities outside the proposed BLRT Extension project footprint. However, conflicts cannot be determined until the proposed BLRT Extension project's Engineering phase. Utilities located in the right-of-way and owned by cities could be subject to an individual franchise agreement as authorized by Minnesota Statute (Minn. Stat.) 216B, Public Utilities, which provides the terms for which the utility companies may operate in the public right-of-way.

Public and private utilities must conform to MnDOT's Procedures for Accommodation of Utilities on Highway Right-of-Way, which require owners to obtain a permit in order to place utility facilities on trunk highway right-of-way. Utility installations on, over, or under BNSF property would require review and approval by BNSF Railway, must conform to the requirements in the BNSF Utility Accommodation Policy, and would require a Utility License Agreement issued by BNSF Railway.

No-Build Alternative

There would be no operating-phase utility impacts from the No-Build Alternative.

Proposed BLRT Extension Project

The locations of private and public utilities that run parallel to or cross the transitway corridor would be identified during the project's Engineering phase to determine whether the utilities would be in conflict with the transitway corridor and would need to be relocated to avoid conflict with LRT operations.

Overhead Utilities

The horizontal and vertical locations of overhead electric and communication lines would be adjusted to provide adequate vertical and horizontal clearance for LRT vehicles and the overhead catenary system. It might be possible to relocate some overhead utilities to a different type of pole or place them underground. However, existing overhead electric transmission lines cannot be easily relocated underground because of the substantial cost of burying them (compared to reconstructing them above ground) and because of operational issues and constraints associated with the diminished ability of buried lines to dissipate heat compared to overhead lines.

The proposed BLRT Extension project would affect existing electrical transmission towers in the transitway corridor as a result of relocating the freight rail track and constructing the LRT track. Because of the distance between the proposed transitway corridor and existing transmission towers, some transmission towers would need to be shifted within the BNSF right-of-way. The

Council anticipates that these towers would likely be shifted (in coordination with Xcel Energy) to the western edge of the existing BNSF right-of-way. The two primary locations for transmission tower relocation are:

- **Xcel Energy transmission line between Olson Memorial Highway and the Indiana Substation (between 33rd and 34th avenues):** Existing steel lattice towers on the east side of the BNSF rail corridor would be shifted to the west side of the rail corridor. Because the existing lattice towers are obsolete, they would be replaced with a current pole type (likely steel monotube poles).
- **Xcel Energy transmission line north of TH 610:** Transmission towers would be relocated to the center of the proposed West Broadway Avenue Boulevard, east of the transitway corridor.

Underground Utilities

The Council anticipates impacts on underground utilities from the proposed BLRT Extension project. Underground utilities, both private and public, would be evaluated by the Council on a case-by-case basis to determine their condition, to determine their reaction to loading from the LRT and freight rail, and to verify that the utility meets the vertical clearance requirements for the utility owner, MnDOT, and BNSF Railway. Utility conflicts would be resolved by lowering the existing utility, encasing the utility for additional protection, or relocating the utility. Manholes and vaults that are in conflict with the transitway corridor and that limit access to the underground utilities would need to be relocated to provide adequate access.

The Council would need to evaluate whether existing ferrous metal utilities could be corroded by stray current from the LRT system. Protective measures might need to be considered for some underground utilities.

5.1.4.2 Construction-Phase (Short-Term) Impacts

No-Build Alternative

There would be no construction-phase utility impacts from the No-Build Alternative.

Proposed BLRT Extension Project

Construction-phase impacts to utilities are most likely to occur during excavation and grading, when placing structural foundations, and during work that requires large-scale equipment, which could affect overhead utilities. Disruptions in utility service would occur throughout construction to allow relocating utilities. The Council anticipates that these disruptions would be minor, with temporary connections provided, as the Council deems necessary, to customers before the utilities are permanently relocated. Utility owners would ultimately decide when and whether planned disruptions to service would be allowed.

Previously unidentified utilities could be encountered in the study area, and a utility could be unintentionally damaged during construction. Service disruptions could result.

5.1.5 Avoidance, Minimization, and/or Mitigation Measures

Long-Term Mitigation Measures. No long-term impacts to utilities are anticipated, since the relocation and reconstruction of utilities that would be conducted as part of the proposed BLRT Extension project would maintain current service levels. The Council will evaluate utilities in areas adjacent to proposed LRT electrification components for potential corrosion concerns; protective measures (such as cathodic protection) will be taken to protect utilities from corrosion if warranted.

Short-Term Mitigation Measures. Utility location excavations and pre-construction surveys will be performed in general accordance with the MnDOT policy of Subsurface Utility Engineering. These procedures will help minimize the number of unintended disruptions in utility service.

The Council will require the utility contractor to notify affected businesses and residents of any planned disruption in service as a result of construction. If utilities are discovered during construction that are not identified in the contract documents, the appropriate utility companies and agencies will be contacted to identify the line(s) and will be consulted on appropriate actions.

Any wells, either known or discovered during construction, that are within the proposed permanent right-of-way will be abandoned and sealed according to state and local regulations. Wells outside but near the proposed BLRT Extension project right-of-way will be avoided. For those locations where impacts to wells would interfere with a necessary supply of potable water or with monitoring groundwater conditions at a site, well replacement or other water supply provisions will be considered.

Minnesota Department of Health guidance will be used to evaluate the feasibility of stormwater infiltration practices located in vulnerable Wellhead Protection Areas.

Temporary dewatering during construction could require DNR groundwater appropriation permits.

5.2 Floodplains

The Council reviewed Federal Emergency Management Agency (FEMA) 100-year floodplains[5] and FEMA floodways[6] as part of the evaluation for the proposed BLRT Extension project. The floodplains and floodways were identified and evaluated based on current FEMA Flood Insurance Rate Maps (FIRM) and ancillary information.

This section describes the existing floodplains in the study area and describes several factors that have caused floodplain impacts to change in the study area since publication of the Draft EIS. These factors include refinements to the footprint of the proposed BLRT Extension project and modifications to the mapping of the 100-year floodplain in the Bassett Creek area. This section also describes the impacts of the No-Build Alternative and the proposed BLRT Extension project on floodplains.

The data in this section are based on the information in the *Preliminary Floodplain Impacts and Mitigation Strategies Technical Memorandum* (Council, 2016b), or *Floodplain Technical Memorandum*. The Council conducted the analysis for this section in coordination with USACE, DNR, and local watershed organizations (Bassett Creek Water Management Commission [BCWMC], Shingle Creek Watershed Management Commission [SCWMC], West Mississippi Water Management Commission [WMWMC], and Mississippi Watershed Management Organization [MWMO]) as described in the *Floodplain Technical Memorandum*. Wetlands are addressed separately in **Section 5.3**.

[5] According to 44 CFR Part 9.4, *100-year floodplain* (also known as *base floodplain*) means the floodplain "for the flood which has a one percent chance of being equaled or exceeded in any given year."

[6] According to 44 CFR Part 9.4, "*floodway* means that portion of the floodplain which is effective in carrying flow, within which this carrying capacity must be preserved and where the flood hazard is generally highest, i.e., where water depths and velocities are the greatest. It is that area which provides for the discharge of the base flood so the cumulative increase in water surface elevation is no more than one foot." In Minnesota, the floodway is defined as a cumulative increase in water surface elevations of no more than 6 inches. Local communities may designate more-restrictive definitions of the floodway.

5.2.1 Regulatory Context and Methodology

Floodplains[7] are protected by local, state, and federal legislation because of their ecological value and functionality. Regulatory and permitting authority for floodplain impacts falls to the local government unit (LGU), which is typically the municipality. Watershed management organizations (WMOs) also regulate floodplain impacts to waters within their jurisdictional authority. In addition to the LGUs and WMOs, FEMA, USDOT, and DNR play a role in floodplain management and impacts to water resources in the study area. Floodplain regulatory agencies that have jurisdictional authority in the study area include:

- FEMA[8]
- USDOT[9]
- DNR
- MWMO
- BCWMC
- SCWMC and WMWMC, respectively, or SCWM WMC when referred to in reference to their joint watershed management plan
- City of Minneapolis
- City of Golden Valley
- City of Robbinsdale
- City of Crystal
- City of Brooklyn Park

The floodplains in the study area are associated with Bassett Creek, Grimes Pond, and North Rice Pond. The floodplain and floodway areas are shown in **Figure 5.2-1**, which provides an overview of mapped floodplains in the study area. **Figure 5.2-2, Figure 5.2-3, and Figure 5.2-4** show a detailed view of mapped floodplains in the northern and southern portions of the study area.

Several factors have caused floodplain impacts to change in the study area since the publication of the Draft EIS. These factors include refinements to the footprint of the proposed BLRT Extension project and modifications to the mapping of the 100-year floodplain in the Bassett Creek area.

Executive Order 13690, *Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input* (https://www.whitehouse.gov/the-press-office/2015/01/30/executive-order-establishing-federal-flood-risk-management-standard-and-), was implemented on January 30, 2015. Executive Order 13690 amends Executive Order 11988, *Floodplain Management*, and, based on informed climate science, it addresses the potential for increased severity and duration of weather events and resulting flood elevations. The designed profile elevation of the proposed BLRT Extension project and associated facilities is influenced by Executive Order 13690. The profile elevation must be above the predicted future flood elevations. The appended *Floodplain Technical Memorandum* (**Appendix F**) describes project-related floodplain data and regulation in more detail.

---

[7] *Floodplains* are defined by Executive Order 11988 as "the lowland and relatively flat areas adjoining inland and coastal waters including floodprone areas of offshore islands, including at a minimum, that area subject to a one percent or greater chance of flooding in any given year."

[8] FEMA approval of a Letter of Map Revision (LOMR) will be required if the floodplain mitigation site is constructed in advance of the construction of the proposed BLRT Extension project as anticipated.

[9] USDOT Order 5650.2, *Floodplain Management and Protection*

DNR has developed regulatory standards for floodplain development in the state. LGUs must, at a minimum, adopt these standards. The appended *Floodplain Technical Memorandum* (**Appendix F**) provides additional details. The floodplain requirements of each community and water management organization (WMO) located along the proposed BLRT Extension project corridor meet or exceed the minimum guidance provided by DNR.

Placing fill of any kind in a floodway or floodplain can impede the flow of water and increase flood elevations. Such activities are generally restricted and require mitigation in the form of compensatory storage and/or conveyance modifications to offset the lost floodway storage and/or conveyance. Any project that involves activity in a floodway must be reviewed to determine whether the project would increase the regulatory floodway elevations. A No-rise Certification would be issued by the LGU if hydraulic analyses demonstrate that the proposed BLRT Extension project would not increase flooding. The appended *Floodplain Technical Memorandum* (**Appendix F**) provides additional data. The No-rise Certification takes into account the balance of the proposed impacts as well as the proposed mitigation for the impacts.

Once the project has been constructed and as-builts of the proposed impacts and mitigation for the impacts have been completed, the Letter of Map Revision (LOMR) documentation will be submitted to FEMA for approval. The LOMR is FEMA's modification to an effective FIRM. In this case, the modification will result in inclusion of the mitigation area to be within the floodplain.

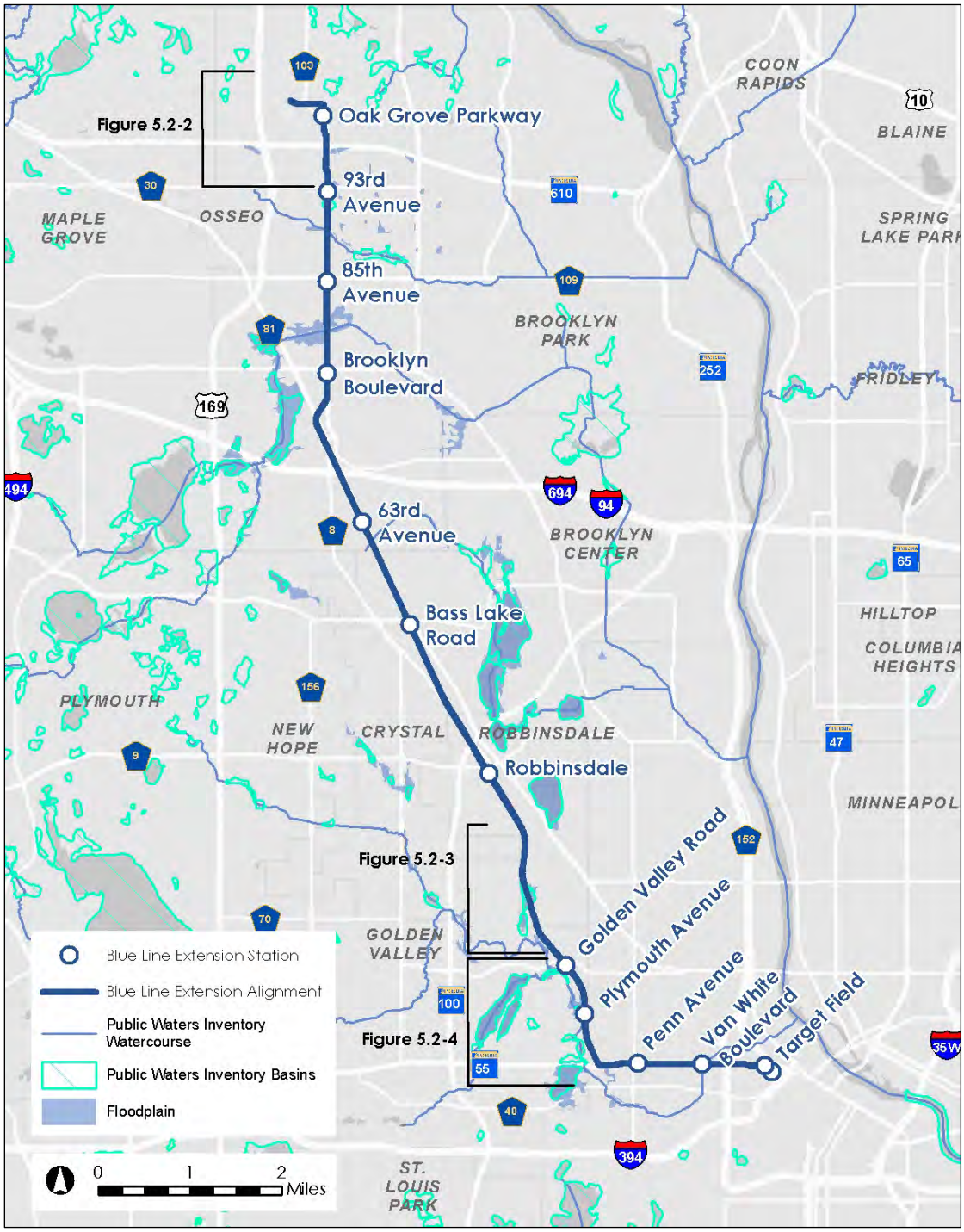
5.2.2 Study Area

The study area for 100-year floodplain and floodway impacts is defined as the area coinciding with the LOD of the proposed BLRT Extension project, including associated facilities (OMF and park-and-rides). The study area also includes several areas adjacent to the proposed BLRT Extension project that could provide suitable floodplain mitigation.

5.2.3 Affected Environment

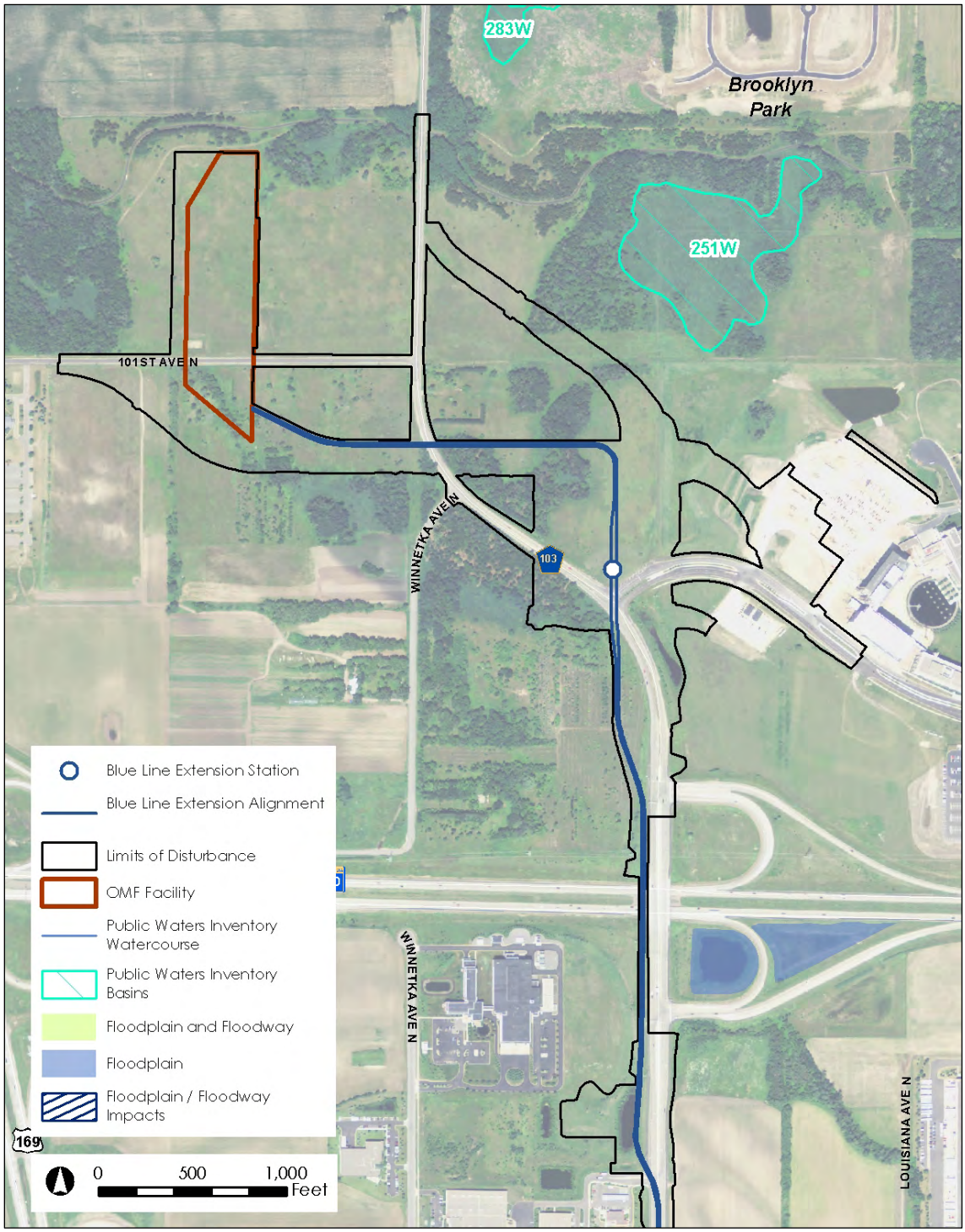
The land use in the study area adjacent to the proposed BLRT Extension project is characterized by commercial, industrial, and residential development. The floodplains in the study area are associated with Bassett Creek, Grimes Pond, and North Rice Pond. **Figure 5.2-1 through Figure 5.2-4** show the floodways and 100-year floodplain boundaries in the study area and impacts within the LOD.

Figure 5.2-1. Overview of Mapped Floodplains near the Proposed BLRT Extension Project



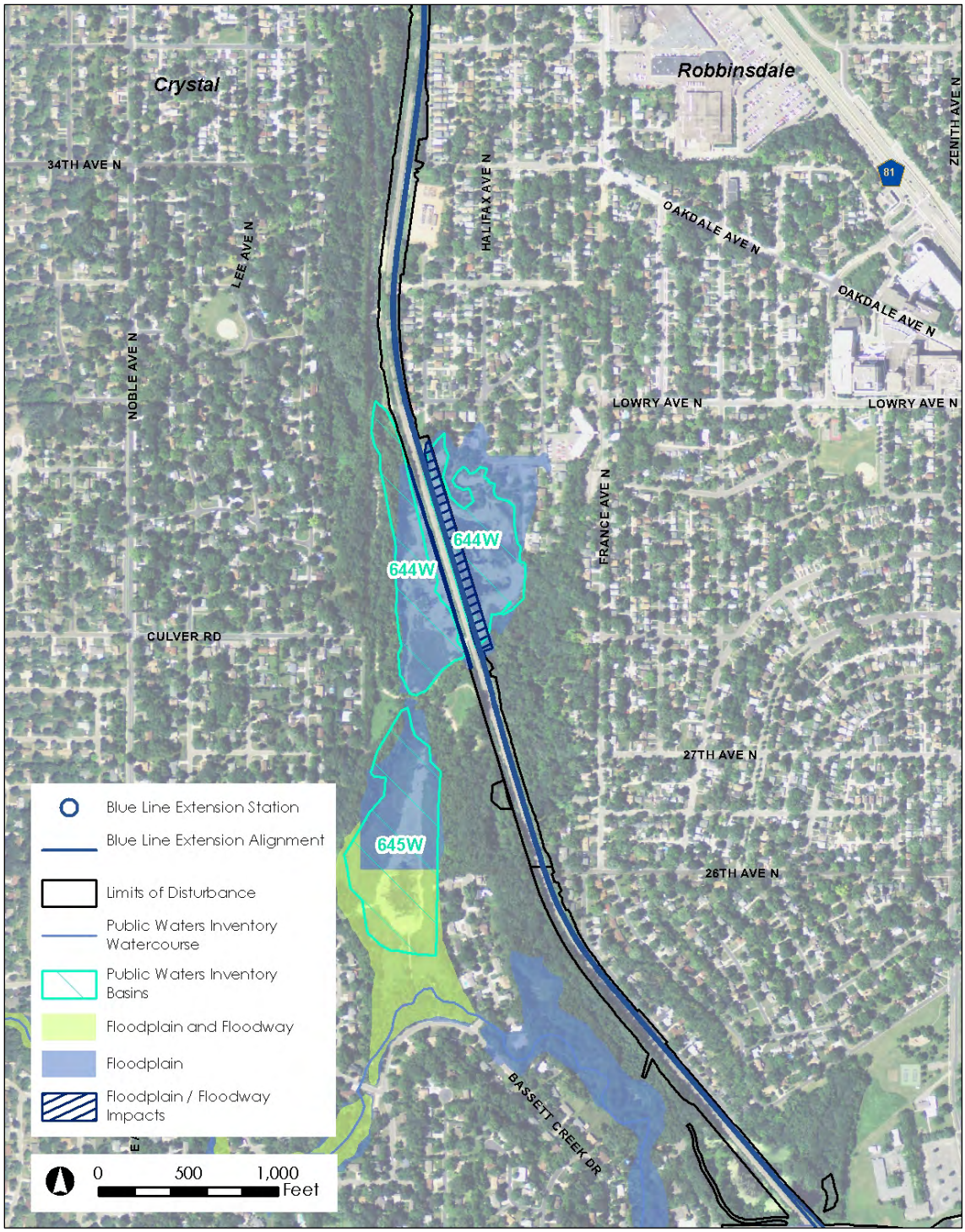
Sources: Aerial: 2013 Hennepin County NAIP US Department of Agriculture; Floodplain: Federal Emergency Management Agency GIS 2010 (modified by Council, 2015); DNR Public Waters Inventory: DNR, 2008

Figure 5.2-2. Detail of Mapped Floodplains near the Northern Portion of the Proposed BLRT Extension Project



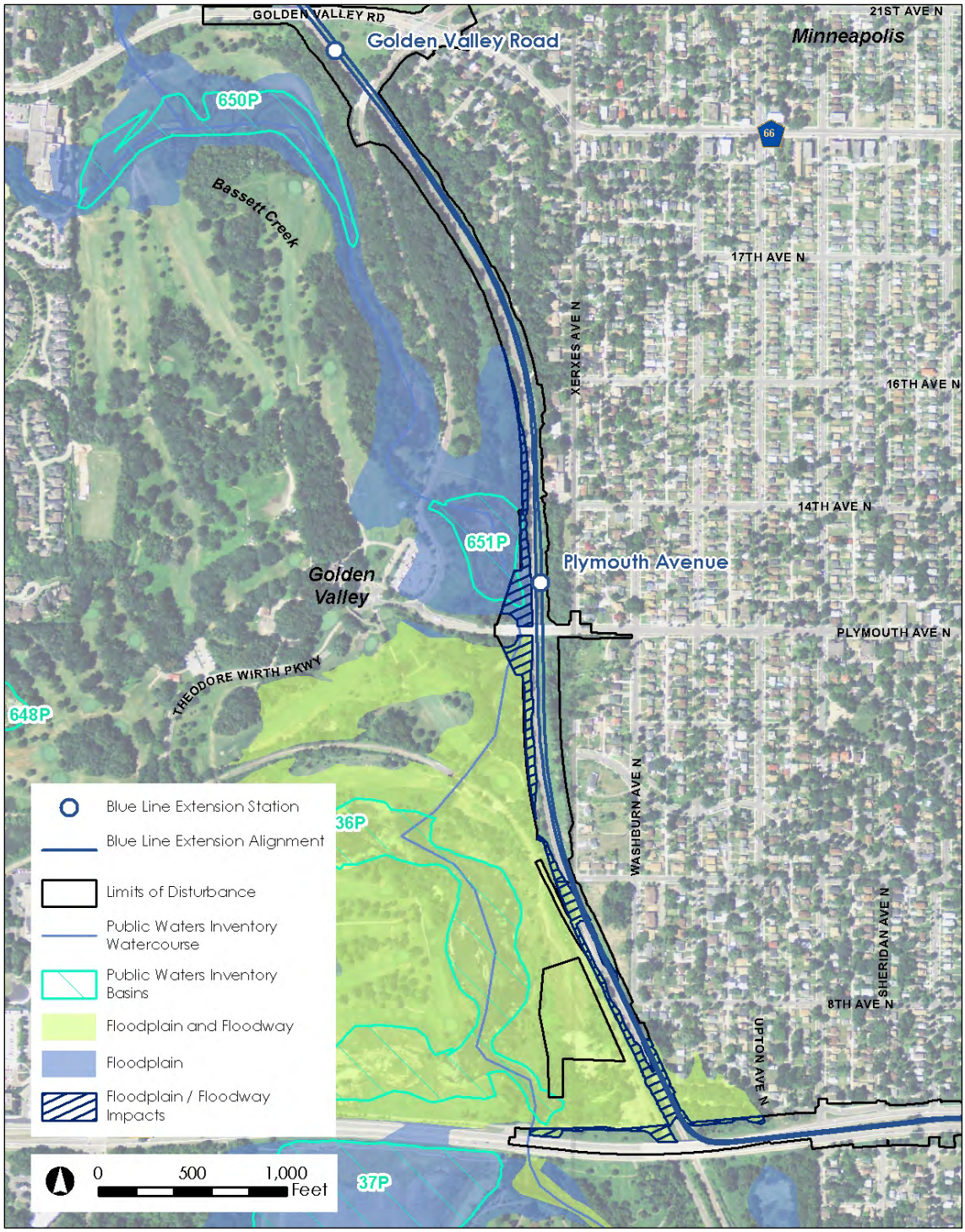
Sources: Aerial: 2013 Hennepin County NAIP US Department of Agriculture; Floodplain: Federal Emergency Management Agency GIS 2010 (modified by Council, 2015); DNR Public Waters Inventory: DNR, 2008

Figure 5.2-3. Detail of Mapped Floodplains near the Southern Portion of the Proposed BLRT Extension Project – Robbinsdale/Golden Valley



Sources: Aerial: 2013 Hennepin County NAIP US Department of Agriculture; Floodplain: Federal Emergency Management Agency GIS 2010 (modified by Council, 2015); DNR Public Waters Inventory: DNR, 2008

Figure 5.2-4. Detail of Mapped Floodplains near the Southern Portion of the Proposed BLRT Extension Project – Golden Valley/Minneapolis



Sources: Aerial: 2013 Hennepin County NAIP US Department of Agriculture; Floodplain: Federal Emergency Management Agency GIS 2010 (modified by Council, 2015); DNR Public Waters Inventory: DNR, 2008

5.2.4 Environmental Consequences

5.2.4.1 Operating-Phase (Long-Term) Impacts

No-Build Alternative

There would be no operating-phase impacts to floodplains and floodways from the No-Build Alternative, nor would any known future developments affect floodplains or floodways as a result of the No-Build Alternative.

Proposed BLRT Extension Project

The proposed BLRT Extension project would affect several floodplains in the study area. Floodplain impacts are determined by the loss or gain in flood storage volume. Floodplain impacts were estimated based on a conceptual (10-percent) design of the proposed BLRT Extension project corridor.

The expected impacts to floodplains and floodways from the proposed BLRT Extension project are shown in **Table 5.2-1**. Impact areas are illustrated above in **Figure 5.2-2** through **Figure 5.2-4.** Segments of the proposed BLRT Extension project corridor without impacts might not be included in these figures. The impacts summarized in **Table 5.2-1** include floodplain and floodway impacts. The boundaries of the floodway are the same as the floodplain associated with Bassett Creek, and include the conveyance and the storage elements due to the flood control structure that was constructed downstream. The floodway and floodplain boundaries have been administratively determined by the Bassett Creek Flood Control Commission, DNR, the city of Golden Valley, and FEMA as part of a management "envelope" to limit development within areas necessary for flood control.

Table 5.2-1. Impacts on Floodplains from the Proposed BLRT Extension Project

In cubic yards

Floodplain	100-Year Floodplain Impacts			
	Alignment/ Station Impacts	Park-and-Ride Impacts	OMF Impacts	Total Impacts
Bassett Creek	16,800	—	—	**16,800**
Grimes Pond	200	—	—	**200**
North Rice Pond	—	—	—	—
Total	**17,000**	**—**	**—**	**17,000**

BCWMC is currently performing a study to update the existing floodplain and floodway elevations; this study could modify the floodplain and floodway boundaries adjacent to Bassett Creek. The Council will continue to coordinate with the city of Golden Valley and BCWMC to confirm the floodplain impacts based on the outcome of this study. Additional hydraulic analysis would be required to determine actual floodplain and floodway impacts caused by the proposed construction; this determination cannot be made until the design of the proposed BLRT Extension project is further refined and final construction limits are established.

Traction Power Substations (TPSS)

None of the proposed TPSSs would affect floodplains in the study area.

5.2.4.2 Construction-Phase (Short-Term) Impacts

Construction-phase impacts are activities that would be in excess of the impacts described in the previous **Proposed BLRT Extension Project** section and that would occur for a short period at the same time as installing and constructing the proposed BLRT Extension project.

No-Build Alternative

There would be no construction-phase impacts to floodplains or floodways from the No-Build Alternative.

Proposed BLRT Extension Project

Floodplain mitigation sites will be constructed in advance of the proposed BLRT Extension project construction. This will create the necessary compensatory flood storage prior to the anticipated temporary and permanent placement of fill in floodplain areas. Therefore, there would be no temporary construction-phase impacts to floodways or floodplains from the proposed BLRT Extension project and associated facilities. Some construction activities would result in the loss or disturbance of soils and vegetation, which would increase the likelihood of temporary erosion and sedimentation in floodplains. The Council will develop appropriate plans and obtain applicable permits for floodplains, as well as implement appropriate wildlife-friendly BMPs, to avoid erosion and sedimentation impacts to floodplains during construction.

TPSS

Several TPSSs are proposed throughout the proposed BLRT Extension project alignment. None of the proposed TPSSs are located in mapped 100-year floodplains or in areas within a 2-foot freeboard higher in elevation than the mapped 100-year floodplains. The Council does not anticipate any temporary construction-phase impacts to floodplains or floodways from TPSS sites.

5.2.5 Avoidance, Minimization, and/or Mitigation Measures

Complete avoidance of floodplain impacts throughout the study area was not feasible. Therefore, in compliance with Executive Order 11988, as amended, answers to four floodplain questions are required in order to demonstrate that the proposed project would not cause any significant floodplain impacts. These four questions concern (1) potential flood-related disruption of emergency services, (2) significant adverse impacts on natural and beneficial floodplain values, (3) increased risk of flooding, and (4) encouragement of incompatible floodplain development. Environmental analyses conducted as part of the proposed BLRT Extension project demonstrate that the impacts of the proposed BLRT Extension project would be below the threshold of significance for each of these concerns. See the appended *Floodplain Technical Memorandum* (**Appendix F**) for additional details.

Impacts to floodplains associated with Grimes Pond were minimized considerably with a design that elevates the LRT tracks on a structure rather than on an embankment. Thus, with the current design, floodplain impacts would be the cumulative volume of structural support piers and abutments rather than the continuous fill of an embankment.

Long-Term Mitigation Measures. Impacts to locally regulated floodplains shall be mitigated by appropriate compensatory storage within or adjacent to the affected waterbody. The Council will use the following methods to create compensatory storage: excavating upland adjacent to existing floodplains, excavating existing floodplains, and constructing stormwater BMPs with the capacity for storage. The final design of the proposed BLRT Extension project shall include the appropriate compensatory storage required by applicable local agencies. Based on coordination with constituent municipalities and BCWMC, floodplain mitigation must occur within the same hydraulic modeling reach (that is, culvert to culvert) as the proposed floodplain impacts. The Council identified the following areas that meet these criteria for suitable floodplain mitigation:

- **Bassett Creek Floodplain Mitigation.** The floodplain mitigation area between the main stem of Bassett Creek and the LRT and BNSF rail corridor (partially in TWRP and partially on private property; initially identified in the Draft EIS) has been further refined. The mitigation will include excavating adjacent ground below the 100-year floodplain elevation to provide compensatory floodplain storage for the fill placed in the floodplain.
- **Grimes Pond Floodplain Mitigation.** As a result of using an elevated structure for the LRT tracks, floodplain impacts at Grimes Pond would be minor (200 cubic yards). Some excavation of adjacent ground below the 100-year floodplain elevation will provide compensatory floodplain storage for the fill placed in the floodplain.

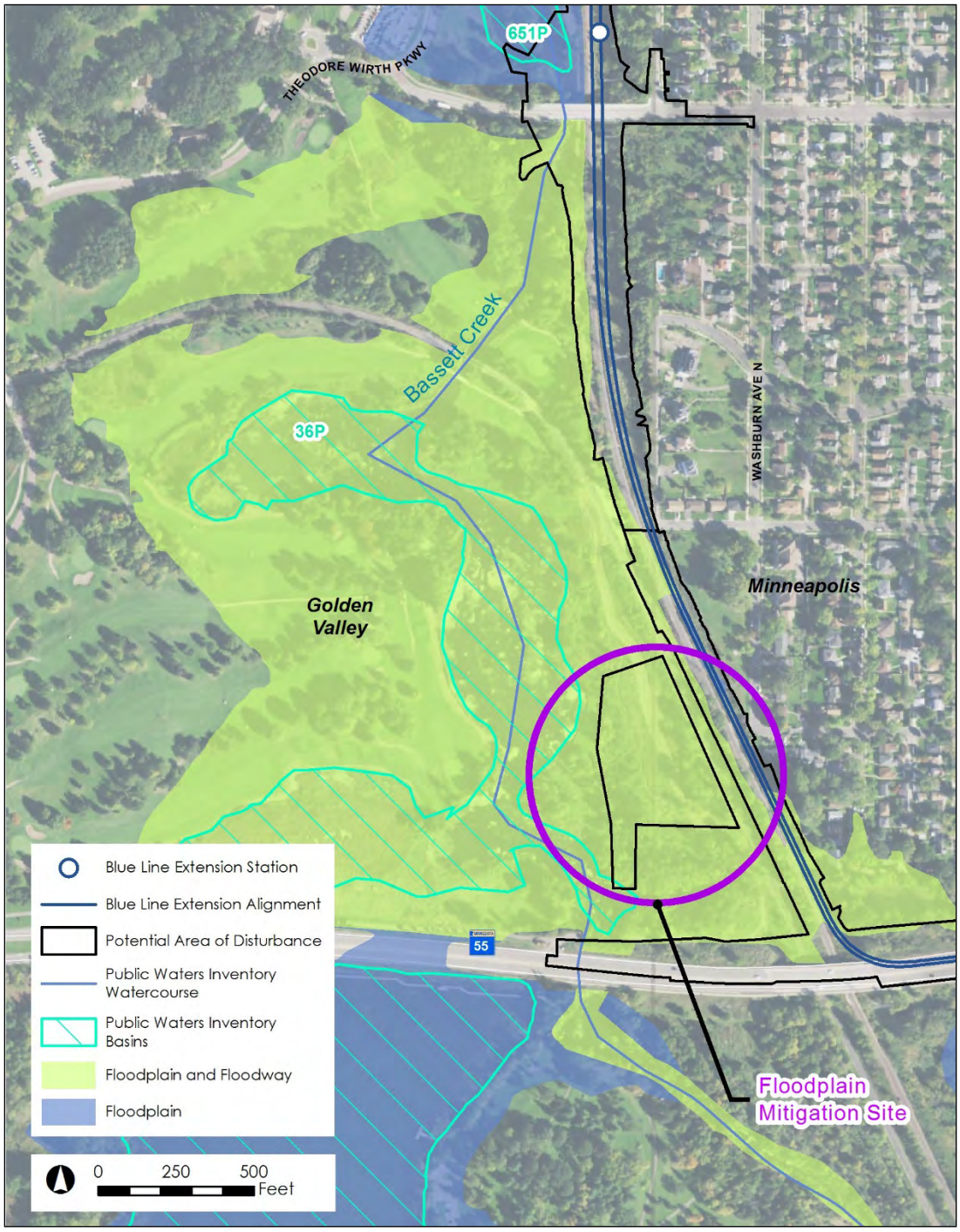
Figure 5.2-5 shows the Bassett Creek floodplain mitigation site near the proposed BLRT Extension project.

The city of Minneapolis will be the owner of the perpetual easements relevant to the proposed Bassett Creek floodplain mitigation site. The city of Robbinsdale will be the owner of the perpetual easements relevant to floodplain mitigation associated with Grimes Pond.

Floodplain mitigation adjacent to the proposed BLRT Extension project will require approval from the city of Golden Valley, which will issue a permit to the Council for the proposed work. As part of that permitting process, both the city of Golden Valley and BCWMC will be provided the opportunity to review and provide comments on the proposed floodplain mitigation to verify that all of the pertinent requirements have been met prior to issuing the permit. Further details regarding the agencies involved in floodplain review are provided in the appended *Floodplain Technical Memorandum* (**Appendix F**). Additional information is provided in the *Preliminary Stormwater Management Plan Technical Memorandum* (Council, 2016a) (**Appendix F**).

Short-Term Mitigation Measures. No short-term mitigation measures are anticipated, because the construction of floodplain mitigation will occur prior to the placement of construction fill in floodplain areas to avoid temporary impacts.

Figure 5.2-5. Bassett Creek Floodplain Mitigation Site near the Proposed BLRT Extension Project



Sources: Aerial: 2013 Hennepin County NAIP US Department of Agriculture; Wetland: National Wetland Inventory Update for Minnesota 2015 (modified by Council, 2015); Floodplain: Federal Emergency Management Agency GIS 2010 (modified by Council, 2015); DNR Public Waters Inventory: DNR, 2008

5.3 Wetlands and Other Aquatic Resources

This section describes the wetland types and wetland boundaries that have been identified and delineated in the study area according to the standards of USACE and BWSR and describes the impacts of the No-Build Alternative and the proposed BLRT Extension project on wetlands and other aquatic resources.

The information in this section is based on information in the *Wetlands Technical Report* (Council, 2016c) (see **Appendix F**). The analysis for this section was conducted in coordination with USACE as part of the National Environmental Policy Act (NEPA)/404 merger process, as discussed in **Section 5.3.1** and **Chapter 9 – Consultation and Coordination**. Floodplains are addressed separately in **Section 5.2**.

For this Final EIS, wetland types and wetland boundaries have been identified and delineated within and near the proposed BLRT Extension project and associated facilities according to USACE and BWSR standards. Wetland boundaries and types have been approved by representatives of the WCA LGU and USACE.

Wetland impacts (see **Section 5.3.4**) are estimated based on the known construction footprint of the current level of design for the proposed BLRT Extension project and on the wetland jurisdictional determinations made by USACE and the WCA LGU.

5.3.1 Regulatory Context and Methodology

Wetlands are protected by local, state, and federal legislation because of their ecological and functional value. The federal Clean Water Act (CWA) establishes the basic structure for regulating discharges of pollutants into the waters of the United States and for regulating quality standards for surface waters. EPA oversees state implementation of the CWA and reviews and comments on Individual 401 Water Quality Certifications associated with applications for Section 404 Individual Permits.

Section 404 of the CWA establishes a program to regulate the discharge of dredged or fill material into waters of the United States. Section 404 of the CWA is under the purview of USACE (for the proposed BLRT Extension project, the USACE St. Paul District) and requires a permit to be issued by USACE prior to the placement of any dredged or fill material into any waters of the United States, including wetlands. Transportation projects that would cause more than 5 acres of impacts require an Individual Permit and a public comment period.

Lakes, rivers, streams, and wetlands are regulated by DNR if they have been identified by the State as public waters or public waters wetlands. Public waters and public waters wetlands are all water basins and water courses that meet the criteria in Minn. Stat., Section 103G.005, subdivision 15, and that are identified on Public Waters Inventory (PWI) maps (Minn. Stat., Section 103G.201). Proposed impacts involving a change in the course, current, or cross-section of public waters (including streams) and public waters wetlands would require a Public Waters Work Permit from DNR. Utilities work in public waters or public waters wetlands could require a utilities crossing license from DNR.

WCA, under the purview of BWSR and LGUs, establishes the goal of no net loss of wetlands (Minnesota Rule 8420). WCA requires that anyone proposing to drain or fill a wetland must try to avoid disturbing the wetland. If avoidance cannot be achieved, WCA requires that impacts be minimized to the extent possible and any impacted areas be replaced with suitable and acceptable mitigation.

The designated LGU would need to determine the need for and requirements of a WCA wetland replacement plan for the project. As a consequence of the proposed BLRT Extension project being a linear project, the proposed BLRT Extension project crosses through several cities and four WMO boundaries: SCWMC, WMWMC, BCWMC, and MWMO.

NEPA/404 Merger Process

The analysis completed for this section includes the Council and USACE coordination for obtaining permit approval under Section 404 of the CWA. Coordination with USACE also included FTA and Council participation in a merger process between the NEPA and the CWA Section 404 permitting processes. The NEPA/404 merger process provided USACE with an opportunity to review and comment on four sequential concurrence points at key milestones during project development: (1) purpose and need, (2) array of alternatives and alternatives carried forward, (3) identification of the Preferred Alternative, and (4) design phase impact minimization. The goal of the NEPA/404 merger process is to achieve an orderly, concurrent NEPA/404 review process and to ensure that the project being reviewed is likely to succeed in obtaining a Section 404 permit.

USACE provided concurrence to the first two milestones on June 19, 2013. On October 1, 2013, USACE provided concurrence on the identification of the proposed BLRT Extension project (Concurrence Point 3). As part of providing concurrence to the third milestone, USACE identified the Least Environmentally Damaging Practicable Alternative from among those that meet USACE's overall project purpose and determined that the proposed BLRT Extension project is likely to be permittable under the CWA. Documentation of USACE's concurrence with each milestone is provided in Appendix D of the Draft EIS.

The fourth milestone has been documented in the Section 404 permit application (see **Appendix I**), which includes a comprehensive description of the design avoidance and minimization efforts for each aquatic resource in the wetland study area and proposed mitigation. USACE has provided concurrence to the fourth and final milestone in a letter dated June 16, 2016.

On May 16, 2016, the Council submitted the Section 404 CWA permit application to USACE (see **Appendix I**). This application included the following items: (1) applicant and site location information, (2) a detailed summary of impacted aquatic resources, (3) supporting information for activities not requiring mitigation, (4) a detailed description of the Council's avoidance and minimization efforts known to date, and (5) a summary of the replacement/compensatory mitigation that would be provided for this project. The public notice period for this permit application will be concurrent with the circulation of the Final EIS. The Section 404 CWA permit would be issued prior to construction of the proposed BLRT Extension project.

5.3.2 Study Area

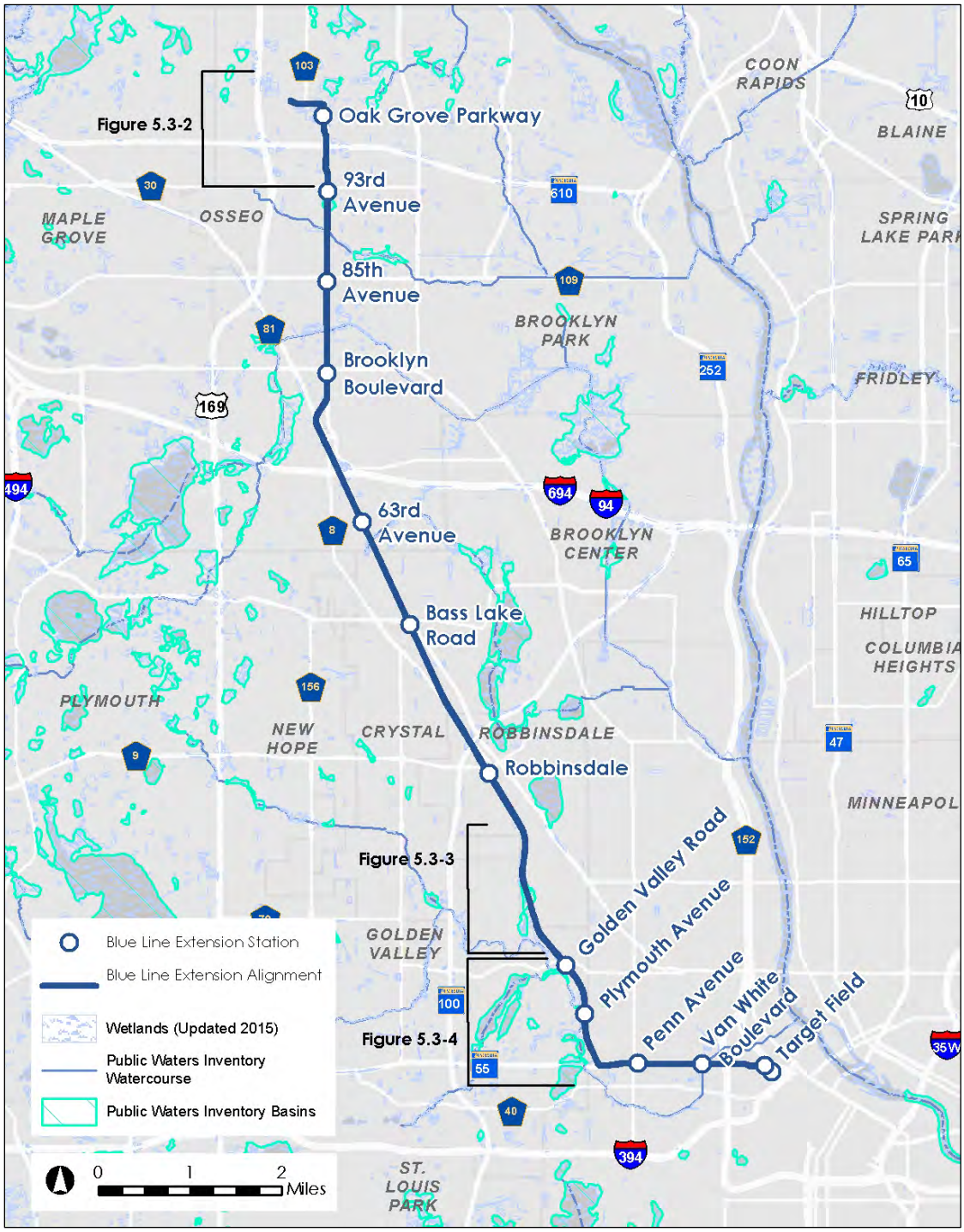
The study area for wetlands is defined as the area adjacent to the proposed BLRT Extension project tracks and associated facilities such as the OMF, the local road network, park-and-rides, and proposed stormwater management areas and mitigation areas. This study area captures wetlands near the proposed BLRT Extension project that could be affected. The study area on West Broadway Avenue between about 94th Avenue and Candlewood Drive is more limited in its extent because Hennepin County is implementing mitigation associated with reconstructing West Broadway Avenue as described in a separate Environmental Assessment Worksheet for the West Broadway Avenue Reconstruction project.

5.3.3 Affected Environment

Much of the study area is characterized by commercial, industrial, and residential development. The segment of the study area from the Target Field Station westward along Olson Memorial Highway is completely developed, and wetlands are not present. The study area along the BNSF freight rail tracks from Olson Memorial Highway north to 36th Avenue North in Robbinsdale has abundant wetlands generally associated with Bassett Creek and its backwaters, Grimes Pond, and North Rice Pond. The study area from 36th Avenue North (in Robbinsdale) north to Candlewood Drive (in Brooklyn Park) is highly urbanized, and wetlands are generally lacking. The portion of the study area north of TH 610 is a mix of urbanizing rural land with isolated remnants of wetland remaining.

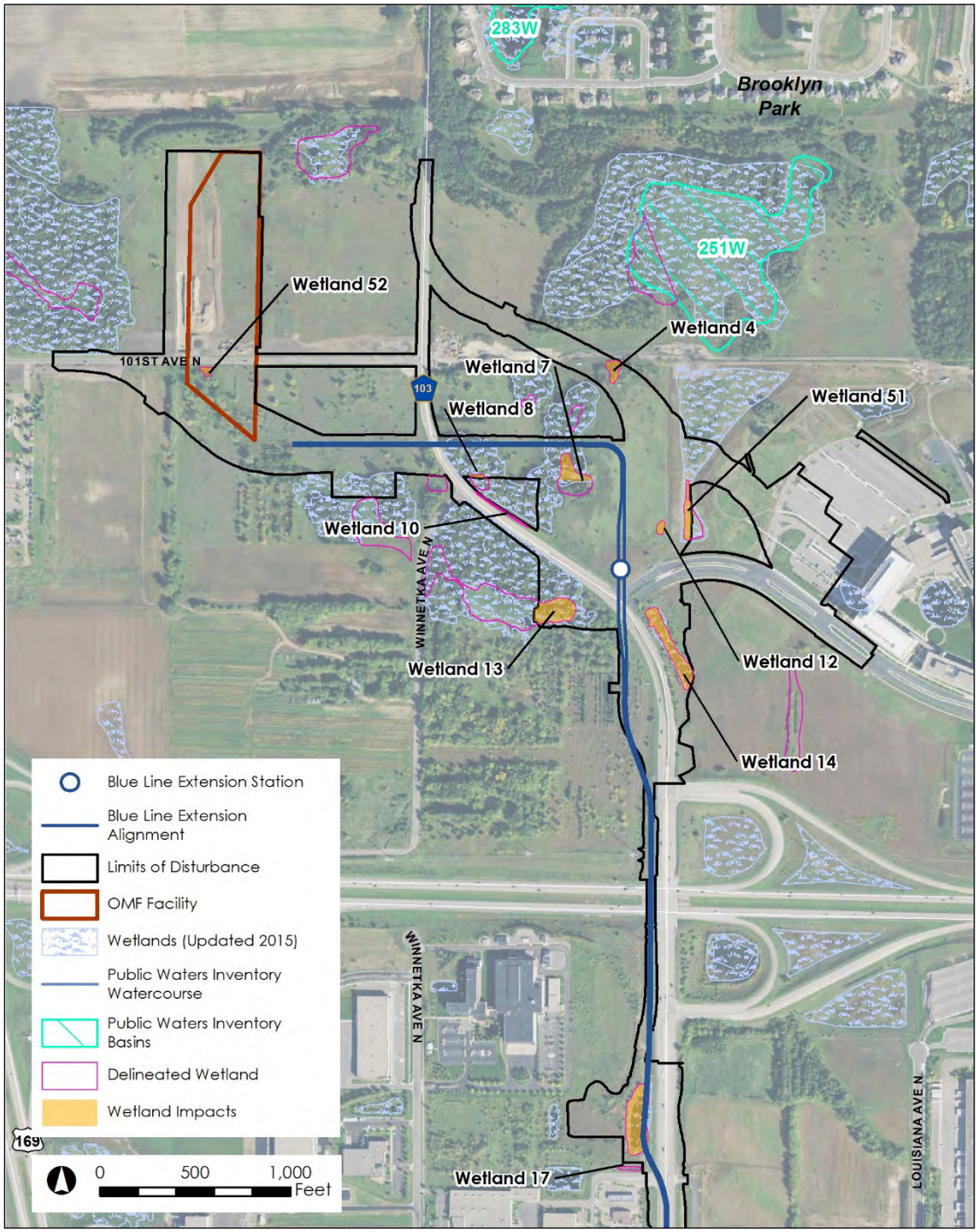
Wetlands were delineated along the proposed BLRT Extension project and associated facilities during the spring and summer of 2015. An overview of delineated basins along the proposed BLRT Extension project is provided in **Figure 5.3-1**. Details of delineated wetlands in the northern and southern portions of the proposed BLRT Extension project are shown in **Figure 5.3-2 through Figure 5.3-4**. For this analysis, delineated basins are divided into two categories: stormwater ponds and natural wetland basins.

Figure 5.3-1. Overview of Delineated Wetlands Near the Proposed BLRT Extension Project



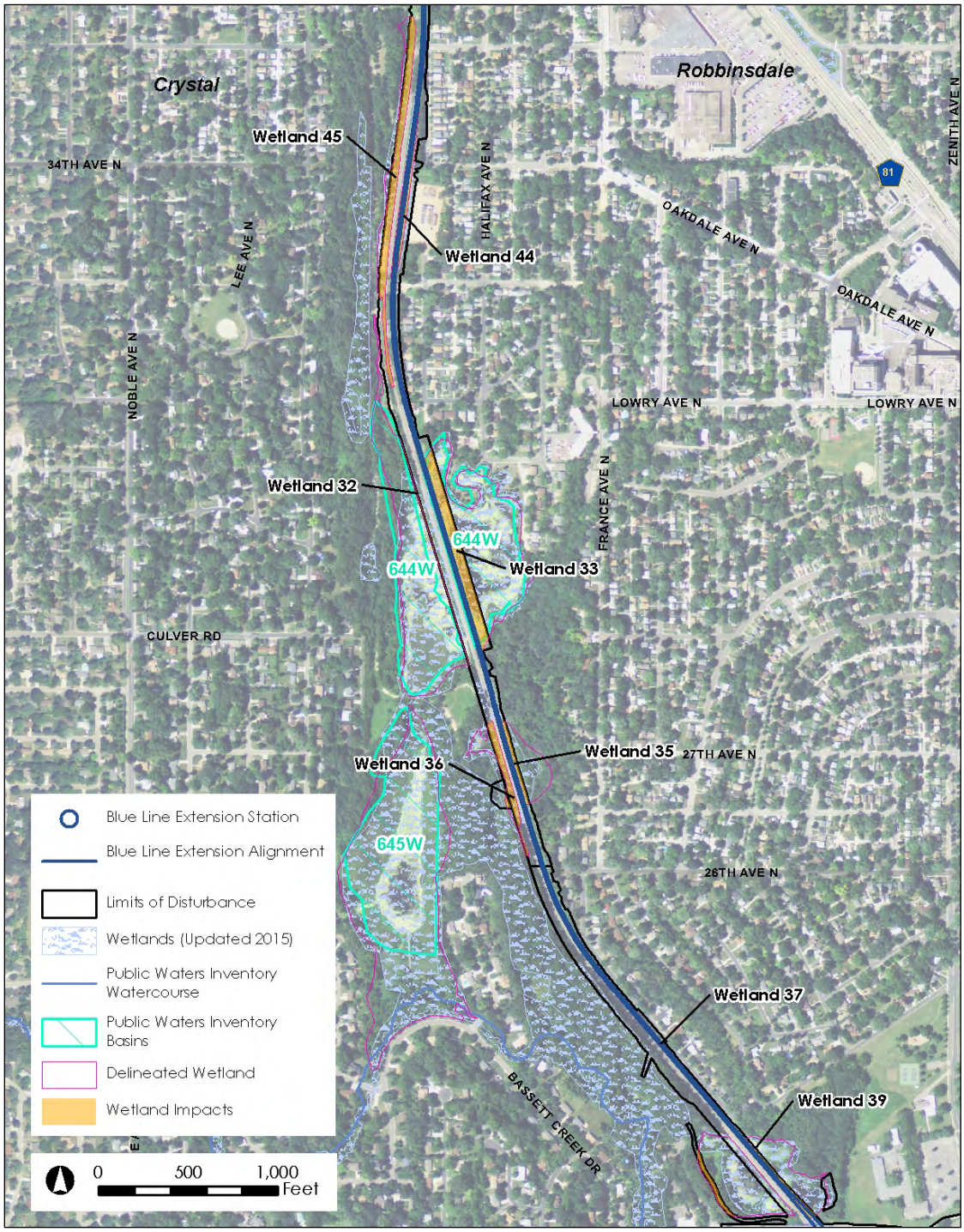
Source: Sources: Aerial: 2013 Hennepin County NAIP US Department of Agriculture; Wetland: National Wetland Inventory Update for Minnesota 2015 (modified by SEH, 2015), Delineated Basins (SEH, 2015); DNR Public Waters Inventory: DNR, 2008

Figure 5.3-2. Detail of Wetlands near the Northern Portion of the Proposed BLRT Extension Project



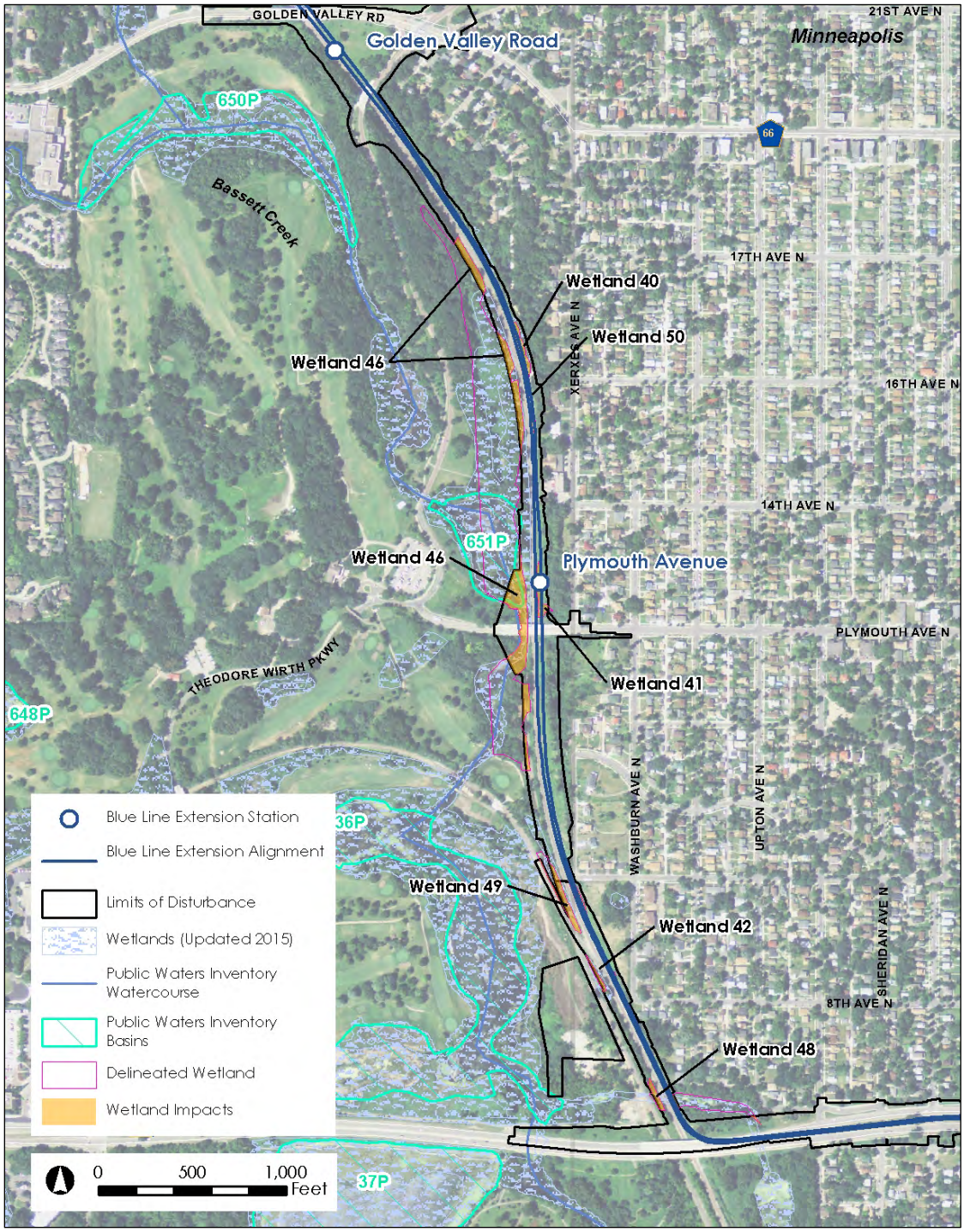
Source: Source: Sources: Aerial: 2013 Hennepin County NAIP US Department of Agriculture; Wetland: National Wetland Inventory Update for Minnesota 2015 (modified by SEH, 2015), Delineated Basins (SEH, 2015); DNR Public Waters Inventory: DNR, 2008

Figure 5.3-3. Detail of Wetlands near the Southern Portion of the Proposed BLRT Extension Project – Robbinsdale/Golden Valley



Source: Source: Sources: Aerial: 2013 Hennepin County NAIP US Department of Agriculture; Wetland: National Wetland Inventory Update for Minnesota 2015 (modified by SEH, 2015), Delineated Basins (SEH, 2015); DNR Public Waters Inventory: DNR, 2008

Figure 5.3-4. Detail of Wetlands near the Southern Portion of the Proposed BLRT Extension Project – Golden Valley/Minneapolis



Source: Source: Sources: Aerial: 2013 Hennepin County NAIP US Department of Agriculture; Wetland: National Wetland Inventory Update for Minnesota 2015 (modified by SEH, 2015), Delineated Basins (SEH, 2015); DNR Public Waters Inventory: DNR, 2008

Table 5.3-1 summarizes the extent of various wetland types in the study area. Stormwater ponds have generally been extensively excavated in order to enhance stormwater management. Those basins designated as natural wetland basins generally have not been extensively excavated and are underlain by mapped hydric soils.

Table 5.3-1. Extent of Wetland Types in the Study Area

Wetland Type		Total Extent (acres)	
Circular 39[1]	Eggers and Reed[2]	Natural Wetland Basins	Stormwater Ponds
Type 1	Seasonally flooded basin	>38.29	1.04
Type 3	Shallow marsh	0.00	1.02
Type 4	Deep marsh	17.51	2.34
Type 5	Open water	13.36	1.20
Type 6	Shrub carr	1.39	1.13
	Total	**>70.55**	**6.73**

[1] Plant communities classified based on US Fish and Wildlife Circular 39.

[2] Plant communities classified based on *Wetland Plants and Plant Communities of Minnesota and Wisconsin* by Eggers and Reed (1997) (USACE St. Paul District).

5.3.3.1 Notable Aquatic Habitats

Four wetland complexes in the study area were identified by the Council as notable aquatic habitats. Notable aquatic habitats are generally larger complexes of diverse wetland types. Notable aquatic habitats can be natural wetlands or wetlands excavated in the distant past; however, a variety of wetland functions have developed over time.

These notable aquatic habitats provide refuge for a variety of frogs and toads, turtles, snakes, and bird species.

- **North and South Rice Ponds,** located in Robbinsdale and Golden Valley on the west side of the existing BNSF tracks. The total size of this wetland complex is about 25 acres.
- **Grimes Pond,** located in Robbinsdale on the east side of the existing BNSF tracks. The total size of this wetland complex is about 7 acres.
- **Golden Valley Ponds,** located on the north side of Golden Valley Road on both sides of the existing BNSF tracks. The total size of these ponds is about 5 acres.
- **TWRP (Bassett Creek and backwaters),** located north and south of the Plymouth Avenue bridge on the west side of the existing BNSF tracks. The total size of this wetland complex is more than 12 acres.

Bassett Creek and its associated backwaters flow through and near a large portion of the study area from North Rice Pond south to Olson Memorial Highway. The headwaters of Bassett Creek is Medicine Lake in Plymouth, and its terminus is the confluence with the Mississippi River in Minneapolis. The entire length of Bassett Creek is currently listed on the MPCA's 303(d) List of

Impaired Waters. Aquatic recreation is impaired as a result of high fecal coliform. Aquatic life is impaired as a result of high chloride and stressors affecting the fish community in the creek.

Table 5.3-2 summarizes the delineated wetlands and aquatic resources in the study area that are designated as DNR public waters, public waters wetlands, or public watercourses.

Table 5.3-2. DNR Public Waters, Public Waters Wetlands, and Public Watercourses in the Study Area

Public Waters ID[1]	Wetland Basin ID[2]	Notes
644W	Wetlands 32 and 33	North Rice Pond and Grimes Pond
651P	Wetland 46	Backwaters of Bassett Creek near Plymouth Avenue
36P	Wetland 48	Backwaters of Bassett Creek near Olson Memorial Highway
Bassett Creek	Adjacent to Wetland 46	Channel of Bassett Creek

Source: DNR Public Waters Inventory

[1] W indicates DNR public waters wetlands, P indicates public waters, and unnumbered waterbodies indicate public watercourses.

[2] Wetland basin IDs (identifiers) are described in the *Wetlands Technical Memorandum*.

5.3.4 Environmental Consequences

5.3.4.1 Operating-Phase (Long-Term) Impacts

No-Build Alternative

There would be no operating-phase impacts to wetlands or other aquatic resources from the No-Build Alternative.

Proposed BLRT Extension Project

The expected wetland impacts of the proposed BLRT Extension project are summarized in **Table 5.3-3** by wetland type. The table describes total permanent and temporary impacts to wetlands, as well as impacts that are under the jurisdiction of USACE and WCA. Impact areas are shown above in **Figures 5.2-2 and 5.2-3**. Impacts to each delineated basin within and near the proposed BLRT Extension project are further described and depicted in the appended *Wetlands Technical Memorandum* (**Appendix F**).

Standard erosion-control BMPs will be used for work within adjacent wetland and aquatic resources where necessary, thereby minimizing impacts to the waterbodies downslope and to aquatic wildlife.

Table 5.3-3. Impacts to Delineated Basins from the Proposed BLRT Extension Project by Wetland Type

Wetland Type		Impacts (acres)				
Circular 39[1]	Eggers and Reed[2]	Permanent Impacts	Temporary Impacts	Total Impacts	USACE Jurisdictional Impacts	WCA Jurisdictional Impacts
Type 1	Seasonally flooded basin	5.33	1.26	6.59	2.52	4.28
Type 3	Shallow marsh	—	—	—	—	—
Type 4	Deep marsh	2.44	0.05	2.49	1.01	0.10
Type 5	Open water	1.69	1.92	3.61	0.42	1.69
Type 6	Shrub carr	0.50	—	0.50	0.21	0.21
	Total	**9.96**	**3.23**	**13.19**	**4.16**	**6.28**

[1] Plant communities classified based on US Fish and Wildlife Circular 39.

[2] Plant communities classified based on *Wetland Plants and Plant Communities of Minnesota and Wisconsin* by Eggers and Reed (1997) (USACE St. Paul District).

A portion of Bassett Creek, a stream reach of about 450 feet total length, near the Plymouth Avenue bridge will be relocated to accommodate the proposed BLRT Extension project and associated infrastructure. The upstream limit of the stream relocation is about 200 feet north of the Plymouth Avenue centerline, and the downstream limit is about 250 feet south of the Plymouth Avenue bridge centerline. This reach of Bassett Creek would be moved about 20 feet west. The final design of the creek realignment will include considerations for construction staging to ensure that flow rates are managed and to ensure safe discharge of the flows during construction. These considerations could include diversion and pumping and scheduling the construction during winter when the flows are typically low.

The permanent impact to Bassett Creek is quantified in the permit application (see Section 5.4 of the Section 404 permit application in **Appendix I**). Restoration activities on the relocated reach of stream would be specified in the issued permit and would be considered mitigation for the relocation.

OMF

The OMF configuration was modified to minimize impacts to wetlands. Construction of the proposed OMF will impact approximately 0.05 acre of wetland.

TPSS

No impacts to wetlands in the study area are anticipated from TPSS. If refined design of the proposed BLRT Extension project requires unavoidable impacts to wetlands, the impacts would be minimized using features such as retaining walls, steep fill slopes, and appropriate anti-erosion measures consistent with USACE and BWSR minimization guidance.

5.3.4.2 Construction-Phase (Short-Term) Impacts

No-Build Alternative

There would be no construction-phase impacts to wetlands or other aquatic resources from the No-Build Alternative.

Proposed BLRT Extension Project

Typically, construction-related wetland impacts are caused by building temporary access roads. Temporary wetland impacts are anticipated in portions of Sochacki Park to allow construction of the Grimes Pond bridge. Several other small areas of temporary impacts to wetlands at various locations throughout the proposed BLRT Extension project area would be necessary. These temporary impacts are associated with construction access and staging activities. Total temporary wetland impacts would be about 3.23 acres associated with five separate delineated wetlands. Temporary access roads would be designed to avoid or minimize wetland impacts to the extent practicable. Temporarily disturbed wetland areas would be restored to pre-construction conditions as required by permit stipulations.

Grading and disturbing soil during construction could cause temporary erosion and sedimentation of disturbed areas. These temporary construction-phase impacts would be minimized to the extent possible by using BMPs for erosion control. All disturbed areas would be graded and reseeded to stabilize the soil. Measures such as silt fences, erosion-control blankets, and other soil-stabilization measures would be implemented to maintain water quality.

TPSS

There would be no temporary construction-phase impacts to wetlands from constructing and installing TPSSs as part of the proposed BLRT Extension project.

5.3.5 Avoidance, Minimization, and/or Mitigation Measures

Complete avoidance of wetland impacts from the proposed BLRT Extension project and associated facilities is not feasible; therefore, several measures to reduce wetland impacts from the proposed BLRT Extension project and associated facilities have been incorporated into the design. The Council used the following measures to minimize wetland impacts in the study area:

- **Operating-Phase (Long-Term) Impacts**
  - **OMF Configuration.** Several configurations of the OMF north of TH 610 were examined to minimize the wetland impacts reported in the Draft EIS. One conceptual north-south configuration would have had a large wetland impact. Another east-west configuration also would have had a large wetland impact. The OMF in the proposed BLRT Extension project north-south design (see **Figure 2.5-4**) would have an impact of about 0.05 acre on one small wetland.
  - **BLRT on Elevated Structure across Grimes Pond and ponds near Golden Valley Road.** The proposed BLRT Extension project design accommodates the LRT tracks on an elevated structure in the segment that bisects Grimes Pond/North Rice Pond, as well as the segment that bisects the ponds north of Golden Valley Road. The Draft EIS conceptual designs used a continuous embankment of fill in Grimes Pond to support the LRT tracks. The current design reduces wetland impacts because the total wetland fill with the elevated structure would be the cumulative footprint of the piers and bridge abutments rather than of continuous fill.
- **Construction-Phase Impacts**
  - **BMPs for Erosion Control.** Appropriate BMPs will be implemented to protect wetlands and other aquatic resources that are downslope of or downstream from areas disturbed as a result of earthmoving. Such BMPs could include silt fencing, silt curtains, erosion mats, and rapid revegetation of disturbed areas.

Long-Term Mitigation Measures. The proposed BLRT Extension project shall require coordination and permitting from local, state, and federal water resource agencies. The Council coordinated with the Wetlands Technical Evaluation Panel regarding mitigation strategies prior to submitting the WCA and CWA Section 404 permit applications. The Council's analysis of preliminary mitigation strategies included establishing project-specific permittee-responsible mitigation sites and purchasing wetland mitigation bank credits. Based on this analysis, the Council determined that wetland impacts from the proposed BLRT Extension project shall be mitigated through a combination of on-site wetland mitigation and purchases of private wetland credits from existing mitigation banks in suitable major watersheds and Bank Service Areas.

Based on the USACE St. Paul District Policy for Wetland Compensatory Mitigation in Minnesota (USACE, 2009), the current replacement ratio for wetland credits in this area of Minnesota is 2.5 to 1 (mitigation to impacts), although, if mitigation is constructed prior to impacting wetlands (such as with wetland mitigation banks) and is of the same type as the impacted wetlands, the ratio is typically reduced to 2 to 1. For on-site wetland mitigation, various amounts of wetland credit are

allocated depending on the mitigation activity undertaken, such as wetland creation versus wetland restoration.

Given the urbanized and rapidly urbanizing nature of the study area, opportunities for on-site wetland mitigation could be limited. Several open areas of drained hydric soils in Brooklyn Park north and south of TH 610 could provide some on-site wetland mitigation opportunities. Other opportunities might be feasible farther south in TWRP within the proposed floodplain mitigation area associated with Bassett Creek (see **Section 5.2.5**). Final on-site mitigation site selection and design will be completed in accordance with the requirements of the WCA mitigation plan approval and CWA Section 404 permit.

The Council will purchase wetland mitigation bank credits from established and approved wetland bank accounts in accordance with the applicable USACE, WCA, and LGU siting priority requirements prior to the construction of the proposed BLRT Extension project. The proposed BLRT Extension project alignment is entirely within the seven-county metro area, Major Watershed 20 (Mississippi River – Twin Cities), and Bank Service Area 7. Thus, the Council will first seek purchases of private wetland mitigation credits within the seven-county metro area, Bank Service Area 7, and Major Watershed 20. The Council will expand the search for suitable private wetland credits to adjacent Bank Service Areas and major watersheds if needed, though a mitigation ratio higher than 2 to 1 will typically apply in that case.

Short-Term Mitigation Measures. Wetland areas affected on a temporary basis during construction will be restored to their existing grade and hydrology (to existing conditions when applicable) and reseeded with an appropriate native wetland species seed mix, as required by the WCA and the CWA. The restoration details associated with each short-term wetland impact will be identified in the WCA and CWA permit applications. The Council will consult with USACE to determine whether purchase of wetland mitigation bank credits for CWA regulated wetlands will be required for temporary impacts lasting longer than 180 days.

5.4 Geology, Soils, and Topography

This section describes the existing geology, soils, and topography in the study area and the short-term impacts on geology, soils, and topography from constructing the proposed BLRT Extension project.

5.4.1 Regulatory Context and Methodology

In Minnesota, geologic resources are rarely regulated, with the exceptions of groundwater dewatering and mining activities. A permit from the DNR is required to dewater in excess of 1.0 million gallons per year or 10,000 gallons a day.

The discharge from dewatering is regulated under the NPDES permit that is required for construction activities. If the water is contaminated, an individual NPDES permit must be obtained from MPCA, or the groundwater can be discharged to the sanitary sewer system if approved by MCES.

The geologic resources listed in this section are not isolated and can affect or be affected by other water resources discussed in **Sections 5.2 and 5.3**.

The Council consulted the Geologic Atlas of Hennepin County (Minnesota Geological Survey, 1989) and the Minnesota Geospatial Information Office for information regarding surface geology, bedrock geology**,** and groundwater resources.

5.4.2 Study Area

The study area for geology, soils, and topography is defined as the area within and adjacent to the LOD of the proposed BLRT Extension project.

5.4.3 Affected Environment

5.4.3.1 Geology

The unconsolidated sediments in the study area were deposited primarily by glacial ice and meltwater during the last glaciation (Wisconsinan Stage). Sediments along the majority of the study area can be attributed to the advancement and retreat of the Superior lobe, the Grantsburg sublobe of the Des Moines lobe, and meltwater from these lobes. The underlying sandstone and carbonate bedrock are deeply cut with a branched network of valleys carved out by meltwater streams that drain toward master streams, such as the modern-day Mississippi River. Middle- and upper-terrace deposits of sand, gravelly sand, and loamy sand dominate much of the study area. Small areas of sandy to loamy till from the Des Moines lobe and Grantsburg sublobe are also present.

Lakes and wetlands throughout the region formed in low-lying areas created by the presence of underlying bedrock valleys or as a result of ice block melting as the glaciers were breaking up and retreating.

Karst features such as springs, caverns, and sinkholes are typically found in areas where carbonate bedrock is overlain by a thin cover of glacial material. The majority of the study area is mapped as *buried karst* (over 100 feet of sediment over carbonate bedrock). Small areas of *transition karst*

(between 50 and 100 feet of sediment) and *active karst* (less than 50 feet of sediment) have also been identified in the study area.

An area designated as active karst has been mapped along the proposed BLRT Extension project between downtown Minneapolis and the BNSF rail corridor (see **Figure 5.4-1**). No actual karst features have been mapped in the study area, but two springs are located about 1 mile to the southwest.

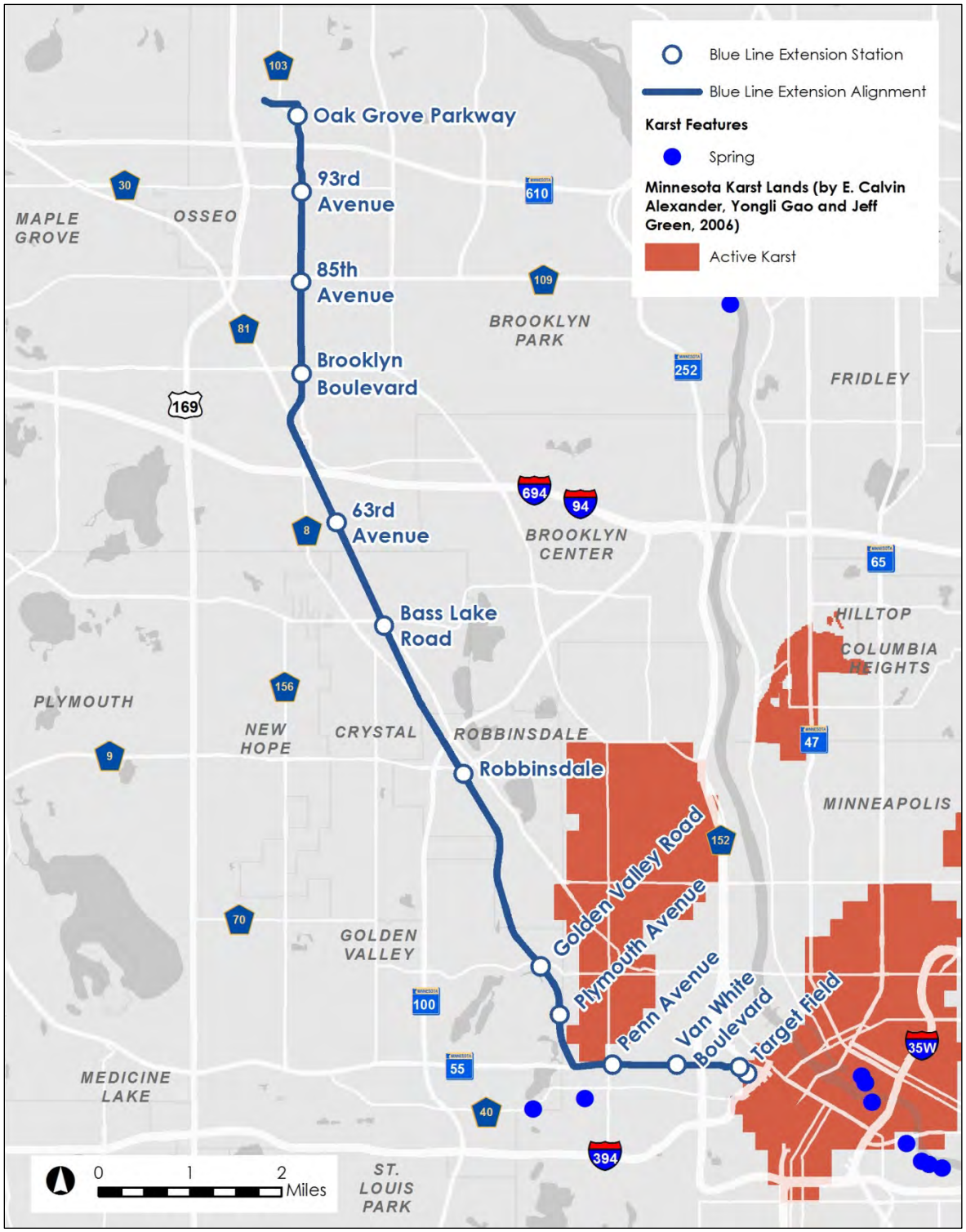
5.4.3.2 Soils

Soil types vary in the study area. Soil data were obtained from digital soil surveys of Hennepin County distributed by the Council. Digital soil data and descriptions for Hennepin County were gathered from the April 1974 Soil Survey of Hennepin County, Soil Conservation Service (now Natural Resources Conservation Service [NRCS]) soil maps produced for eastern Hennepin County in 1983, and NRCS Mylar Maps of the Hennepin County Soil Survey.

The majority of the study area is located on previously developed land and includes soils that have been highly disturbed. The major soil types within the LOD for the proposed BLRT Extension project are as follows:

- Sandy loams and loamy sands that range from poorly drained soils to well-drained soils. The poorly drained soils are associated with the wetlands and floodplain areas in the study area. Individual soil complexes include:
  - Forada sandy loam
  - Anoka and Zimmerman soils
  - Duelm loamy sand
  - Isan sandy loam
  - Soderville loamy fine sand
- Soils that are considered highly disturbed by human activity. These soils are generally classified as well drained to excessively drained. Individual soil complexes include:
  - Urban land – Hubbard Complex
  - Urban land – Udipsamments
  - Urban land – Lester complex
  - Urban land – Dundas complex
- Soils located in filled areas that were previously marshes, river floodplains, or swamps (wet areas). These soils are considered poorly drained. Individual soil complexes include:
  - Udorthents, wet substratum

Figure 5.4-1. Active Karst Areas



Sources: University of Minnesota, Department of Geology and Geophysics; DNR – Division of Waters

Areas of poor soils have been identified along the study area. Poor soils are defined in the context of the proposed BLRT Extension project as soils that have low strength and high compressibility. These soils are susceptible to large, non-uniform settlement. Such soils are often described as peats, organic clays, soft clays, and swamp deposits. The largest area of poor soils identified in the study area is located between Olson Memorial Highway and 36th Avenue (**Figure 5.4-2**). Geotechnical borings have been concentrated along this stretch to better understand subsurface conditions. Areas of poor soils down to depths over 100 feet have been identified.

5.4.3.3 Topography

The general topography of the study area consists of gently rolling hills. Land surface elevation ranges from 812 feet to 905 feet throughout the study area based on LIDAR data (a remote sensing method that uses light in the form of a pulsed laser to measure variable distances to the Earth) received from DNR (2012). The general grade along the proposed BLRT Extension project decreases to the south and east. Low-lying areas in the study area, relative to the surrounding land, were noted in the vicinity of wetlands and natural areas that abut the proposed BLRT Extension project alignment in Golden Valley and Robbinsdale.

5.4.4 Environmental Consequences

5.4.4.1 Operating-Phase (Long-Term) Impacts

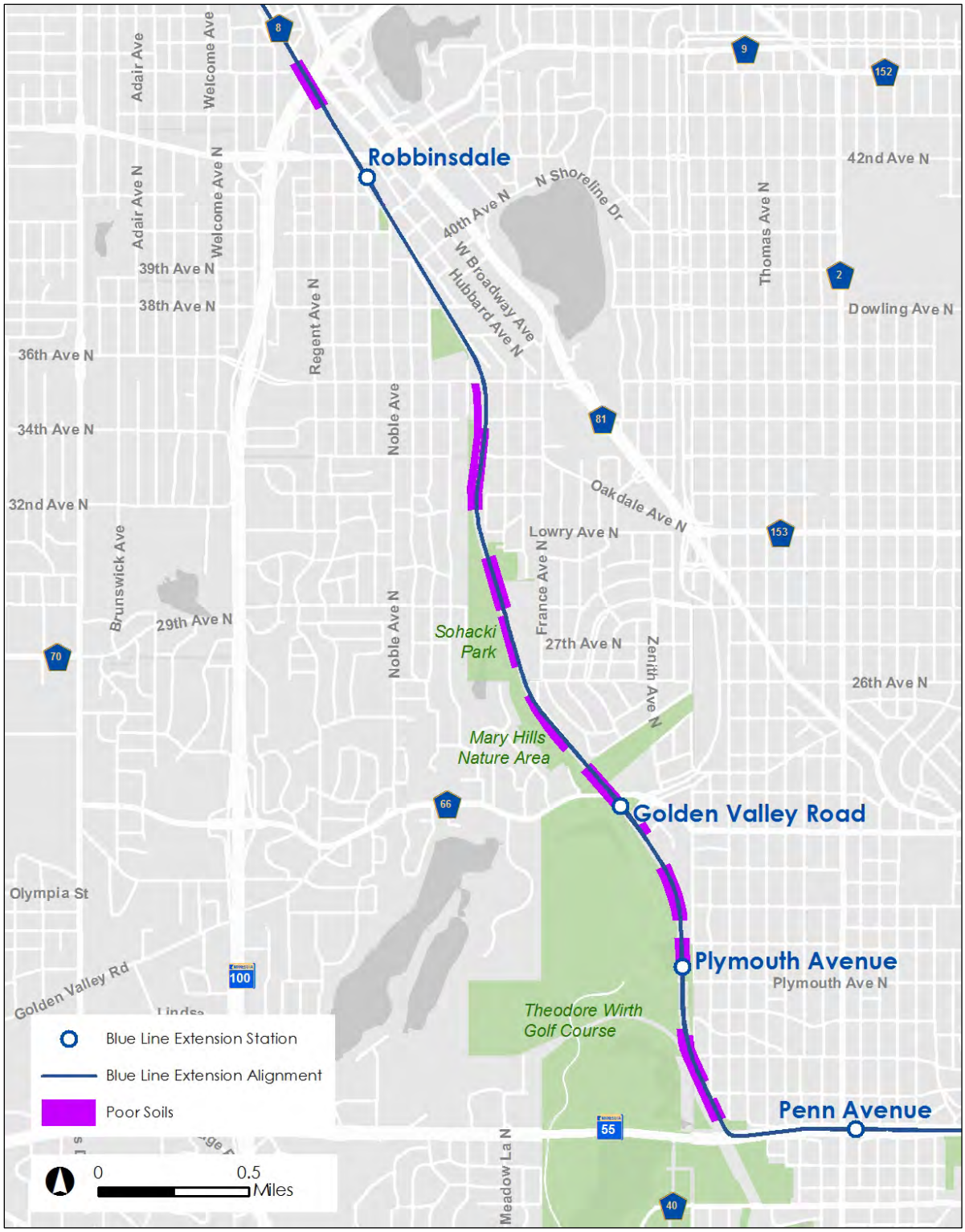
No-Build Alternative

There would be no operating-phase impacts to geology, soils, or topography from the No-Build Alternative.

Proposed BLRT Extension Project

Impacts from the proposed BLRT Extension project to geology and soils would occur solely during construction; therefore, no operating-phase (long-term) impacts are anticipated from the proposed BLRT Extension project.

Figure 5.4-2. Areas of Poor Soils



5.4.4.2 Construction-Phase (Short-Term) Impacts

No-Build Alternative

There would be no construction-phase impacts to geology, soils, or topography from the No-Build Alternative.

Proposed BLRT Extension Project

No geologic features or hazards were identified in the study area; however, a portion of the proposed BLRT Extension project is located in an area identified as active karst. Two springs were mapped 1 mile southwest of the study area. Though no karst features have been identified along the proposed BLRT Extension project, a small segment of the study area has a high probability for karst, as shown in **Figure 5.4-1**. The design and operation of project infrastructure could be affected if subsurface features are encountered during construction. The presence of karst could also exacerbate the spread of contamination if spills or releases of hazardous materials were to occur in this area. Details regarding releases of hazardous materials in karst areas are discussed further in **Section 5.5.5**.

Individual locations of limited dewatering for utility construction or similar short duration installations may occur, however there are no planned areas of large scale, long duration dewatering.

Areas of poor soils complicate the design and construction phases of the proposed BLRT Extension project. Poor soils in the study area could allow non-uniform settlement of built infrastructure if the soils are not adequately accommodated for in the design phase. The most concentrated area of poor soils is along the BNSF rail corridor between Olson Memorial Highway and 36th Avenue in Golden Valley and Robbinsdale. In order to address this concentrated area of poor soils, the Council has evaluated a range of mitigation alternatives from a relatively expensive conventional bridge structure spanning the poor soils to low-cost wick drains. The Council selected load transfer platforms supported by vertical elements on a grid spacing likely between 6 and 8 feet on center. The load transfer platform is a built-up layered system of geogrid and stone aggregate approximately 3 feet thick. The vertical elements would likely be piles or rigid inclusions.

Since the majority of the proposed BLRT Extension project would follow existing freight tracks or roads at similar elevations, substantial grading is not needed to work around steep slopes or other topographic extremes. Short-term dewatering would be needed for open-trench subsurface work in areas of high groundwater, but specific needs would be better defined as the final design of the proposed BLRT Extension project advances.

5.4.5 Avoidance, Minimization, and/or Mitigation Measures

Long-Term Mitigation Measures. No mitigation measures are warranted for long-term or short-term impacts to geology or soils, because the effectiveness of identified avoidance measures (load transfer platforms) and BMPs would prevent any adverse impacts.

Short-Term Mitigation Measures. All project-related construction activity will adhere to the appropriate standards and applicable permitting requirements of MPCA, MnDOT, and Hennepin

County for grading and erosion control. Dewatering permits, if required, would be obtained from DNR. See **Section 5.5.5** for mitigation of the increased risk to groundwater resources from spills in karst areas.

For areas of poor soils, the proposed BLRT Extension project design will incorporate geotechnical elements to provide a stable base for project components (for example, track and station platforms) and to avoid differential settlement of soils. Geotechnical design elements include load transfer platforms and lightweight fill. Specifically, the ground improvements to allow the proposed BLRT and freight construction over top of the poor soils would be in-situ and therefore would be contained within the existing BNSF right-of-way. The ground improvement method would be a load transfer platform that strengthens and bridges the existing soil strata without ground settlement along with some use of lightweight fill that offsets any additional soil loading by displacing existing heavier soil with lightweight fill.

5.5 Hazardous Materials Contamination

This section describes the properties in the study area that potentially contain hazardous or regulated materials and describes the potential for encountering contaminated soil and/or groundwater during construction of the proposed BLRT Extension project. The analysis is based on information in the Modified Phase I ESA conducted by the Council for the proposed BLRT Extension project along the proposed BLRT Extension project, including an OMF north of the Oak Grove Parkway park-and-ride.

5.5.1 Regulatory Context and Methodology

MPCA oversees regulations pertaining to approvals for cleanup plans for contaminated soil, groundwater, and waste; registration and removal of petroleum underground storage tanks; and NPDES permitting. Additionally, the Minnesota Department of Health regulates asbestos abatement and disposal of lead-based paint. Activities that encounter contaminated materials must follow state requirements for safe handling and disposal under the purview of MPCA.

There is no single, comprehensive source of information available that identifies known or potential sources of environmental contamination. Therefore, to identify and evaluate properties that potentially contain hazardous or regulated materials (such as petroleum products) or other sources of contamination, the Council completed a Modified Phase I ESA in conformance with EPA, All Appropriate Inquiry, and American Society for Testing and Materials (ASTM) 1527-13, as modified by MnDOT for transportation projects. The Modified Phase I ESA is an accepted industry practice for transportation projects and consists of the following key components for evaluating properties for the likelihood of contamination: (1) site reconnaissance, (2) records review, (3) historical review, and (4) interviews with representatives from local government.

The Modified Phase I ESA is a qualitative review that evaluates the risk of encountering contamination during construction based on the key components listed above for properties along the proposed BLRT Extension project. It does not measure the severity of any potential hazardous materials found on site. The following rankings were used to evaluate potentially contaminated properties:

- **Low potential for contamination properties** include properties that are hazardous waste generators, properties that are light industrial facilities, and possibly some properties where site reconnaissance showed poor housekeeping or soil disturbance.
- **Medium potential for contamination properties** include properties with closed leaking underground or aboveground storage tanks (LUASTs), all properties with underground or aboveground storage tanks (USTs or ASTs), all properties with historic or current vehicle and/or auto body repair activities and petroleum use or storage, and properties with unintentional releases of hazardous materials.
- **High potential for contamination properties** include all active and inactive Voluntary Investigation and Cleanup (VIC) Program sites; all active Petroleum Brownfields Program (PBP) sites; Minnesota Environmental Response and Liability Act (MERLA) sites; all heavy industry sites; all active and inactive dumpsites; all Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) sites; and all active LUAST sites.

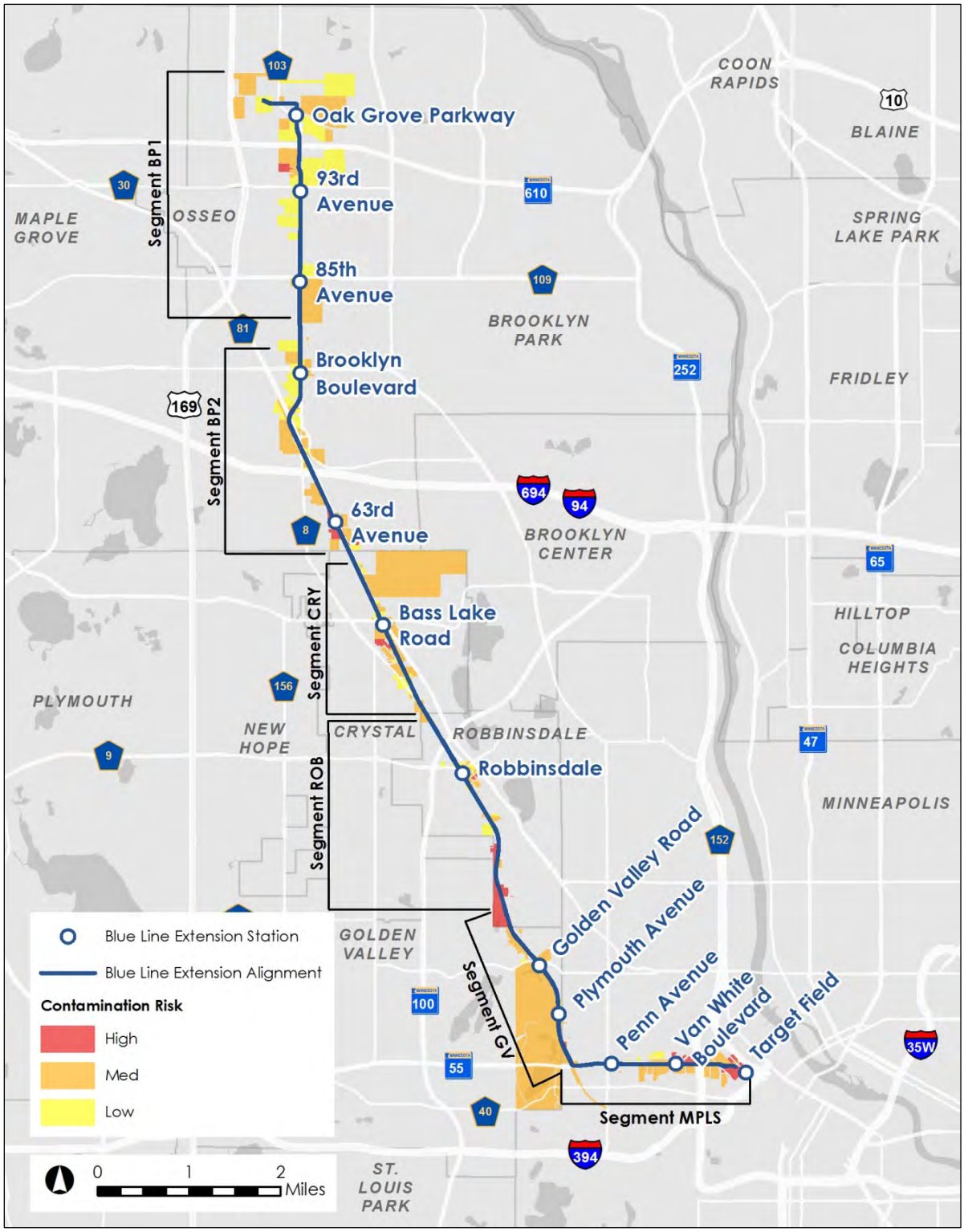
5.5.2 Study Area

The study area for hazardous materials contamination includes potentially contaminated properties or regulated material facilities within 500-feet of the proposed BLRT Extension project and the OMF.

For the discussion in the following sections, the study area was divided into six segments that generally correspond with the cities along the proposed BLRT Extension project. These segments are listed below and shown in **Figure 5.5-1**:

- **Segment MPLS**, located in the City of Minneapolis, a segment about 2 miles long
- **Segment GV**, located in the City of Golden Valley, a segment about 1.4 miles long
- **Segment ROB**, located in the City of Robbinsdale, a segment about 2.6 miles long
- **Segment CRY**, located in in the City of Crystal, a segment about 1.9 miles long
- **Segment BP2**, located in the City of Brooklyn Park, a segment about 2.6 miles long
- **Segment BP1**, located in the City of Brooklyn Park, a segment about 2.4 miles long

Figure 5.5-1. Locations of Potentially Contaminated Properties



Source: Modified Phase I ESA, September 2015, prepared by Braun Intertec

5.5.3 Affected Environment

Potentially contaminated properties are often found in previously developed industrial and commercial areas. These types of land uses are common throughout the study area, and there is a potential to encounter contaminated soils, groundwater, and materials based on prior use and development along the proposed BLRT Extension project alignment.

Table 5.5-1 summarizes the potentially contaminated properties that were identified in the study area (by segment) as identified in the Modified Phase I ESA. The properties are also shown in **Figure 5.5-1**.

Table 5.5-1. Number of Recorded Properties with Potential Contamination by Segment

Segment	Properties with Low Potential for Contamination	Properties with Medium Potential for Contamination	Properties with High Potential for Contamination	Total
Minneapolis	9	28	10	**47**
Golden Valley	3	6	0	**9**
Robbinsdale	37	23	7	**67**
Crystal	20	41	2	**63**
Brooklyn Park 2	24	26	4	**54**
Brooklyn Park 1	19	11	1	**31**
Total	**112**	**135**	**24**	**271**

5.5.4 Environmental Consequences

5.5.4.1 Operating-Phase (Long-Term) Impacts

No-Build Alternative

There is no likelihood of encountering contamination from hazardous or regulated materials as a result of the No-Build Alternative.

Proposed BLRT Extension Project

No hazardous or regulated materials would be produced by the proposed BLRT Extension project during its operating phase. No permanent storage tanks would be installed for this project. The long-term operation of the proposed OMF would require responsible management and containment of hazardous materials that are used and stored onsite, consistent with applicable regulatory standards (principally Minnesota Rules Chapter 7045). Oils, grease, and other waste materials generated during vehicle maintenance and repair activities would be collected and disposed of in accordance with recognized industry BMPs for rail transit maintenance facilities.

Acquiring land that is contaminated or that contains hazardous or regulated materials creates risk in the form of potential liability for investigation and cleanup costs. The extent of that risk would be based on the type and extent of the contamination. Therefore, the Council would avoid, to the extent

possible, acquiring land with known contamination that cannot be easily remediated or contained by conducting a more-detailed investigation of the potential for contamination as the proposed BLRT Extension project advances into further stages of project development.

5.5.4.2 Construction-Phase (Short-Term) Impacts

No-Build Alternative

There is no likelihood of encountering contaminated or regulated materials as a result of the No-Build Alternative. Therefore, no positive or negative impacts are expected.

Proposed BLRT Extension Project

The Modified Phase I ESA identified 271 properties in the study area that have a potential for contamination based on the ranking criteria in **Section 5.5.1**. The number of potentially contaminated properties in each segment of the study area is summarized above in **Table 5.5-1**. Construction activities involving subsurface disturbance can spread or release existing contamination that is present along the proposed BLRT Extension project. Encountering unknown contaminated materials can also pose a threat to human health and the environment.

5.5.4.3 Summary of Impacts

As shown above in **Table 5.5-1**, 24 high-potential and 135 medium-potential properties were identified in the study area. The segment with the largest number of high-potential properties (10 properties) was Segment MPLS (City of Minneapolis). This area has been developed since the 1880s, which is at least 50 years prior to the development in other segments. The segment with the largest number of potentially contaminated properties is Segment ROB (City of Robbinsdale), but the majority (37) of these properties are ranked as low potential. Segment CRY (City of Crystal) has a total of 41 properties that are ranked as medium potential for contamination.

Table 5.5-2 describes the 24 properties in the study area that are identified in **Table 5.5-1** as having the highest potential for contamination.

Table 5.5-2. High-Potential Properties in the Study Area by Segment

Segment	Phase I ESA ID[1]	Name	Rationale for Ranking	Disturbance Probable (Y/N)
Minneapolis	1	Ford Center	ASTs, closed LUST, closed spill, inactive VIC site, hazardous waste generator	N
Minneapolis	2	Be The Match	AST, closed LUST, closed spill, active VIC site, active PBP site, hazardous waste generator	N
Minneapolis	3	Hennepin County Energy Recovery Center and Caribou Coffee	Past filling stations and auto repair facilities, ASTs, USTs, closed LUST, closed spill, inactive VIC site, inactive PBP site, inactive CERCLIS site, hazardous waste generator	Y
Minneapolis	5	Property under construction	ASTs, USTs, closed LUST, active VIC site, active PBP site, hazardous waste generator	N
Minneapolis	7	Weather Rite	Past and commercial uses including machine shop, metal manufacturing, waste (garbage) management, and automotive repair and junkyard; USTs; closed LUST; inactive VIC site; active state assessment site (SAS); hazardous waste generator	N
Minneapolis	8	Junction Flats	Past auto repair and junkyard, ASTs, USTs, active VIC site, inactive PBP site, active site response section (SRS), hazardous waste generator	N
Minneapolis	12	Sharing and Caring Hands	Past auto repair and filling stations, UST, closed LUST, inactive VIC site, hazardous waste generator	N
Minneapolis	17	Velocity Express	ASTs, USTs, closed LUST, closed spill site, active VIC site, hazardous waste generator	Y
Minneapolis	21	Heritage Park II	Past commercial uses, USTs, closed LUST, closed spill, inactive VIC site, hazardous waste generator	Y
Minneapolis	47	Undeveloped properties	Inactive VIC site	Y
Robbinsdale	58	Walter Sochacki Community Park	Unpermitted dump site, active SAS, closed spill site	Y
Robbinsdale	59	South Halifax Park	Inactive VIC site, inactive SRS site, restrictive covenant	Y
Robbinsdale	75	Walgreens	Past commercial uses include filling station and auto repair facilities, ASTs, USTs, closed LUST, PBP site, inactive VIC site, hazardous waste generator	N
Robbinsdale	76	Broadway Court Apartments	Former gasoline station and dry cleaner, USTs, closed LUST, inactive VIC site, inactive CERCLIS site, inactive Superfund site, hazardous waste generator	Y

Table 5.5-2. High-Potential Properties in the Study Area by Segment

Segment	Phase I ESA ID[1]	Name	Rationale for Ranking	Disturbance Probable (Y/N)
Robbinsdale	88	Wuollet Bakery & Espresso	Past and current commercial uses, former dry cleaner, inactive VIC site	Y
Robbinsdale	90	Hubbard Market Place	Past auto repair activities, USTs, inactive VIC site	Y
Robbinsdale	107	The Steinhauser Group	Past dry cleaner, inactive VIC site	Y
Crystal	162	Commercial building	USTs, closed spill site, active PBP site, hazardous waste generator, machine shops	Y
Crystal	172	Cell tower and undeveloped land	Former gasoline station and auto repair, inactive VIC site, inactive PBP site, hazardous waste generator	Y
Brooklyn Park 2	190	Former Latzke Iron Works	Inactive VIC site	N
Brooklyn Park 2	192	Waterford Senior Townhomes	ASTs, USTs, inactive VIC site	Y
Brooklyn Park 2	195	Stormwater pond	USTs, closed LUST, closed spill site, active PBP site, active VIC site, hazardous waste generator, exterminating company	N
Brooklyn Park 2	196	Metro Transit Bottineau & 63rd Park-and-Ride	ASTs, USTs, closed LUST, closed PBP site, inactive VIC site, hazardous waste generator	Y
Brooklyn Park 1	258	Undeveloped land	USTs, closed LUST, PBP site, VIC site, hazardous waste generator	N

[1] See Modified Phase I Environmental Site Assessment in **Appendix F**.

Both high- and medium-risk properties have been identified in the Modified Phase I ESA as having a greater known risk of existing contamination. Potential construction-phase impacts include the time and expense of identifying, testing, and removing the contaminated materials found within the LOD.

The Council would use the results of the Modified Phase I ESA to plan the next phase of investigation, known as a Phase II ESA, in which a subsurface investigation is conducted and soil and groundwater samples are collected and then analyzed by a certified laboratory. This subsurface investigation provides a quantitative measurement of existing contamination in areas of proposed ground disturbance in the area of the identified high- and medium-risk properties. The results of the Phase II ESA would identify areas of contamination above regulatory standards that could require special handling and/or disposal during construction. Health and safety considerations might also need to be addressed in areas that exceed published levels of acceptable exposure for construction workers.

5.5.5 Avoidance, Minimization, and/or Mitigation Measures

The results of the Phase II ESA would be reviewed during design activities for the proposed BLRT Extension project, and impacts to areas of contaminated soil and/or groundwater will be avoided or minimized to the extent practicable.

Long-Term Mitigation Measures. No mitigation measures are warranted for long-term hazardous and contaminated materials impacts, because there would be no adverse impacts due to the effectiveness of identified avoidance measures.

Short-Term Mitigation Measures. The Council will enroll the proposed BLRT Extension project in the MPCA Brownfield Program, prior to the start of construction. As the proposed BLRT Extension project advances, it will be further refined to avoid disturbance to properties with known contaminants, as possible. In cases where the disturbance of hazardous and contaminated material cannot be avoided, the Council will conduct site remediation in accordance with the MPCA Brownfield Program regulatory framework and the approved RAPs for the project.

A Phase II ESA shall be completed, to address subsurface disturbance within areas identified as higher risk in the Modified Phase I ESA, after the publication of the Final EIS but prior to the start of construction. Based on the results of the Phase II ESA, the Council shall develop a Response Action Plan (RAP), approved by the MPCA prior to the start of construction that would address proper handling and treating of contaminated soil and/or groundwater that could not be avoided during construction.

A Construction Contingency Plan (CCP) shall be developed as part of the RAP for properly handling, treating, storing, and disposing of solid wastes, hazardous materials, petroleum products, and other regulated materials and wastes that are used or generated during construction and for managing previously unknown hazardous materials discovered during construction.

A Spill Prevention, Control, and Countermeasures (SPCC) Plan will be prepared by the contractor, and approved by MPCA. This plan will establish protocols to minimize impacts to soils and groundwater if a release of hazardous substances were to occur during construction. Areas of active karst, as discussed in **Section 5.4**, will be highlighted in the SPCC Plan as being more sensitive to spills and releases, since travel times from the surface to the underlying water table can be considerably faster in areas with karst features. Special considerations for spill prevention and response would be made for these areas.

In addition to contaminated soil and groundwater, the potential exists for structures on acquired land to contain asbestos, lead paint, or other hazardous materials. Any existing structures on acquired land will be surveyed for the presence of hazardous/regulated materials prior to their demolition or modification. Potentially hazardous materials will be handled and managed in compliance with all applicable regulatory standards and will be disposed in accordance with all Hazardous Materials Abatement Plans for in-place hazardous/regulated materials, and the RAP/CCP for hazardous/regulated materials in the site soils.

5.6 Noise

This section describes the existing noise environment in the study area and the long-term (operating-phase) and short-term (construction-phase) noise impacts from the No-Build Alternative and the proposed BLRT Extension project (for a description of cumulative effects, see **Chapter 6 – Indirect Impacts and Cumulative Effects**). This section provides an overview of the regulatory context and methodology used for the analysis, an assessment of existing noise conditions, a description of the expected noise impacts, and a description of mitigation measures to be implemented with the proposed BLRT Extension project. A technical report has also been prepared in support of this section (see **Appendix F**).

5.6.1 Regulatory Context and Methodology

5.6.1.1 Regulatory Context

This section describes the methodology used to assess predicted noise impacts and to develop mitigation strategies. Noise has been assessed in accordance with guidelines specified in FTA's *Transit Noise and Vibration Impact Assessment* guidance manual (FTA, 2006). The FTA guidance manual is the primary source for the noise assessment methodology. Noise impacts were evaluated using the Detailed Noise Assessment methodology in Chapter 6 of the FTA guidance manual (FTA, 2006).

5.6.1.2 Methodology

The noise assessment methodology for assessing noise impacts from LRT operations included the following steps:

1. Identify noise-sensitive land uses in the study area using aerial photographs, GIS data, and field surveys, typically within 300 feet of the proposed BLRT Extension project.
2. Measure existing noise levels in the study area near sensitive receptors.
3. Predict future project noise levels from transit operations using preliminary engineering plans and information on speeds, headways, track type, vehicle type, and grade-crossing operations for the proposed BLRT Extension project. The project noise level assessment included LRT operations, horns, and bells at grade crossings and stations; associated roadway improvements; and changes in feeder bus operations at selected stations. Details regarding the information used to predict future project noise levels are provided in **Appendix F**.
4. Assess the impact of the proposed BLRT Extension project by comparing the projected future noise levels with existing noise levels using the FTA noise impact criteria in Chapter 3 of the FTA guidance manual.
5. Recommend mitigation at locations where projected future noise levels exceed the FTA impact criteria.

In addition, the Council conducted a construction noise impact assessment using the methodology in Chapter 12 of the FTA guidance manual.

5.6.1.3 Understanding Noise

Sound is defined as small changes in air pressure above and below the standard atmospheric pressure. *Noise* is usually considered to be unwanted sounds. The three parameters that define noise are:

- **Level.** The level of sound is the magnitude of air pressure change above and below atmospheric pressure and is expressed in decibels (dB). Typical sounds fall within a range between 0 dB (the lower limits of human hearing) and 120 dB (the highest sound levels experienced in the environment). A 3-dB change in sound level is perceived as a barely noticeable change outdoors, and a 10-dB increase (or decrease) in sound level is perceived as a doubling (or halving) of the sound level.
- **Frequency.** The frequency (pitch or tone) of sound is the rate of air pressure changes. It is expressed in cycles per second, or Hertz (Hz). Human ears can detect a wide range of frequencies from around 20 Hz to 20,000 Hz. However, human hearing is not effective at high and low frequencies, and the A-weighting system (dBA) is used to correlate noise measurements with human response to noise. The A-weighted sound level has been widely adopted by acousticians as the most appropriate descriptor for environmental noise.
- **Time Pattern.** Because environmental noise is constantly changing, it is common to condense this information into a single number, called the "equivalent" sound level (L_{eq}). The L_{eq} represents the changing sound level over a period of time, typically 1 hour or 24 hours in transit noise assessments. The common noise descriptor used for LRT and freight rail projects is the day-night sound level (L_{dn}). This descriptor has been adopted by most agencies as the best way to describe how people respond to noise in their environment. L_{dn} is a 24-hour cumulative A-weighted noise level that includes all noises that happen within a day, with a 10-dB penalty for nighttime noise (10 p.m. to 7 a.m.). This nighttime penalty means that any noise events at night are equivalent to 10 similar events during the day. Typical L_{dn} values for various transit and freight operations are shown in **Figure 5.6-1**.

5.6.1.4 Noise Criteria

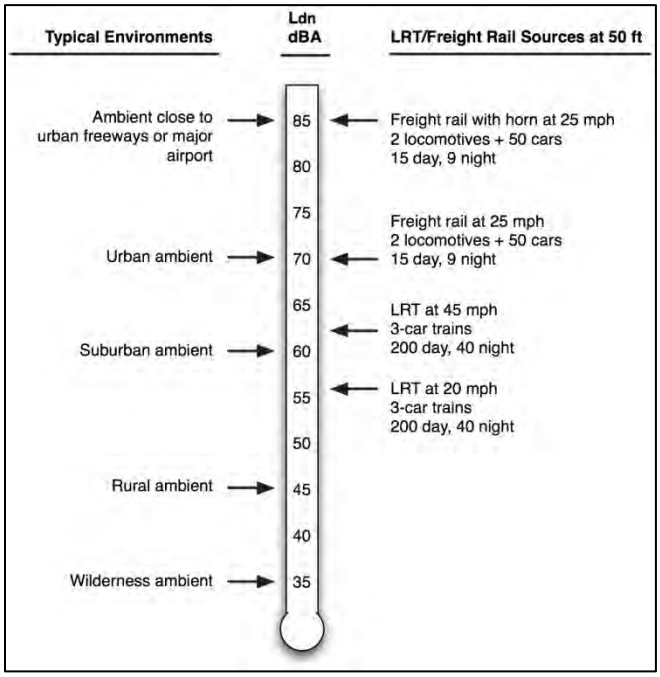
This section describes FTA and MPCA noise impact criteria and their applicability to this noise assessment.

FTA Noise Criteria

FTA's noise impact criteria are described in Chapter 3 of the FTA noise and vibration guidance manual (FTA, 2006). FTA's noise impact criteria are based on well-documented research on community response to noise, existing noise levels, and the change in noise exposure caused by a transit project. The FTA noise criteria compare project noise levels to existing noise levels (not to noise levels with the No-Build Alternative).

FTA's noise criteria are based on the land-use category of the sensitive receptor. The L_{dn} descriptor is used to assess transit-related noise at residential land uses where overnight sleep occurs (Category 2), and the L_{eq} descriptor is used to assess transit-related noise at other land uses, as shown in **Table 5.6-1**.

Figure 5.6-1. Typical Noise Levels from LRT and Freight Rail



Source: CSA, 2015

Table 5.6-1. Land-Use Categories and Metrics for Transit Noise Impact Criteria

Land-Use Category	Noise Metric (dBA)	Description of Land Use Category
1	Outdoor $L_{eq}(h)$ [1]	Tracts of land where quiet is an essential element in their intended purpose. This category includes lands set aside for serenity and quiet, and such land uses as outdoor amphitheaters and concert pavilions, as well as National Historic Landmarks with significant outdoor use. Also included are recording studios and concert halls.
2	Outdoor L_{dn}	Residences and buildings where people normally sleep. This category includes homes, hospitals, and hotels where a nighttime sensitivity to noise is assumed to be of utmost importance.
3	Outdoor $L_{eq}(h)$ [1]	Institutional land uses with primarily daytime and evening use. This category includes schools, libraries, theaters, and churches where it is important to avoid interference with such activities as speech, meditation, and concentration on reading material. Places for meditation or study associated with cemeteries, monuments, museums, campgrounds, and recreational facilities can also be considered to be in this category. Certain historical sites and parks are also included.

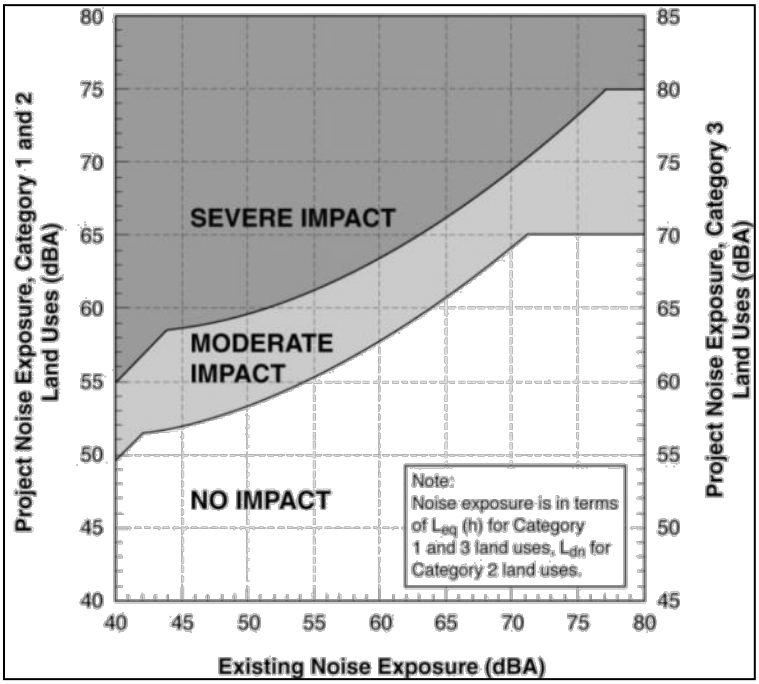
Source: FTA, 2006

[1] L_{eq} for the noisiest hour of transit-related activity during hours of noise sensitivity.

The noise impact criteria are defined by the two curves shown in **Figure 5.6-2**. The figure illustrates existing noise exposure and project-related noise exposure and demonstrates that FTA's noise impact thresholds vary with existing noise levels. FTA's noise impact criteria include the following three levels of impact (**Figure 5.6-2**):

- **No Impact.** In this range, the proposed project is considered to have no impact since, on average, the introduction of the project insignificantly increases the number of people who are highly annoyed by the new noise from the project.
- **Moderate Impact.** At the moderate impact range, changes in the cumulative noise level are noticeable to most people but might not be sufficient to cause strong, adverse reactions from the community. In this transitional area, other project-specific factors must be considered to determine the magnitude of the impact and the need for mitigation, factors such as the existing noise level, the projected level of increase over existing noise levels, and the types and numbers of noise-sensitive land uses that would be affected.
- **Severe Impact.** At the severe impact range, a significant percentage of people are highly annoyed by the new noise from the project. Noise mitigation is applied for severe impact areas unless it is not feasible or reasonable (that is, unless there is no practical method of mitigating the impact).

Figure 5.6-2. FTA Noise Impact Criteria



Source: FTA, 2006

MPCA Noise Criteria

MPCA has an established set of noise standards (Minnesota Rules, Chapter 7030) that provide limits on environmental noise using the L_{10} and L_{50} descriptors, which represent the noise level exceeded 10 percent (6 minutes) and 50 percent (30 minutes) of the time, respectively, during an hour. The standards include both daytime and nighttime limits for three different categories of land use or noise area classification, with residential land included in noise area classification 1. Classifications 2 and 3 are generally for commercial and industrial land uses, respectively (**Table 5.6-2**).

Table 5.6-2. MPCA Noise Standards

Noise Area Classification	Daytime		Nighttime	
	L_{10} (dBA)	L_{50} (dBA)	L_{10} (dBA)	L_{50} (dBA)
1	65	60	55	50
2	70	65	70	65
3	80	75	80	75

Source: Minnesota Rules, Chapter 7030, Noise Pollution

Because of the time limit component of the MPCA noise standards, the proposed BLRT Extension project would not exceed the standards under the proposed operating conditions. Light rail vehicles would pass by a location for about 10 seconds 12 times an hour (based on the operating assumptions of 10-minute headways in each direction) for a total of 120 seconds, or 2 minutes. Because the duration of exposure to LRT noise would not exceed the L_{10} (6-minute) and L_{50} (30-minute) time components, there is no potential for the proposed BLRT Extension project to exceed MPCA thresholds. Because the proposed BLRT Extension project would not exceed the MPCA thresholds, the FTA noise impact criteria described previously are more protective than the MPCA standards and have been used to assess and mitigate noise impacts.

Information regarding existing noise levels in the study area and any existing exceedances of the MPCA standards is provided in **Appendix F**.

FTA Construction Noise Criteria

The Council used FTA's construction noise criteria, summarized in **Table 5.6-3**, for the analysis of short-term noise impacts. FTA's construction noise criteria provide adequate protection for short-term noise impacts and allow reasonable mitigation measures to be applied to the proposed BLRT Extension project. Additionally, MPCA noise criteria were evaluated for the proposed BLRT Extension project, and the Council will work with local jurisdictions to ensure that reasonable measures are taken to limit construction noise.

5.6.2 Study Area

The study area for noise is generally defined as those properties within 300 feet of the proposed BLRT Extension project alignment.

Table 5.6-3. FTA Construction Noise Criteria

Land Use	8-hour L_{eq}, dBA		Noise Exposure, dBA
	Day	Night	30-day Average
Residential	80	70	75
Commercial	85	85	80
Industrial	90	90	85

Source: FTA, 2006

5.6.3 Affected Environment

This section describes existing noise-sensitive land uses and noise levels in the study area.

5.6.3.1 Noise-Sensitive Land Uses

The Council identified noise-sensitive land uses based on aerial photographs, project drawings, and a site survey. Information regarding noise-sensitive land uses by city in the study area is provided in **Appendix F**.

5.6.3.2 Existing Noise Measurements

In order to supplement the existing noise measurements conducted for the Draft EIS, the Council conducted a series of noise measurements in May 2015 at nine locations along the proposed BLRT Extension project to refine the existing noise levels and to respond to comments received on the Draft EIS.

Because the thresholds for impact in FTA's noise criteria are based on existing noise levels, measuring the existing noise and characterizing noise levels at sensitive locations in the study area is an important step in the impact assessment. The noise measurements included both long-term (24-hour) and short-term (1-hour) monitoring of the A-weighted sound level at noise-sensitive locations near the proposed BLRT Extension project.

Table 5.6-4 summarizes the measurements of existing noise, and **Figure 5.6-3** shows the locations of the 21 long-term noise-monitoring sites (LT) and eight short-term noise-monitoring sites (ST) for the proposed BLRT Extension project. The long-term noise measurements were used to characterize the existing noise at residential locations because the FTA assessment methodology uses L_{dn} (24-hour noise descriptor) for all residential locations, and the short-term noise measurements were used to characterize the existing noise at non-residential locations because the FTA assessment methodology uses L_{eq} (1-hour noise descriptor) for all non-residential locations.

At each site, the measurement was conducted at the approximate setback of the building or buildings relative to the proposed BLRT Extension project's location. The Council used the existing noise measurements to determine the existing noise levels for all the noise-sensitive locations. The noise measurement results at each site (which are identified by letters) are described in **Appendix F**. See the Draft EIS *Noise and Vibration Technical Report* for information regarding the Draft EIS noise measurement results (which are identified by numbers).

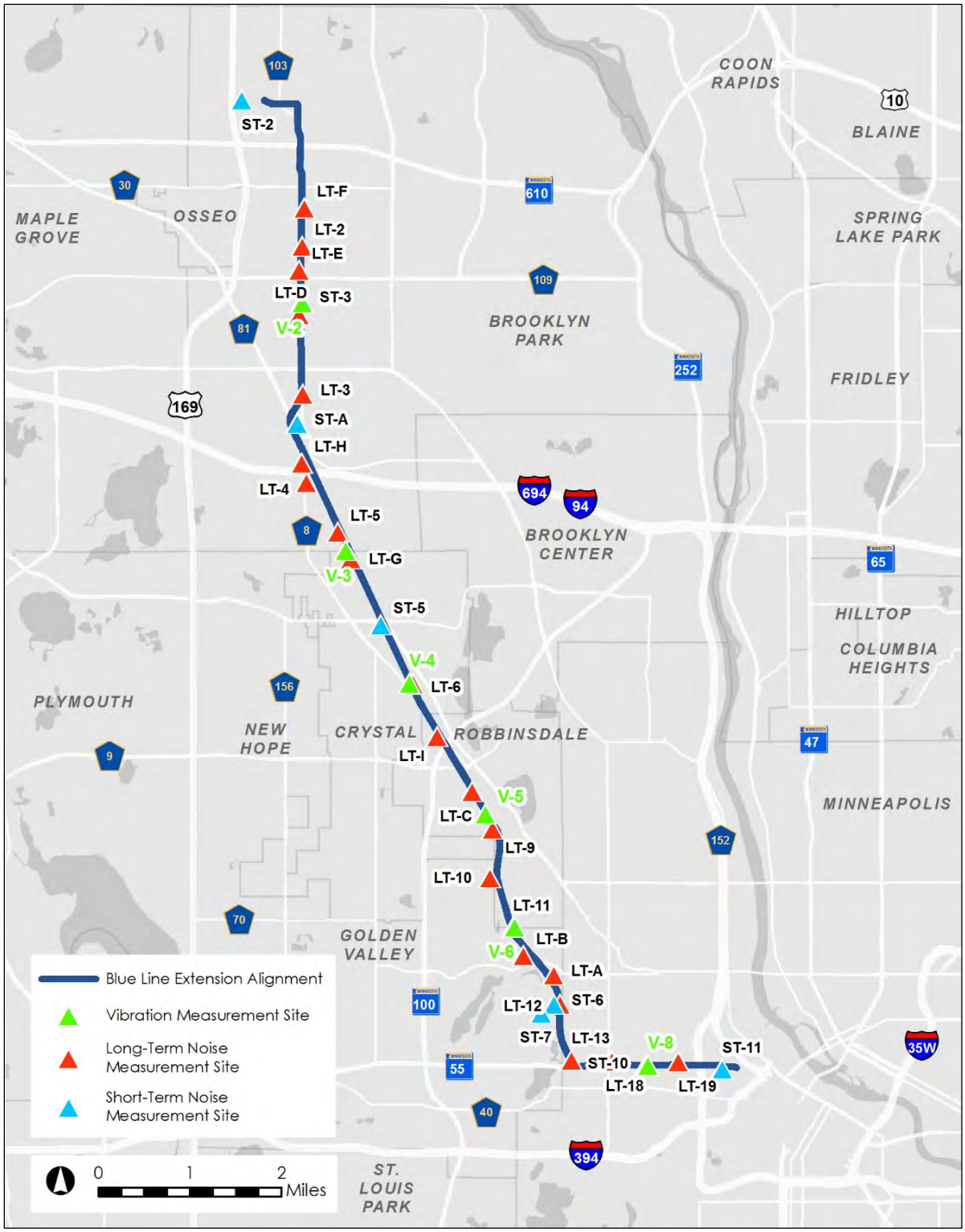
Table 5.6-4. Existing Noise Measurements in the Study Area

Site No.	City	Measurement Location	Draft EIS/ Final EIS	Measurement Start		Meas. Dur. (hr)	Noise Level (dBA)[1]	
				Date	Time		L_{dn}	L_{eq}
ST-11	Minneapolis	Mary My Hope Children's Center	DEIS	5/17/12	16:09	1	65	67
LT-19	Minneapolis	1000 Olson Memorial Highway Heritage Park	DEIS	5/15/12	18:00	24	65	61
ST-10	Minneapolis	Harrison Education Center	DEIS	5/15/12	16:07	1	60	62
LT-18	Minneapolis	611 Oliver Avenue North	DEIS	5/17/12	12:00	24	62	59
LT-13	Minneapolis	623 Vincent Avenue North	DEIS	5/16/12	17:00	24	56	50
ST-6	Golden Valley	TWRP	DEIS	5/18/12	10:01	1	47	49
ST-7	Golden Valley	The Chalet at TWRP	DEIS	5/18/12	11:20	1	53	55
LT-12	Golden Valley	1501 Xerxes Avenue North	DEIS	7/14/11	16:00	24	55	50
LT-A	Golden Valley	1821 York Avenue	FEIS	5/11/15	16:00	24	54	47
LT-B	Golden Valley	2145 Bonnie Lane	FEIS	5/11/15	16:00	24	53	50
LT-11	Robbinsdale	3912 26th Avenue North	DEIS	7/13/11	16:00	24	50	45
LT-10	Golden Valley	3230 Kyle Avenue North	DEIS	5/5/12	14:00	24	51	45
LT-9	Robbinsdale	4400 36th Avenue North	DEIS	5/15/12	15:00	24	54	48
LT-C	Robbinsdale	3954 Noble Avenue	FEIS	5/11/15	17:00	24	55	52
LT-I	Robbinsdale	4416 Toledo Avenue North	FEIS	5/13/15	18:00	24	61	59
LT-6	Crystal	5001 Welcome Avenue North	DEIS	7/14/11	15:00	24	54	48
ST-5	Crystal	Becker Park	DEIS	5/17/12	13:51	1	54	56
LT-G	Crystal	6102 Hampshire Avenue North	FEIS	5/13/15	16:00	24	62	61
LT-5	Brooklyn Park	6288 Louisiana Court North	DEIS	5/14/12	12:00	24	63	58
LT-4	Brooklyn Park	6648 West Broadway Avenue	DEIS	5/15/12	13:00	24	61	61
LT-H	Brooklyn Park	7501 Myers Avenue	FEIS	5/13/15	16:00	24	69	68
ST-A	Brooklyn Park	Prince of Peace Lutheran Church	FEIS	5/12/15	08:38	1	60	62
LT-3	Brooklyn Park	7428 75th Circle North	DEIS	5/14/12	13:00	24	60	55
LT-D	Brooklyn Park	8220 Quebec Court North	FEIS	5/12/15	14:00	24	65	62
ST-3	Brooklyn Park	North Hennepin Community College	DEIS	5/14/12	15:33	1	58	60
LT-E	Brooklyn Park	8558 S. Maplebrook Circle	FEIS	5/12/15	17:00	24	65	62
LT-2	Brooklyn Park	8745 Oregon Avenue North	DEIS	7/14/11	10:00	24	66	62
LT-F	Brooklyn Park	9125 Nevada Court	FEIS	5/12/15	18:00	24	57	51
ST-2	Brooklyn Park	Grace Fellowship Church	DEIS	5/14/12	17:00	1	55	57

Sources: CSA, 2015; HMMH, 2012

[1] L_{dn} is used for Category 2 (residential) land use, and L_{eq} is used for Category 3 (institutional) land use.

Figure 5.6-3. Locations for Measurements of Existing Noise and Vibration



Sources: CSA, 2015; HMMH, 2012

5.6.4 Environmental Consequences

This section identifies the long-term and short-term noise impacts from the No-Build Alternative and the proposed BLRT Extension project. Long-term impacts are those that would continue after construction is complete, while short-term impacts would be temporary and would be associated with the proposed BLRT Extension project's construction activities. (For a description of cumulative effects, see **Chapter 6**.) The evaluation of long-term noise impacts considers the increase in noise levels for sensitive receptors closest to the proposed light rail stations and track as a result of the operation of light rail.

5.6.4.1 Operating-Phase (Long-Term) Impacts

No-Build Alternative

There would be no operating-phase noise impacts from the No-Build Alternative.

Proposed BLRT Extension Project

This section describes the long-term noise impacts from the proposed BLRT Extension project. The Council conducted a detailed noise analysis (for more information, see **Appendix F**). A summary of the analysis results is presented in **Tables 5.6-5 and 5.6-6** for residential and institutional (for example, churches and schools) land uses, respectively.

The tables include a tabulation of location information for each sensitive receptor group, the existing noise levels from all sources, the project noise levels from LRT operations, the FTA impact criteria (moderate or severe), and the type and number of noise impacts, without the implementation of mitigation measures.

As shown in **Table 5.6-5**, the proposed BLRT Extension project would cause 366 moderate noise impacts and 618 severe noise impacts at residential noise receptors (homes and apartment buildings; see **Figure 5.6-4**) because of LRT horns. The impacts represent the number of affected units (including those in multi-family buildings), not the number of buildings. The majority of the noise impacts would be because of LRT horns being sounded at Federal Railroad Administration (FRA)-shared at-grade crossings along the proposed BLRT Extension project. With the proposed implementation of Quiet Zones[10] at all FRA-shared at-grade crossings, the proposed BLRT Extension project would cause 176 moderate noise impacts and 120 severe noise impacts, as shown in parentheses in **Table 5.6-5**. **Appendix F** presents a summary of each residential location with a projected noise level that would exceed the FTA criteria.

[10] Quiet Zones are locations, at least one-half mile in length, where the routine sounding of horns has been eliminated because of safety improvements at at-grade crossings, including modifications to the streets, raised median barriers, four quadrant gates, and other improvements designed and implemented as a part of the proposed BLRT Extension project and consistent with Quiet Zone readiness. Horns are sounded in emergency situations at these locations. Municipalities must apply to FRA for approval of Quiet Zones. If the municipality fails to apply for a Quiet Zone or FRA fails to approve the Quiet Zone, the proposed BLRT Extension project may result in residual noise impacts.

As shown in **Table 5.6-6**, the proposed BLRT Extension project would cause two moderate noise impacts and five severe noise impacts at institutional land uses (for a summary figure of project noise impacts without Quiet Zones, see **Figure 5.6-4**). All of the noise impacts would be due to LRT horns being sounded at FRA-shared at-grade crossings along the proposed BLRT Extension project. With the implementation of Quiet Zones as proposed, there would be no remaining impacts at institutional locations. **Appendix F** presents a summary of each institutional location with a projected noise level that would exceed the FTA criteria.

Should any of the municipalities decide not to apply to FRA for Quiet Zones, the proposed BLRT Extension project would result in the moderate and severe noise impacts detailed in **Table 5.6-5** and in **Appendix F**.

Table 5.6-5. Noise Impacts at Residential Land Uses, with and without Quiet Zones

Location	City	Side of Track	Near Track Distance (ft)	Speed (mph)	Existing Noise Level L_{dn} (dBA)[1]	Project Noise Levels – L_{dn} (dBA)			Type and Number of Impacts[3]	
						Project[1,2]	FTA Criteria		Moderate	Severe
							Moderate	Severe		
I-94 to Humboldt Ave N	Minneapolis	NB	95	20	65	62	61	66	16	0
I-94 to Humboldt Ave N	Minneapolis	SB	130	40	65	55	61	66	0	0
Humboldt Ave N to Penn Ave N	Minneapolis	NB	100	40	62	62	59	64	9	0
Humboldt Ave N to Penn Ave N	Minneapolis	SB	190	40	62	57	59	64	0	0
Penn Ave N to Upton Ave N	Minneapolis	NB	145	35	56	54	56	62	0	0
Penn Ave N to BNSF freight tracks	Minneapolis	SB	160	40	56	53	56	62	0	0
Olson Memorial Hwy to Oak Park Ave N	Minneapolis	NB	35	35	56	61	56	62	1	0
Oak Park Ave N to Plymouth Ave N	Minneapolis	NB	60	55	55	61	55	61	3	0
Plymouth Ave N to 16th Ave N	Golden Valley	NB	220	20	55	56	55	61	9	0
16th Ave N to Golden Valley Rd	Golden Valley	NB	30	45	54	64	55	61	1	0
Golden Valley Rd to 26th Ave N	Golden Valley	NB	80	55	50	65	53	60	9	14
26th Ave N to 31½ Ave N	Robbinsdale	NB	90	55	50	59	53	60	3	0
31½ Ave N to 34th Ave N	Robbinsdale	NB	20	55	50	70	53	60	4	12
34th Ave N to 36th Ave N	Robbinsdale	NB	60	55	54	62	55	61	20	5
34th Ave N to 36th Ave N	Robbinsdale	SB	140	55	54	56	55	61	1	0
36th Ave N to 38th Ave N	Robbinsdale	NB	40	55	54	91	55	61	8	27
36th Ave N to 38th Ave N	Robbinsdale	SB	295	55	54	68	55	61	15 (4)	7 (0)
38th Ave N to 40½ Ave N	Robbinsdale	NB	35	55	55	92	55	61	22 (3)	66 (20)
38th Ave N to 40th Ave N	Robbinsdale	SB	70	45	55	87	55	61	37 (20)	68 (5)
40½ Ave N to 42nd Ave N	Robbinsdale	NB	65	45	55	87	55	61	0 (5)	57 (2)
40th Ave N to 42nd Ave N	Robbinsdale	SB	130	30	55	78	55	61	34 (13)	40 (2)
42nd Ave N to MN-100	Robbinsdale	NB	115	30	61	78	59	64	9 (2)	28 (0)
42nd Ave N to MN-100	Robbinsdale	SB	100	40	61	81	59	64	14 (2)	10 (1)
MN-100 to 47th Ave N	Robbinsdale	NB	95	55	61	84	59	64	12 (10)	20 (1)
MN-100 to 47th Ave N	Robbinsdale	SB	80	55	61	82	59	64	19 (8)	39 (0)

Table 5.6-5. Noise Impacts at Residential Land Uses, with and without Quiet Zones

Location	City	Side of Track	Near Track Distance (ft)	Speed (mph)	Existing Noise Level L_{dn} (dBA)[1]	Project Noise Levels – L_{dn} (dBA)			Type and Number of Impacts[3]	
						Project[1,2]	FTA Criteria		Moderate	Severe
							Moderate	Severe		
47th Ave N to freight tracks	Crystal	NB	35	55	54	94	55	61	35 (10)	93 (31)
47th Ave N to freight tracks	Crystal	SB	120	55	54	81	55	61	26 (0)	24 (0)
Freight tracks to 56th Ave N	Crystal	NB	795	55	62	58	59	64	0 (0)	0 (0)
Freight tracks to 56th Ave N	Crystal	SB	80	25	62	52	59	64	0 (0)	0 (0)
56th Ave N to 60th Ave N	Crystal	NB	440	20	62	63	59	64	5 (0)	0 (0)
56th Ave N to 60th Ave N	Crystal	SB	160	35	62	76	59	64	4 (0)	2 (0)
60th Ave N to 63rd Ave N	Crystal	NB	200	35	63	73	60	65	1 (0)	1 (0)
60th Ave N to 63rd Ave N	Crystal	SB	125	40	63	77	60	65	24 (0)	84 (0)
63rd Ave N to I-694	Brooklyn Park	NB	315	25	63	68	60	65	1 (0)	18 (0)
63rd Ave N to I-694	Brooklyn Park	SB	140	35	63	52	60	65	0 (0)	0 (0)
I-694 to 73rd Ave N	Brooklyn Park	NB	700	40	60	59	58	63	8 (0)	0 (0)
I-694 to 73rd Ave N	Brooklyn Park	SB	170	55	69	74	64	69	2 (0)	3 (0)
73rd Ave N to Brooklyn Blvd	Brooklyn Park	NB	80	35	60	59	58	63	4	0
Brooklyn Blvd to Shingle Creek	Brooklyn Park	NB	85	45	65	59	61	66	0	0
Shingle Creek to 85th Ave N	Brooklyn Park	SB	70	40	65	65	61	66	5	0
85th Ave N to 89th Ave N	Brooklyn Park	NB	85	45	66	58	61	67	0	0
85th Ave N to 89th Ave N	Brooklyn Park	SB	90	45	66	59	61	67	0	0
89th Ave N to 93rd Ave N	Brooklyn Park	NB	120	45	57	57	56	62	5	0
								Total	**366 (176)**	**618 (120)**

Source: CSA, 2015

[1] Reported noise levels are rounded to the nearest decibel.

[2] The predicted project noise level at each location is the highest predicted noise level at any receptor for that location. Predicted noise levels at other receptors for each location are lower.

[3] The "Type and Number of Impacts" column identifies whether the LRT noise level would exceed FTA's moderate or severe noise impact criteria thresholds, which are found in the "Project Noise Levels" column. It also reports the number of units that would experience a moderate or severe noise impact. The numbers in parentheses are the number of impacts remaining after Quiet Zones are implemented.

Table 5.6-6. Noise Impacts at Institutional Land Uses

Location	City	Side of Track	Near Track Distance (ft)	Speed (mph)	Existing Noise Level L_{eq} (dBA)[1]	Project Noise Levels – L_{eq} (dBA)			Type and Number of Impacts	
						Project[1]	FTA Criteria		Moderate	Severe
							Moderate	Severe		
Sumner Library	Minneapolis	NB	110	20	62	50	64	70	0	0
Wayman AME Church	Minneapolis	NB	135	30	62	47	64	70	0	0
Seed Academy	Minneapolis	NB	135	40	62	52	64	70	0	0
Summit Academy	Minneapolis	SB	225	20	62	54	64	70	0	0
Zion Baptist Church	Minneapolis	NB	185	40	62	55	64	70	0	0
Le Creche Early Childhood Center	Minneapolis	NB	135	40	62	52	64	70	0	0
The Family Partnership	Golden Valley	NB	55	35	50	54	58	65	0	0
TWRP[2]	Golden Valley	SB	230	35	49	44	53	59	0	0
The Chalet[2]	Golden Valley	SB	925	20	55	31	56	61	0	0
Bethel World Outreach	Robbinsdale	NB	520	55	52	52	59	65	0	0
Elim Lutheran Church	Robbinsdale	NB	800	50	52	46	59	65	0	0
Sacred Heart Church	Robbinsdale	NB	300	35	52	68	59	65	0	1
Robbins Gallery	Robbinsdale	SB	110	20	52	77	59	65	0	1
Washburn McReavy Funeral Home	Crystal	NB	255	25	52	67	59	65	0	1
Masonic Lodge	Robbinsdale	NB	455	30	59	56	62	68	0	0
Redeemer Lutheran Church	Robbinsdale	SB	505	40	59	54	62	68	0	0
Glen Haven Memorial Gardens	Crystal	SB	610	55	48	58	58	64	1	0
Crystal Medical Center	Crystal	NB	180	30	61	71	63	69	0	1
Little Folks Daycare	Crystal	SB	85	25	56	80	61	66	0	1

Table 5.6-6. Noise Impacts at Institutional Land Uses

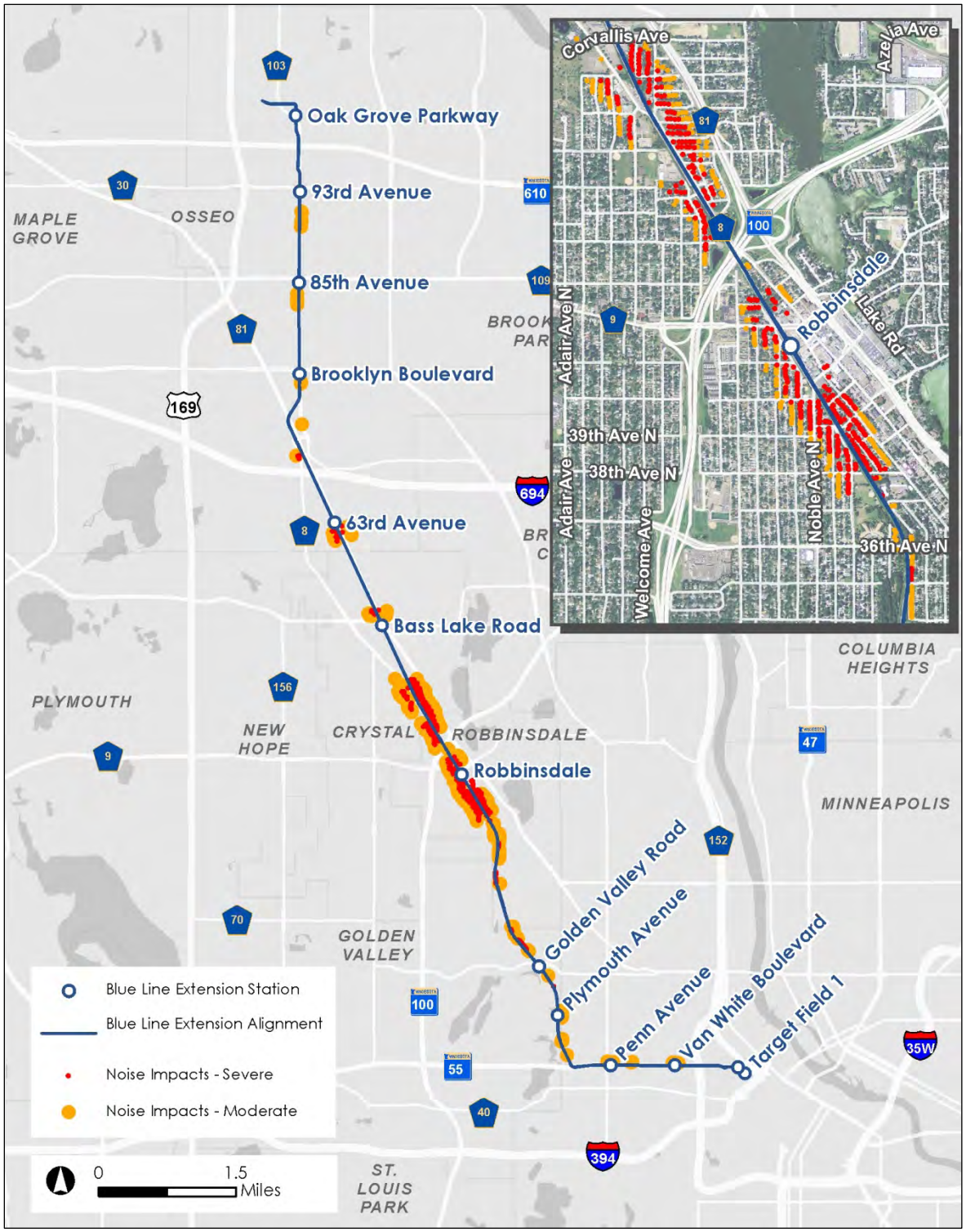
Location	City	Side of Track	Near Track Distance (ft)	Speed (mph)	Existing Noise Level L_{eq} (dBA)[1]	Project Noise Levels – L_{eq} (dBA)			Type and Number of Impacts	
						Project[1]	FTA Criteria		Moderate	Severe
							Moderate	Severe		
Brooklyn Crystal Cemetery	Brooklyn Park	NB	385	35	55	52	60	66	0	0
Prince of Peace Lutheran Church	Brooklyn Park	NB	385	35	62	63	64	70	0	0
Brooklyn Park Evangelical Free Church	Brooklyn Park	SB	145	45	60	51	63	68	0	0
North Hennepin Community College	Brooklyn Park	NB	75	20	60	61	63	68	0	0
Step by Step Montessori School	Brooklyn Park	SB	285	25	60	51	63	68	0	0
Berean Baptist Church	Brooklyn Park	SB	80	45	62	55	64	70	0	0
Ebenezer Community Church	Brooklyn Park	NB	135	20	51	58	59	65	0	0
								Total	**1**	**5**

Source: CSA, 2015

[1] Reported noise levels are rounded to the nearest decibel.

[2] The receiver was assessed as land use category 1.

Figure 5.6-4. Locations of Noise Impacts



Source: CSA, 2015

5.6.4.2 Construction-Phase (Short-Term) Impacts

No-Build Alternative

There would be no construction-phase noise impacts from the No-Build Alternative.

Proposed BLRT Extension Project

This section describes the short-term (construction-phase) noise impacts of the proposed BLRT Extension project.

Construction noise levels are subject to local noise ordinances and noise rules administered by MPCA (Minnesota Rules, Chapter 7030). MPCA administers these noise rules to establish maximum allowable noise levels; where applicable, MPCA procedures allow for the issuance of noise variances. To address both the applicable local noise ordinances and the MPCA noise rules, the Council will develop a Noise Control Plan. The Noise Control Plan will contain information regarding when advanced notice of construction activities will be provided to affected communities. The Noise Control Plan will also contain other stipulations to help avoid or minimize construction noise impacts. For example, the Noise Control Plan will require that construction equipment used by contractors be properly muffled and in proper working order. Most of the construction will consist of site preparation and laying new tracks, which should occur primarily during daytime hours, except when required and allowable within local noise ordinance procedures.

Construction noise varies greatly depending on the type of construction activities, equipment used, staging of the construction process, the layout of the construction site, and the distance to sensitive receptors. Elevated noise levels during construction are, to a degree, unavoidable for this type of project, and short-term noise during construction of the proposed BLRT Extension project can be intrusive to residents near the construction sites. For most construction equipment, diesel engines are typically the dominant noise source. For other activities, such as impact pile driving and jackhammering, noise generated by the actual process dominates. The contractor will provide specific information on equipment and methods as a part of the Noise Control Plan for construction of the proposed BLRT Extension project. The contractor will also indicate whether or not the proposed BLRT Extension project would pursue a noise variance in any municipality along the proposed BLRT Extension project corridor. The Council will review noise variance requests prior to submittal to MPCA for approval.

Affected communities would be given advance notice of any planned abnormally loud construction activities. In general, construction would occur within daytime hours. However, night construction could sometimes be required; for example, to reduce traffic impacts or improve safety. A nighttime construction mitigation plan will be developed if nighttime construction were necessary.

For residential land use, short-term noise impacts from at-grade track construction can extend to about 120 feet from the construction site. However, if nighttime construction is conducted, short-term noise impacts from at-grade track construction can extend to about 380 feet from the construction site. For more information about the construction noise impact assessment, see **Appendix F**.

For more information regarding the Council's approach to construction noise mitigation, see **Section 5.6.5**.

5.6.5 Avoidance, Minimization, and/or Mitigation Measures

This section describes the measures the Council will implement to mitigate the proposed BLRT Extension project's long-term and short-term noise impacts. FTA guidance states that severe noise impacts need to be mitigated, unless there are no feasible or practical means to do so (FTA, 2006). For moderate noise impacts, discretion should be used, and project-specific factors should be included in the consideration of mitigation. The project-specific factors can include both the existing noise levels and the projected increase in noise levels, the types and number of noise-sensitive land uses with impacts, existing sound insulation of buildings, and the cost-effectiveness of providing noise mitigation.

The Council used a mitigation approach (described in **Appendix F**) that specifies moderate impacts that qualify for mitigation. The mitigation guidelines state that, in locations with moderate impacts, where the existing noise levels exceed 65 dBA L_{dn} or where there is an increase in noise due to the proposed BLRT Extension project of three dB or greater, mitigation is required where it is reasonable and feasible.

Long-Term Mitigation Measures. Several noise mitigation measures have been evaluated based on the source, path, or receiver, which are further described in **Appendix F**. Additionally, **Table 5.6-7** provides a summary of the mitigation measures that will be implemented. At select locations, more-detailed interior testing is required prior to the identification of a mitigation measure. In addition to the specific noise mitigation measures listed below in **Table 5.6-7**, the proposed BLRT Extension project will employ several best practice methods to minimize noise project-wide. These measures include using wheel skirts (panels over the wheels) to reduce wheel/rail noise and continuously welded rail to eliminate gaps in the tracks that generate additional noise. Wheel truing (to keep the wheels smooth and round) and rail grinding (to remove corrugations) will also be conducted on a regular basis, which helps to control the noise and vibration levels for the system. Where appropriate and as needed, lubrication may be employed to limit noise. Throughout the design process, noise-generating elements (e.g., crossovers) have been located, where possible, away from sensitive locations. Finally, the Quiet Zones identified below would also have the added benefit of eliminating horn blowing from the existing freight trains in the proposed BLRT Extension corridor. The results shown in **Table 5.6-7** indicate that residential noise impacts at two locations (Golden Valley Road to 26th Avenue North and 31½ Avenue North to 34th Avenue North) are not mitigated, and that residual noise impacts would remain at these locations after mitigation.

Quiet Zones, which allow the use of LRT bells instead of horns at at-grade crossings, would eliminate many of the proposed BLRT Extension project's noise impacts. The Quiet Zones would have the additional benefit of eliminating the existing freight horns as well. Several noise mitigation measures have been evaluated based on the source, path, or receiver; measures which are further described in **Appendix F**. However, if the municipality fails to apply to FRA for Quiet Zone or if FRA fails to approve the Quiet Zone, the proposed BLRT Extension project would result in residual noise impacts at the associated locations.

Table 5.6-7 lists the residential mitigation measures that will be used after Quiet Zones are implemented. The results in **Table 5.6-7** indicate that the majority of residential noise impacts would be eliminated with the proposed mitigation measures. More-detailed descriptions of the noise mitigation measures at selected locations are provided in **Appendix F**.

The results of the noise assessment indicate that all institutional noise impacts would be eliminated with the proposed mitigation measures, which include the Quiet Zones discussed above in this section.

Table 5.6-7. Residential Noise Mitigation Measures after Implementation of Quiet Zones

Location	City	Side of Track	Type and Number of Impacts without Mitigation[1]		Noise Level Increase[2] (dB)	Proposed Mitigation Measure[3]	Residual Impacts with Mitigation	
			Moderate	Severe			Moderate	Severe
I-94 to Humboldt Ave N	Minneapolis	NB	16	0	0 to 1.8	None[4]	N/A	N/A
Humboldt Ave N to Penn Ave N	Minneapolis	NB	9	0	0 to 2.9	None[4]	N/A	N/A
Olson Memorial Hwy to Oak Park Ave N	Minneapolis	NB	1	0	0.1 to 5.8	Interior testing to determine mitigation measure[5]	0	0
Oak Park Ave N to Plymouth Ave N	Minneapolis	NB	3	0	1.3 to 6.8	Interior testing to determine mitigation measure[5]	0	0
Plymouth Ave N to 16th Ave N	Golden Valley	NB	9	0	0.1 to 5.6	Interior testing to determine mitigation measure[5]	0	0
16th Ave N to Golden Valley Rd	Golden Valley	NB	1	0	0.2 to 3.5	Interior testing to determine mitigation measure[5]	0	0
Golden Valley Rd to 26th Ave N	Golden Valley	NB	9	14	0.9 to 15.2	Noise barrier E-2: 10 feet tall, 2,540 feet long	1	1
26th Ave N to 31½ Ave N	Robbinsdale	NB	3	0	3.8 to 9.6	Noise barrier E-2: 10 feet tall, 2,540 feet long	0	0
31½ Ave N to 34th Ave N	Robbinsdale	NB	4	12	1.8 to 19.4	Noise barrier E-3: 10 feet tall, 1,200 feet long	4	1
34th Ave N to 36th Ave N	Robbinsdale	NB	20	5	0.7 to 8.3	Noise barrier E-4: 8 feet tall, 1,325 feet long	0	0
34th Ave N to 36th Ave N	Robbinsdale	SB	1	0	2.7 to 4.1	Interior testing to determine mitigation measure[5]	0	0
36th Ave N to 38th Ave N	Robbinsdale	NB	8	27	0.9 to 16.7	Noise barrier E-6: 8 feet tall, 3,110 feet long	0	0
36th Ave N to 38th Ave N	Robbinsdale	SB	4	0	0.1 to 9.0	Noise barrier W-5: 6 feet tall, 650 feet long	0	0
38th Ave N to 40½ Ave N	Robbinsdale	NB	3	20	0 to 16.6	Noise barrier E-6: 8 feet tall, 3,110 feet long	0	0
38th Ave N to 40th Ave N	Robbinsdale	SB	20	5	0 to 11.1	Noise barrier W-7: 6 feet tall, 1,850 feet long and interior testing to determine mitigation measure	0	0
40½ Ave N to 42nd Ave N	Robbinsdale	NB	5	2	0.1 to 11.6	Wayside device and noise barrier E-6: 8 feet tall, 3,110 feet long	0	0
40th Ave N to 42nd Ave N	Robbinsdale	SB	13	2	0 to 7.3	Wayside device and interior testing to determine mitigation measure[5]	0	0
42nd Ave N to MN-100	Robbinsdale	NB	2	0	0 to 3.4	Interior testing to determine mitigation measure[5]	0	0
42nd Ave N to MN-100	Robbinsdale	SB	2	1	0 to 4.6	Wayside device	0	0

Table 5.6-7. Residential Noise Mitigation Measures after Implementation of Quiet Zones

Location	City	Side of Track	Type and Number of Impacts without Mitigation[1]		Noise Level Increase[2] (dB)	Proposed Mitigation Measure[3]	Residual Impacts with Mitigation	
			Moderate	Severe			Moderate	Severe
MN-100 to 47th Ave N	Robbinsdale	NB	10	1	0.1 to 5.0	Wayside device and noise barrier E-10: 10 feet tall, 1,300 feet long and interior testing to determine mitigation measure	0	0
MN-100 to 47th Ave N	Robbinsdale	SB	8	0	0 to 3.6	Wayside device and interior testing to determine mitigation measure[5]	0	0
47th Ave N to freight tracks	Crystal	NB	11	31	0 to 18.5	Wayside device, noise barrier E-10: 10 feet tall, 1,300 feet long, noise barrier E-11: 10 feet tall, 1,100 feet long, and interior testing to determine mitigation measure	0	0
47th Ave N to freight tracks	Crystal	SB	0	0	0.1 to 1.8	None required	0	0
56th Ave N to 60th Ave N	Crystal	NB	0	0	0 to 0.4	None required	0	0
56th Ave N to 60th Ave N	Crystal	SB	0	0	0 to 4.6	None required	0	0
60th Ave N to 63rd Ave N	Crystal	NB	0	0	0 to 0.7	None required	0	0
60th Ave N to 63rd Ave N	Crystal	SB	0	0	0 to 1.1	None required	0	0
63rd Ave N to I-694	Brooklyn Park	NB	0	0	0 to 0.3	None required	0	0
I-694 to 73rd Ave N	Brooklyn Park	NB	0	0	0 to 0.6	None required	0	0
I-694 to 73rd Ave N	Brooklyn Park	SB	0	0	0 to 0.7	None required	0	0
73rd Ave N to Brooklyn Blvd	Brooklyn Park	NB	4	0	0 to 2.4	None[4]	N/A	N/A

Table 5.6-7. Residential Noise Mitigation Measures after Implementation of Quiet Zones

Location	City	Side of Track	Type and Number of Impacts without Mitigation[1]		Noise Level Increase[2] (dB)	Proposed Mitigation Measure[3]	Residual Impacts with Mitigation	
			Moderate	Severe			Moderate	Severe
Shingle Creek to 85th Ave N	Brooklyn Park	SB	5	0 (0)	0 to 2.9	None[4]	N/A	N/A
89th Ave N to 93rd Ave N	Brooklyn Park	NB	5	0 (0)	0.3 to 0.8	None[4]	N/A	N/A

Source: CSA, 2015

[1] The number of impacts without mitigation reflects the implementation of Quiet Zones. Quiet Zones are locations, at least one-half mile in length, where the routine sounding of horns has been eliminated because of safety improvements at at-grade crossings, including modifications to the streets, raised median barriers, four quadrant gates, and other improvements designed and implemented by the proposed BLRT Extension project and consistent with Quiet Zone readiness. Horns are sounded in emergency situations at these locations. Municipalities must apply to FRA for approval of Quiet Zones.

[2] The reported noise level increases are the range of increases in noise levels (without mitigation) due to the project for each location.

[3] If the proposed noise mitigation does not meet the reasonableness criteria as defined in the Regional Transitways Guidelines (March 2016) (see **Appendix F**), or if the property owner(s) does not approve sound insulation, the proposed BLRT Extension project would result in additional residual noise impacts.

[4] The moderate impacts at these locations do not meet the threshold for mitigation as defined by the Regional Transitways Guidelines (March 2016) (see **Appendix F**).

[5] The Council has determined that a noise barrier at these locations would not meet the reasonableness criteria for noise mitigation as defined in the Regional Transitways Guidelines (March 2016); specifically, a noise barrier at these locations does not meet cost-effectiveness criteria. As such, no noise barrier will be constructed to mitigate impacts to these residences. Final determination of mitigation measures for these residences will be assessed with on-site testing to determine if the residences meet the interior noise level criteria. Based on the results, the Council will identify the noise mitigation to be implemented for these residences during Engineering and once on-site measurements are completed. If an exceedance of interior noise level is identified at these locations, the Council will work with property owners on applicable mitigation. This could include implementation of sound insulation, which would still require approval by the property owner(s).

N/A = not applicable

Short-Term Mitigation Measures. The primary means of mitigating noise from construction activities is to require the contractor to prepare a detailed Noise Control Plan. A noise control engineer or acoustician will work with the contractor to prepare a Noise Control Plan in conjunction with the contractor's specific equipment and methods of construction. Key elements of a Noise Control Plan include:

- Contractor's specific equipment types
- Schedule and methods of construction
- Maximum noise limits for each piece of equipment with certification testing
- Prohibitions on certain types of equipment and processes during the nighttime hours without local agency coordination and approved variances
- Identification of specific sensitive sites near construction sites
- Methods for projecting construction noise levels
- Implementation of noise-control measures where appropriate
- Methods for responding to community complaints

5.7 Vibration

This section describes the existing vibration in the study area and the long-term (operating-phase) and short-term (construction-phase) vibration impacts from the No-Build Alternative and the proposed BLRT Extension project. This section provides an overview of the regulatory context and methodology used for the analysis, an assessment of existing vibration measurements, a description of the expected vibration impacts, and a description of mitigation measures to implement with the proposed BLRT Extension project. A technical report has been prepared in support of this section (see **Appendix F**).

5.7.1 Regulatory Context and Methodology

5.7.1.1 Regulatory Context

This section describes the methodology used to assess predicted vibration impacts and to develop mitigation strategies. Vibration has been assessed in accordance with guidelines specified in FTA's *Transit Noise and Vibration Impact Assessment* guidance manual (FTA, 2006).

The FTA guidance manual is the primary source for the vibration assessment methodology. Vibration impacts were evaluated using the Detailed Vibration Assessment methodology in Chapter 11 of the FTA guidance manual (FTA, 2006).

5.7.1.2 Methodology

The vibration assessment methodology for assessing vibration impacts from LRT operations included the following steps:

1. Identify vibration-sensitive land uses in the study area using aerial photographs, GIS data, and field surveys, typically within 300 feet of the proposed BLRT Extension project (see **Section 5.7.3.1**).
2. Measure vibration-propagation characteristics of the soil in the study area near sensitive receptors (see **Section 5.7.3.2**).
3. Predict future project vibration levels from transit operations and information on speeds, headways, track type, and vehicle vibration characteristics. Details regarding the information used to predict future project vibration levels are provided in **Appendix F**.
4. Assess the impact of the proposed BLRT Extension project by comparing the projected future vibration levels with the FTA vibration impact criteria in Chapter 8 of the FTA guidance manual.
5. Recommend mitigation at locations where projected future vibration levels exceed the FTA impact criteria.

In addition, the Council conducted a construction vibration impact assessment using the methodology in Chapter 12 of the FTA guidance manual.

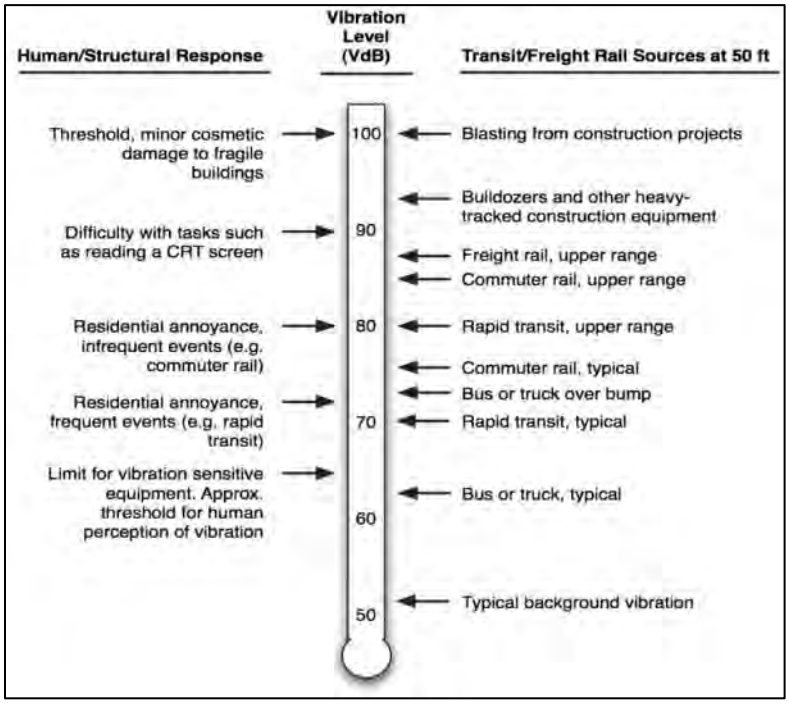
5.7.1.3 Understanding Vibration

Ground-borne vibration is the motion of the ground transmitted into a building that can be described in terms of displacement, velocity, or acceleration. Vibration velocity is used in transit and freight rail and is defined by the following:

- **Level.** Vibration is expressed in terms of vibration velocity level using vibration decibels (VdB) with a reference of 1 micro-inch per second. The level of vibration represents how much the ground is moving. The threshold of human perception to transit and freight rail vibration is about 65 VdB, and annoyance begins to occur for frequent events at vibration levels over 70 VdB.
- **Frequency.** Vibration frequency is expressed in Hz. Human response to vibration is typically from about 6 Hz to 200 Hz.
- **Time Pattern.** Environmental vibration changes all the time, and human response is roughly correlated to the number of vibration events during the day. The more events that occur, the more sensitive people are to the vibration.

Figure 5.7-1 illustrates typical ground-borne vibration levels for transit and freight projects as well as the corresponding human and structural responses to vibration.

Figure 5.7-1. Typical Vibration Levels from LRT and Freight Rail



Source: CSA, 2015

5.7.1.4 Vibration Criteria

The vibration impact criteria used for the proposed BLRT Extension project are based on the information in Chapter 8 of the FTA guidance manual. The criteria for a general vibration assessment are based on land use and train frequency, as shown in **Table 5.7-1**. Some buildings, such as concert halls, recording studios, and theaters, can have a higher sensitivity to vibration (or ground-borne noise) but do not fit into the three categories listed in **Table 5.7-1**. Because of the sensitivity of these buildings, special attention is paid to these buildings during the environmental assessment of a project. **Table 5.7-2** shows the FTA criteria for acceptable levels of vibration for several types of special buildings.

Tables 5.7-1 and 5.7-2 include additional criteria for ground-borne noise, which is a low-frequency noise that is radiated from the motion of room surfaces, such as walls and ceilings, in buildings due to ground-borne vibration. Ground-borne noise is defined in terms of dBA, which emphasizes middle and high frequencies, which are more audible to human ears. The criteria for ground-borne noise are much lower than for airborne noise to account for the low-frequency character of ground-borne noise; however, because airborne noise typically masks ground-borne noise for above-ground (at-grade or elevated) transit systems, ground-borne noise is assessed only for operations in tunnels, where airborne noise is not a factor, or at locations such as recording studios, which are well-insulated from airborne noise.

Table 5.7-1. Ground-Borne Vibration and Ground-Borne Noise Impact Criteria for General Assessment

Land Use Category	Ground-Borne Vibration Impact Levels (VdB re 1 micro-inch/sec)			Ground-Borne Noise Impact Levels (dBA re 20 micro-Pascals)		
	Frequent Events[1]	Occasional Events[2]	Infrequent Events[3]	Frequent Events[1]	Occasional Events[2]	Infrequent Events[3]
Category 1: Buildings where vibration would interfere with interior operations	65[4]	65[4]	65[4]	N/A[5]	N/A[5]	N/A[5]
Category 2: Residences and buildings where people normally sleep	72	75	80	35	38	43
Category 3: Institutional land uses with primarily daytime use	75	78	83	40	43	48

Source: FTA, 2006

[1] *Frequent events* is defined as more than 70 vibration events from the same source per day. Most rapid transit projects are in this category.

[2] *Occasional events* is defined as between 30 and 70 vibration events from the same source per day. Most commuter trunk lines have this many operations.

[3] *Infrequent events* is defined as fewer than 30 vibration events of the same kind per day. This category includes most commuter rail branch lines.

[4] This criterion limit is based on levels that are acceptable for most moderately sensitive equipment, such as optical microscopes. Vibration-sensitive manufacturing or research would require detailed evaluation to define the acceptable vibration levels. Ensuring lower vibration levels in a building often requires special design of the heating, ventilating, and air conditioning (HVAC) systems and stiffened floors.

[5] Vibration-sensitive equipment is generally not sensitive to ground-borne noise.

Table 5.7-2. Ground-Borne Vibration and Ground-Borne Noise Impact Criteria for Special Buildings

Type of Building or Room	Ground-Borne Vibration Impact Levels (VdB re 1 micro-inch/sec)		Ground-Borne Noise Impact Levels (dBA re 20 micro Pascals)	
	Frequent Events[1]	Occasional or Infrequent Events[2]	Frequent Events[1]	Occasional or Infrequent Events[2]
Concert halls	65	65	25	25
TV studios	65	65	25	25
Recording studios	65	65	25	25
Auditoriums	72	80	30	38
Theaters	72	80	35	43

Source: FTA, 2006

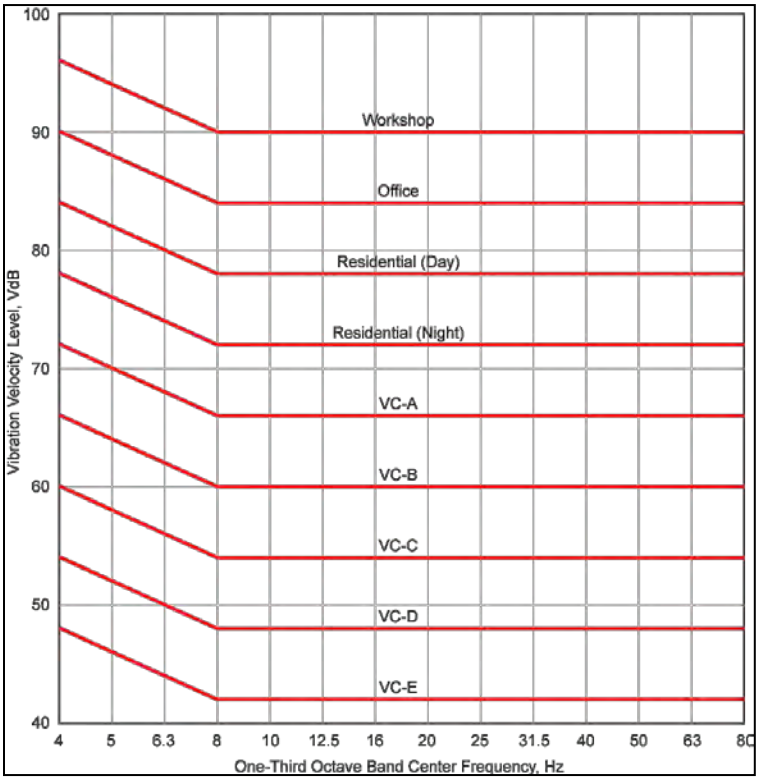
[1] *Frequent events* is defined as more than 70 vibration events per day. Most rapid transit projects are in this category.

[2] *Occasional or infrequent events* is defined as fewer than 70 vibration events per day. This category includes most commuter rail systems. If the building would rarely be occupied when the trains are operating, there is no need to consider impact. As an example, consider locating a commuter rail line next to a concert hall. If no commuter trains would operate after 7 p.m., it should be rare that the trains interfere with the use of the hall.

The criteria that the Council used to conduct a detailed vibration assessment are shown in **Figure 5.7-2**, and descriptions of the curves are shown in **Table 5.7-3**. The curves in **Figure 5.7-2** were applied to the projected vibration spectrum for the proposed BLRT Extension project. If the vibration level at any one frequency exceeds the criteria, there would be a vibration impact. Conversely, if the entire projected vibration spectrum of the proposed BLRT Extension project is below the curve, there would be no vibration impact.

For the proposed BLRT Extension project, the general vibration assessment criteria were used at special buildings. The detailed vibration assessment criteria were used to assess LRT ground-borne vibration.

Figure 5.7-2. Detailed Vibration Criteria



Source: FTA, 2006

Table 5.7-3. Interpretation of Vibration Criteria for Detailed Analysis

Criterion Curve (see Figure 5.7-2)	Max Level (VdB)[1]	Description of Use
Workshop	90	Distinctly feelable vibration. Appropriate to workshops and nonsensitive areas.
Office	84	Feelable vibration. Appropriate to offices and nonsensitive areas.
Residential day	78	Barely feelable vibration. Adequate for computer equipment and low-power optical microscopes (up to 20×).
Residential night, operating rooms	72	Vibration not feelable, but ground-borne noise might be audible inside quiet rooms. Suitable for medium-power optical microscopes (100×) and other equipment of low sensitivity.
VC-A	66	Adequate for medium- to high-power optical microscopes (400×), microbalances, optical balances, and similar specialized equipment.
VC-B	60	Adequate for high-power optical microscopes (1,000×) and inspection and lithography equipment to 3-micron line widths.
VC-C	54	Appropriate for most lithography and inspection equipment to 1-micron-detail size.
VC-D	48	Suitable in most instances for the most demanding equipment, including electron microscopes operating to the limits of their capability.
VC-E	42	The most demanding criterion for extremely vibration-sensitive equipment.

Source: FTA, 2006

[1] As measured in one-third-octave bands of frequency over the frequency range eight to 80 Hz.

5.7.2 Study Area

The study area for vibration is generally defined as properties within 300 feet of the proposed BLRT Extension project alignment.

5.7.3 Affected Environment

This section describes vibration-sensitive land uses and existing vibration measurements in the study area.

5.7.3.1 Vibration-Sensitive Land Uses

The Council identified vibration-sensitive land uses based on aerial photographs, project drawings, project outreach to businesses to identify sensitive uses within buildings, and a site survey. Information regarding vibration-sensitive land uses by city is provided in **Appendix F**.

5.7.3.2 Existing Vibration Measurements

The existing vibration measurements for the project were conducted during the Draft EIS phase of the project. Specific information regarding instrumentation, procedures, analysis methods, and measurement locations are available in the Draft EIS *Noise and Vibration Technical Report*. Detailed information regarding the vibration propagation measurement results are provided in the appendices of this report.

The vibration measurements conducted for the Draft EIS were used to characterize the response of the soil at locations in the proposed BLRT Extension project corridor. At each site, vibration propagation tests were conducted by impacting the ground with an instrumented weight and measuring the response of the soil and/or building foundations at various distances (line source transfer mobility). The results of the vibration propagation tests were combined with the force density (vehicle input force) to predict vibration levels from LRT operations at locations along the proposed BLRT Extension project. The locations of the six vibration measurement sites used for this Final EIS are shown in **Figure 5.6-3** in **Section 5.6**.

5.7.4 Environmental Consequences

This section identifies the long-term and short-term vibration impacts from the No-Build Alternative and the proposed BLRT Extension project. Long-term vibration impacts would be a result of the operation of light rail vehicles. Short-term vibration impacts are those that would be temporary and that would be associated with the proposed BLRT Extension project's construction activities.

5.7.4.1 Operating-Phase (Long-Term) Impacts

No-Build Alternative

There would be no operating-phase vibration impacts from the No-Build Alternative.

Proposed BLRT Extension Project

This section describes the long-term vibration impacts for the proposed BLRT Extension project. The Council conducted a detailed vibration analysis. Summaries of the analysis results are presented in **Tables 5.7-4 and 5.7-5** for residential and institutional (for example, church and school) land uses, respectively.

The tables include a tabulation of location information for each sensitive receptor group, the projections of future vibration levels, the impact criteria, and whether there would be vibration impacts. The tables also show the total number vibration impacts for each location, without mitigation measures.

As shown in **Table 5.7-4**, the proposed BLRT Extension project would cause 28 vibration impacts at residential receptors (homes and apartment buildings; for the locations of impacts, see **Figure 5.7-2** following the table). **Appendix F** summarizes each residential location that would experience vibration impacts.

Table 5.7-4. Vibration Impacts at Residential Land Uses

Location	City	Side of Track	Near Track Dist. (ft)	Speed (mph)	Project Vibration Levels (VdB)		Number of Impacts
					Project	FTA Impact Criterion	
I-94 to Humboldt Ave N	Minneapolis	NB	205	30	54	72	0
I-94 to Humboldt Ave N	Minneapolis	SB	170	30	55	72	0
Humboldt Ave N to Penn Ave N	Minneapolis	NB	100	40	58	72	0
Humboldt Ave N to Penn Ave N	Minneapolis	SB	190	40	55	72	0
Penn Ave N to Upton Ave N	Minneapolis	NB	110	35	48	72	0
Penn Ave N to BNSF freight tracks	Minneapolis	SB	155	40	46	72	0
Olson Memorial Hwy to Oak Park Ave N	Minneapolis	NB	35	35	58	72	0
Oak Park Ave N to Plymouth Ave N	Minneapolis	NB	60	55	49	72	0
Plymouth Ave N to 16th Ave N	Golden Valley	NB	265	45	43	72	0
16th Ave N to Golden Valley Rd	Golden Valley	NB	30	45	55	72	0
Golden Valley Rd to 26th Ave N	Golden Valley	NB	80	55	56	72	0
26th Ave N to 31½ Ave N	Robbinsdale	NB	90	55	45	72	0
31½ Ave N to 34th Ave N	Robbinsdale	NB	20	55	66	72	0
34th Ave N to 36th Ave N	Robbinsdale	NB	60	55	67	72	0
34th Ave N to 36th Ave N	Robbinsdale	SB	140	55	54	72	0
36th Ave N to 38th Ave N	Robbinsdale	NB	35	55	77	72	26
36th Ave N to 38th Ave N	Robbinsdale	SB	75	55	63	72	0

Table 5.7-4. Vibration Impacts at Residential Land Uses

Location	City	Side of Track	Near Track Dist. (ft)	Speed (mph)	Project Vibration Levels (VdB)		Number of Impacts
					Project	FTA Impact Criterion	
38th Ave N to 40½ Ave N	Robbinsdale	NB	35	55	76	72	1
38th Ave N to 40th Ave N	Robbinsdale	SB	70	45	64	72	0
40½ Ave N to 42nd Ave N	Robbinsdale	NB	90	45	60	72	0
40th Ave N to 42nd Ave N	Robbinsdale	SB	130	30	57	72	0
42nd Ave N to MN-100	Robbinsdale	NB	90	50	61	72	0
42nd Ave N to MN-100	Robbinsdale	SB	70	40	61	72	0
MN-100 to 47th Ave N	Robbinsdale	NB	120	55	68	72	0
MN-100 to 47th Ave N	Robbinsdale	SB	80	55	62	72	0
47th Ave N to freight tracks	Crystal	NB	35	55	72	72	1
47th Ave N to freight tracks	Crystal	SB	120	55	58	72	0
Freight tracks to 56th Ave N	Crystal	NB	735	40	55	72	0
Freight tracks to 56th Ave N	Crystal	SB	80	25	57	72	0
56th Ave N to 60th Ave N	Crystal	NB	695	30	51	72	0
56th Ave N to 60th Ave N	Crystal	SB	165	55	55	72	0
60th Ave N to 63rd Ave N	Crystal	NB	180	55	55	72	0
60th Ave N to 63rd Ave N	Crystal	SB	135	55	56	72	0
63rd Ave N to I-694	Brooklyn Park	NB	280	55	54	72	0
63rd Ave N to I-694	Brooklyn Park	SB	140	35	53	72	0
I-694 to 73rd Ave N	Brooklyn Park	NB	735	55	51	72	0
I-694 to 73rd Ave N	Brooklyn Park	SB	170	55	63	72	0
73rd Ave N to Brooklyn Blvd	Brooklyn Park	NB	75	35	57	72	0
Brooklyn Blvd to Shingle Creek	Brooklyn Park	NB	80	45	60	72	0
Shingle Creek to 85th Ave N	Brooklyn Park	SB	70	40	71	72	0
85th Ave N to 89th Ave N	Brooklyn Park	NB	85	45	59	72	0
89th Ave N to 93rd Ave N	Brooklyn Park	NB	70	45	62	72	0
						Total	**28**

Source: CSA, 2015

The vibration levels for each location are the highest levels projected for that location. Vibration projections at other receptors within each location are lower. The threshold of human perception to LRT vibration is about 65 VdB or less, and annoyance begins to occur for frequent events at vibration levels over 70 VdB.

Figure 5.7-3. Locations of Vibration Impacts

Source: CSA, 2015

As shown in **Table 5.7-5**, the proposed BLRT Extension project would not cause any vibration impacts at institutional land uses.

Table 5.7-5. Vibration Impacts at Institutional Land Uses

Location	City	Side of Track	Near Track Dist. (ft)	Speed (mph)	Project Vibration Levels (VdB)		Number of Impacts
					Project	FTA Impact Criterion	
Sumner Library	Minneapolis	NB	110	20	45	78	0
Wayman AME Church	Minneapolis	NB	135	30	46	78	0
Seed Academy	Minneapolis	NB	135	40	47	78	0
Summit Academy	Minneapolis	SB	225	20	41	78	0
Zion Baptist Church	Minneapolis	NB	185	40	55	78	0
Le Creche Early Childhood Center	Minneapolis	NB	135	40	47	78	0
The Family Partnership	Golden Valley	NB	55	35	46	78	0
The Chalet	Golden Valley	SB	925	20	38	78	0
Bethel World Outreach	Robbinsdale	NB	520	55	51	78	0
Elim Lutheran Church	Robbinsdale	NB	800	50	51	78	0
Sacred Heart Church	Robbinsdale	NB	300	35	53	78	0
Robbins Gallery	Robbinsdale	SB	110	20	53	78	0
Washburn McReavy Funeral Home	Crystal	NB	255	25	51	78	0
Masonic Lodge	Robbinsdale	NB	455	30	51	78	0
Redeemer Lutheran Church	Robbinsdale	SB	505	40	55	78	0
Doug Stanton Ministries	Crystal	SB	365	55	55	78	0
Crystal Medical Center	Crystal	NB	180	30	51	78	0
Little Folks Daycare	Crystal	SB	85	25	53	78	0
Prince of Peace Lutheran Church	Brooklyn Park	NB	385	35	39	78	0
Brooklyn Park Evangelical Free Church	Brooklyn Park	SB	145	45	52	78	0
North Hennepin Community College	Brooklyn Park	NB	75	20	56	78	0
Step by Step Montessori School	Brooklyn Park	SB	285	25	47	78	0
Berean Baptist Church	Brooklyn Park	SB	80	45	60	78	0
Ebenezer Community Church	Brooklyn Park	NB	135	20	49	78	0

Source: CSA, 2015.

The vibration levels for each location are the highest levels projected for that location. Vibration projections at other receptors within each location are lower. The threshold of human perception to LRT vibration is about 65 VdB or less, and annoyance begins to occur for frequent events at vibration levels over 70 VdB.

5.7.4.2 Construction-Phase (Short-Term) Impacts

No-Build Alternative

There would be no construction-phase vibration impacts from the No-Build Alternative.

Proposed BLRT Extension Project

Vibration related to construction activities would result from the operation of heavy equipment (pile driving, vibratory hammers, hoe rams, vibratory compaction, and loaded trucks) needed to construct bridges, retaining walls, roads, and park-and-ride facilities. Most limits on construction vibration are based on reducing the effects on nearby structures. Although construction vibrations are temporary, it is appropriate to assess the potential for human annoyance and damage.

Most of the buildings along the proposed BLRT Extension project alignment are typical engineered concrete and masonry, or reinforced-concrete, steel or timber construction. The Council used a vibration criterion of 98 VdB to assess the potential for damage impacts (for more information on construction vibration, see **Appendix F**) and a vibration criterion of 72 VdB to assess vibration annoyance from construction activities.

With the exception of impact pile driving, the potential for damage would be limited to buildings within 20 feet of construction activities. The distance for the potential for damage to buildings from impact pile driving is up to 40 feet. For more information about the construction vibration impact assessment, see **Appendix F**.

5.7.5 Avoidance, Minimization, and/or Mitigation Measures

This section describes the measures the Council will implement to mitigate the proposed BLRT Extension project's long-term and short-term vibration impacts. Vibration impacts that exceed the FTA criteria are considered significant and should be mitigated unless there are no feasible or practical means to do so. Vibration mitigation is primarily applied at the source, generally the track structure, and depends on the frequency content of the vibration and any resonances of the materials. **Appendix F** describes the most common vibration mitigation measures.

Long-Term Mitigation Measures. **Table 5.7-6** presents the mitigation measures for the operating-phase (long-term) vibration impacts. Ballast mats or the equivalent would eliminate the vibration impacts at all locations. Detailed descriptions of the vibration mitigation measures are provided in **Appendix F**.

Table 5.7-6. Residential Vibration Mitigation Measures

Location	City	Number of Impacts without Mitigation	Proposed Mitigation Measure	Number of Residual Impacts with Mitigation
36th Ave N to 38th Ave N	Robbinsdale	26	700-foot ballast mat	0
38th Ave N to 40½ Ave N	Robbinsdale	1	300-foot ballast mat	0
47th Ave N to freight tracks	Crystal	1	300-foot ballast mat	0
	Total	**28**	**1,300-foot ballast mat**	**0**

Source: CSA, 2015

Short-Term Mitigation Measures. The most effective methods for reducing the impact from construction vibration are to limit the use of high-vibration activities, such as impact pile driving and vibratory rolling, and to include vibration limits in the construction specifications. To mitigate vibration impacts from construction activities, the following measures will be applied, where feasible:

- **Limit Construction Hours.** Limit high-vibration activities at night.
- **Construction Specifications.** Include limits on vibration in the construction specifications, especially at locations where high-vibration activities would occur.
- **Alternative Construction Methods.** Minimize the use of impact and vibratory equipment, where possible and appropriate.
- **Truck Routes.** Use truck haul routes that minimize exposure to sensitive receptors and minimize damage to roadway surfaces, where appropriate.
- **Pre-construction Surveys.** Perform pre-construction surveys to document the existing conditions of the structures in the vicinity of sites where high-vibration construction activities would be performed.
- **Vibration Monitoring.** If a construction activity could exceed the damage criteria at any building, the contractor will be required to conduct vibration monitoring. If the vibration exceeds the limit, the activity must be modified or terminated.

5.8 Biological Environment (Wildlife Habitat and Endangered Species)

This section describes the preferred habitats of rare, threatened, and endangered species in the study area and the expected impacts to plants and animals and their habitat from the No-Build Alternative and the proposed BLRT Extension project. The information in this section is based on the information in the *Biological Environment Technical Report* (Council, 2016e). The analysis completed for this section was conducted in coordination with the US Fish and Wildlife Service (USFWS) and DNR regarding the presence of, and potential impacts to, threatened or endangered species and other biological resources in the study area.

This section is divided into four parts: endangered and threatened species, wildlife habitat, migratory birds, and noxious weeds.

5.8.1 Regulatory Context and Methodology

5.8.1.1 Endangered and Threatened Species

Section 7 of the Endangered Species Act of 1973 (16 USC §§ 1531–1544) requires that all federal agencies consider and avoid, if possible, adverse impacts to federally listed threatened or endangered species or their critical habitats that could result from their direct, regulatory, or funding actions. USFWS is responsible for compiling and maintaining the federal list of threatened and endangered species. Section 7 of the Endangered Species Act also prohibits the taking of any federally listed species by any person without prior authorization. The term *taking* is broadly defined at the federal level and explicitly extends to any habitat modification that could significantly impair the ability of that species to feed, reproduce, or otherwise survive.

Potential impacts to federally listed species require coordination with USFWS in a Section 7 consultation. The result of the Section 7 consultation is one of the following determinations for each species evaluated:

- **No Effect.** No impacts, whether positive or negative, on the species.
- **May Affect, Not Likely to Adversely Affect.** Any impacts would be beneficial, insignificant, or discountable.
- **May Affect, Likely to Adversely Affect.** Any impacts would be negative and beyond an insignificant or discountable level.

Minnesota's endangered species law (Minn. Stat., Section 84.0895) and associated rules (Minnesota Rules 6212.1800–6212.2300) regulate the taking, importation, transportation, and sale of state endangered or threatened species. DNR administers the state law and manages the listing of state rare, threatened, and endangered species. Species listed as Special Concern by DNR have no protections afforded to them.

The Council reviewed the USFWS Endangered Species Program website (www.fws.gov/endangered) to determine whether any federally listed threatened or endangered species have been documented or have critical habitat in Hennepin County or the study area. Additionally, project biologists

initiated coordination with USFWS concerning federally listed species or designated critical habitat in the study area.

Northern long-eared bats (NLEB; listed as federally threatened in May 2015) might use forested habitat statewide (including in the study area) as summer roosting habitat. The Interim 4(d) Guidelines, published by USFWS, summarize the habitat requirements of NLEBs and measures to reduce impacts to this listed species. Additionally, bald eagles (recently delisted from the federal Endangered Species Act) have been known to nest near the proposed BLRT Extension project alignment. Though delisted, bald eagles are still monitored and are still protected under other federal laws, including the Bald and Golden Eagle Protection Act.

The Council evaluated the proposed BLRT Extension project LOD, including LRT tracks, stations, TPSS locations and auxiliary project infrastructure, and the OMF site for preferred habitats of rare species in coordination with state and local agencies and in accordance with Minnesota's endangered species law.

The Council used the DNR Natural Heritage Information System (NHIS) Database to identify federal and state listed species, rare plant communities, animal aggregation areas (such as colonial waterbird nesting areas), and other features known to be present in and near the study area. Per the stipulations of the NHIS program, known locations of listed species and other rare features cannot be specifically described or depicted in public documents. Rather, locations of rare species and features can be described and depicted only in a general manner. **Section 5.8.3** discusses specific rare species and features that have been documented in and near the study area.

5.8.1.2 Wildlife Habitat

Wildlife species that inhabit terrestrial or aquatic habitat in the study area are generalist species adapted to urban conditions. These species are generally more tolerant of human presence and activities, including traffic (pedestrian, rail, and vehicle) and have demonstrated by their presence that they adapt readily to the human environment.

Notable Terrestrial Habitats. The Council identified notable terrestrial habitats in the study area by collecting data from the Minnesota Land Cover Classification System (MLCCS) and field visits. The Council identified MLCCS forest polygons within about 0.25 mile of the proposed BLRT Extension project alignment. The Council compared these polygons to recent (2013) aerial photographs to identify areas where forest had been cleared after the MLCCS data were gathered and trimmed the MLCCS polygons accordingly. The Council then classified large, contiguously forested areas as notable terrestrial habitats.

Notable Aquatic Habitats. The notable aquatic habitats identified in the study area provide refuge for a variety of frogs, toads, turtles, snakes, waterfowl, and songbirds. The total acreage of notable aquatic habitat in the study area is about 49 acres. Notable aquatic habitats in the study area were identified by the Council through fieldwork conducted in the spring and summer of 2015 using standard wetland identification criteria (see **Section 5.3**).

5.8.1.3 Migratory Birds

The Migratory Bird Treaty Act (MBTA) of 1918 (16 USC §§ 703–712) governs the taking, killing, possession, transportation, and importation of migratory birds including eggs, parts, and nests. Such actions are prohibited unless authorized under a valid permit. The MBTA was enacted as a way to protect migratory bird populations from over-harvesting. This law applies to migratory birds native to the United States and its territories. It does not apply to non-native migratory birds or resident species that do not migrate on a seasonal basis.

USFWS oversees and enforces the MBTA and issues depredation permits for destroying active nests of species covered under the MBTA. A depredation permit is not needed for destroying nests that are not active. DNR also has permit authority over destroying active nests.

Bald eagles are native migratory birds protected under the MBTA and by the Bald Eagle and Golden Eagle Protection Act of 1940 (16 USC §§ 668–668d, 54 Stat. 250), which prohibits the taking, possession, or commerce of these species.

5.8.1.4 Noxious Weeds

Noxious weed species are regulated by federal and state laws. The Federal Noxious Weed Act, Title 7, Chapter 61, Section 2803, regulates federally listed noxious weeds through the US Department of Agriculture. Under this rule, the sale, purchase, exchange, or receipt of federal noxious weeds is illegal.

The Minnesota Noxious Weed Law (Minn. Stat., Sections 18.75–18.91) defines a *noxious weed* as an annual, biennial, or perennial plant that the Commissioner of Agriculture designates to be injurious to public health, the environment, public roads, crops, livestock, or other property. Prohibited noxious weeds must be controlled or eradicated as required in Minn. Stat., Section 18.78.

The Council identified noxious weed concentrations in the study area during fieldwork in the spring and fall of 2015. The Council used the Minnesota and Federal Noxious and Prohibited Weed List (updated May 15, 2014) to verify the status of observed noxious weeds.

5.8.2 Study Area

The study area for rare, threatened, and endangered species and other features included in the DNR NHIS Database is defined as a 1-mile buffer around the LOD of the proposed BLRT Extension project and associated facilities.

5.8.3 Affected Environment

5.8.3.1 Endangered and Threatened Species

The Council reviewed the DNR NHIS Database, which includes state and federally listed species, and coordinated with USFWS staff. This research revealed that three federally listed species or their habitat are known to be present in the study area. These species are the NLEB, the bald eagle (delisted though still monitored), and the dwarf trout lily. These federally listed species, as well as

their status, habitat requirements, and generalized locations, are described below and summarized in **Table 5.8-1**.

Northern Long-Eared Bat (*Myotis septentrionalis*). Forested areas in the study area provide summer roosting habitat for NLEBs (federally threatened). Therefore, this species is discussed further in **Section 5.8**.

Bald Eagle (*Haliaeetus leucocephalus*). Bald eagles (delisted though still monitored) have been documented to nest about 1 mile east of the proposed BLRT Extension project and associated facilities. Therefore, suitable nesting habitat may be present in the study area and nest locations may have changed with time. Therefore, bald eagles are discussed further in **Section 5.8**.

Dwarf Trout Lily (*Erythronium propullans*). Dwarf trout lilies have been documented in TWRP southwest of the proposed BLRT Extension project and associated facilities (south of Olson Memorial Highway). However, this documented population of dwarf trout lilies was transplanted to the Eloise Butler Wildflower Sanctuary (part of Theodore Wirth Park about ½ to ¾ mile southwest of the proposed BLRT Extension project) early in the 20th century from a population in southern Minnesota. Dwarf trout lilies require rich maple basswood forest and associated floodplain dominated by elm and cottonwood. Forested habitats in the study area are highly disturbed and are not suitable for dwarf trout lilies. Because of the disturbed habitat, this rare species is not likely to be present in the study area; therefore, it is not discussed further in **Section 5.8**.

Table 5.8-1. Federally Listed Species Documented in the Study Area

Species	Federal Status	Notes
Northern long-eared bat (*Myotis septenrtionalis*)	Threatened	Listed per the Endangered Species Act in May 2015. Forested areas throughout Minnesota could be used for summer roosting habitat.
Bald eagle (*Haliaeetus leucocephalus*)	Watchlist	Delisted from the federal list of threatened and endangered species; population is still monitored. Documented nest about 1 mile east of the proposed BLRT Extension project.
Dwarf trout lily (*Erythronium propullans*)	Endangered	Rediscovered in 2005 in TWRP (south of Olson Memorial Highway) southwest of the proposed BLRT Extension project alignment.

Source: DNR NHIS Database, Licensing Agreement 722_2014

State Special Concern and State Watchlist Species and Other Rare Features

The Council reviewed the DNR NHIS Database, which provides information about Minnesota's Special Concern and State Watchlist plants and animals, native plant communities, and other sensitive rare natural resource features. Species of State Special Concern and species on the State Watchlist have no specific legal protections under state endangered species law. Similarly, inventoried native plant communities have no specific legal protection. Other rare natural resource features could include colonial waterbird nesting areas; for example, a heron or cormorant rookery. Colonial waterbirds are not specifically protected under state endangered species law, but they are federally protected under the MBTA. These rare species, as well as their status, habitat requirements, and general locations, are described below and summarized in **Table 5.8-2**.

Long-Bearded Hawkweed (*Heiracеum longipilum*). Long-bearded hawkweed (State Watchlist) could be present in dry old-field habitat north of TH 610. However, it is not a state-listed species, so it is not discussed further in **Section 5.8**.

Water Willow (*Decodon verticillatus*). Water willow (State Special Concern) is not likely present in the study area, and it is not a state-listed species; therefore, it is not discussed further in **Section 5.8**.

Least Darter (*Etheostoma microperca*). Least darters (State Special Concern) are not likely present in the study area, and it is not a state-listed species; therefore, this species is not discussed further in **Section 5.8**.

Hooded Warbler (*Setophaga citrina*). Hooded warblers (State Special Concern) could be present in the study area. However, it is not a state-listed species, so it is not discussed further in **Section 5.8**.

Bullfrog (*Lithobates catesbeiana*). Bullfrogs (State Watchlist) could be present in the study area. However, it is not a state-listed species, so it is not discussed further in **Section 5.8**.

Peregrine Falcon (*Falco peregrinus*). Peregrine falcons (State Special Concern) are not likely present in the study area and it is not a state-listed species, so it is not discussed further in **Section 5.8**.

Table 5.8-2. State-Listed and Special-Concern Species Documented in the Study Area

Species	State Status	Notes
Long-bearded hawkweed (*Hieracium longipilum*)	State Watchlist	Known from two dry prairie/old-field locations north and east of the northern end of the study area.
Water willow (*Decodon verticillatus*)	Special Concern	Observed in the 1940s and 1950s in two lakes in Robbinsdale outside (east) of the study area.
Least darter (*Etheostoma microperca*)	Special Concern	Observed in 1931 in a lake in Robbinsdale outside (east) of the study area.
Hooded warbler (*Setophaga citrina*)	Special Concern	Observed during the breeding season in 1979 in TWRP.
Bullfrog (*Lithobates catesbeianus*)	State Watchlist	Observed in 2003, 2008, and 2011 in a shallow pond connected to Bassett Creek.
Peregrine falcon (*Falco peregrinus*)	Special Concern	Observed nesting in 2000, 2003, and 2011 in downtown Minneapolis on several skyscrapers.

Source: DNR NHIS Database, Licensing Agreement 722_2014

Other rare features documented in the DNR NHIS Database that are present in the study area are described below and summarized in **Table 5.8-3**.

Colonial Waterbird Nesting Areas. Two colonial waterbird nesting areas have been documented west and east of the study area. Colonial waterbird nesting areas are not currently present in the study area; however, rookery locations do change over time, so locations would be monitored. Locations of colonial waterbird nesting areas are not discussed further in **Section 5.8**. Rookeries, typically occupied by great blue herons and double-crested cormorants, are quite obvious when

active, so rookery locations would be monitored throughout the project planning and construction phases.

Tamarack Swamp (Southern) Type. A tamarack swamp (southern) type has been documented in the DNR NHIS Database in part of TWRP southwest of the study area. The Council also concludes that the tamarack swamp identified in the NHIS Database is not located in the study area; therefore, it is not discussed further in **Section 5.8**.

Table 5.8-3. Other Elements Documented in the Study Area

Element	State Status	Notes
Colonial waterbird nesting area	Tracked by DNR Natural Heritage Program	Two locations observed in 1997, 1998, and 2010 outside (east and west) of the study area.
Tamarack swamp (southern) type	Tracked by DNR Natural Heritage Program	Observed in 1998 in TWRP outside (southwest) of the study area.

Source: DNR NHIS Database, Licensing Agreement 722_2014

State Threatened or Endangered Species

The Council reviewed the DNR NHIS Database, which provides information about Minnesota's threatened and endangered species. The threatened or endangered species known to be present in the study area, as well as their status, habitat requirements, and general locations, are summarized below and in **Table 5.8-4**.

Valerian (*Valerian edulis* var. *ciliata*). Valerian (State Threatened), last observed in 1891 near but outside the study area, is not likely present; therefore, it is not discussed further in **Section 5.8**.

Blanding's Turtle (*Emydoidea blandingii*). Blanding's turtles (State Threatened) could be present in the study area. Therefore, this species is discussed further in **Section 5.8**.

Table 5.8-4. State Threatened or Endangered Species Documented in the Study Area

Species	State Status	Notes
Valerian (*Valeriana edulis* var. *ciliata*)	Threatened	Last observed in 1891 outside (southwest) of the study area.
Blanding's turtle (*Emydoidea blandingii*)	Threatened	A dead female Blanding's turtle was observed in 2000 on Olson Memorial Highway near TWRP.

Source: DNR NHIS Database, Licensing Agreement 722_2014

5.8.3.2 Wildlife Habitat

General Habitat. The proposed BLRT Extension project is proposed to be constructed mainly in areas that have been previously disturbed or developed with impervious surfaces and buildings. However, the proposed BLRT Extension project and associated facilities would affect aquatic and terrestrial wildlife habitat. The size and quality of these natural areas or open spaces determines the likelihood of their supporting terrestrial and aquatic wildlife. (The following section discusses notable terrestrial and aquatic habitats.)

Generally, the study area is characterized as urbanized from downtown Minneapolis west and north to TH 610 and as urbanizing rural north of TH 610. The portion of the study area from downtown Minneapolis westward along Olson Memorial Highway into TWRP is highly urbanized with no natural habitat types present.

The large central portion of the study area from Olson Memorial Highway to about 36th Avenue North (in the cities of Minneapolis, Golden Valley, and Robbinsdale) is characterized by abundant parkland with a mosaic of forested habitat types and aquatic resources.

The portion of the study area from 36th Avenue North to TH 610 (in Robbinsdale, Crystal, and Brooklyn Park) is highly urbanized. Land north of TH 610 is a mosaic of agricultural fields, abandoned old fields, and landscaped corporate campuses.

Habitat in the study area is highly disturbed as a result of urbanization, historical road and railroad ditch and embankment work, dumping of concrete rubble, and historical vegetation clearing. Much of the forested habitat in the study area is young to submature second-growth disturbed deciduous forest. Several small, scattered areas of parkland near the study area have been recently been cleared of forest and planted with a prairie seed mix.

Vegetated open land (forest land, shrubland, and forb and grassland), such as the parkland in the study area, provides important loafing and feeding habitat for migratory songbirds. Songbirds might also nest in these disturbed habitats, but, given the fragmented condition of the habitat and the fact that invasive species survive better in a fragmented habitat, many of the nests are taken over by invasive species such as brown-headed cowbirds and other aggressive species.

Disturbed habitats in the study area provide suitable conditions for generalist wildlife species adapted to urban conditions. Generalist mammal species include white-tailed deer, raccoons, opossums, grey squirrels, and chipmunks. Common generalist bird species that are well-adapted to these conditions are robins, cardinals, blue jays, crows, brown-headed cowbirds, grackles, starlings, and English sparrows. Disturbed aquatic habitat in and near the study area supports a variety of common generalist amphibian species, such as frogs and toads, and reptiles, such as turtles and snakes.

Notable Terrestrial and Aquatic Habitats. Ten forest complexes, containing about 269 acres of notable terrestrial habitat, were identified in the study area. Four areas of notable aquatic habitat, containing about 49 acres, were identified in the study area (**Table 5.8-5**). The field data that the Council collected during 2015 verified the disturbed nature of habitats in the study area.

Table 5.8-5. Total Extent of Notable Terrestrial and Aquatic Habitats in the Study Area

Notable Habitat Type	Total Size (acres)
Terrestrial	269 acres
Aquatic	49 acres

Sources: MLCCS; field data from Council (2015)

The notable aquatic habitats summarized above in **Table 5.8-5** provide refuge for a variety of frogs, toads, turtles, snakes, and birds. Additionally, the notable terrestrial habitats summarized in the table could provide summer roosting habitat for NLEBs, a federally threatened species.

The appended *Biological Environment Technical Report* (Council, 2016e) (**Appendix F**) provides additional information about notable terrestrial and aquatic habitats.

5.8.3.3 Migratory Birds

A large number of migratory bird species are covered under the MBTA. These species might pass through or nest in or near the study area as part of their seasonal migrations. Some migratory bird species might nest in vegetated habitats, and others, such as barn swallows and cliff swallows, have adapted to building mud nests under bridges and other human-made structures.

The Council examined bridges and structures during the summer of 2015 for the presence of barn and cliff swallows and nests. Several nests were observed on the underside of bridges in the study area; however, the number of nests was low. One nest (on Plymouth Avenue Bridge) was evidently occupied and being guarded by a swallow. **Table 5.8-6** summarizes swallow nest locations and characteristics in the study area.

Table 5.8-6. Observed Swallow Nests on Bridge Structures in the Study Area

Bridge	Number of Nests Observed	Notes
Golden Valley Road bridge	2	Bridge observed on June 10, 2015. No swallows were present.
Theodore Wirth Parkway bridge	0	Bridge observed on June 10, 2015. No nests or swallows were present.
Plymouth Avenue bridge	1	Bridge observed on June 10, 2015. Swallow observed sitting on electrical conduit next to nest.
36th Avenue bridge	0	Bridge observed on June 10, 2015. No nests or swallows were present.

Source: Field data from Council (2015)

5.8.3.4 Noxious Weeds

The Council reviewed the Minnesota and Federal Noxious and Prohibited Weed List (updated May 15, 2014) to determine the status of invasive species encountered during fieldwork in the study area in the spring and summer of 2015. **Table 5.8-7** summarizes common noxious plant species, their status, and general locations observed during fieldwork.

Table 5.8-7. Noxious Plant Species in the Study Area

Plant Species	Noxious Status[1]	Notes
Garlic mustard (*Alliaria petiolata*)	RN	Ubiquitous in forested plant communities throughout the study area.
Spotted knapweed (*Centaurea stoebe* ssp. *micranthos*)	SN	Common on railroad ballast and adjacent dry ditches.
Canada thistle (*Cirsium arvense*)	SN	Common throughout the study area.
Leafy spurge (*Euphorbia esula*)	SN	Common on railroad ballast and adjacent dry ditches.
Wild parsnip (*Pastinaca sativa*)	SN	Common on disturbed embankments throughout the study area.
Japanese knotweed (*Polygonum cuspidatum*)	SN	Observed in highly disturbed forest.
European buckthorn (*Rhamnus cathartica*)	RN	Ubiquitous in the herbaceous, shrub, and tree strata of forested areas throughout the study area.
Poison ivy (*Toxicodendron radicans*)	SN	Common in vegetated areas throughout the study area.

Sources: Council field data (2015); Minnesota and Federal Noxious and Prohibited Weed List (updated May 15, 2014)
[1] RN = restricted noxious weed, SN = state noxious weed

5.8.4 Environmental Consequences

5.8.4.1 Operating-Phase (Long-Term) Impacts

No-Build Alternative

There would be no operating-phase impacts to biological resources from the No-Build Alternative.

Proposed BLRT Extension Project

Endangered and Threatened Species

Forest complexes in the study area could provide suitable summer roosting habitat for NLEBs, a federally threatened species. Table 5.8-8 summarizes the total extent of and total impacts to forest complexes in the study area.

Table 5.8-8. Total Extent and Total Impacts to Notable Terrestrial and Aquatic Habitats in the Study Area

Notable Habitat Type	Total Extent (acres)	Total Impacts (acres)
Terrestrial (forest complexes)	269	**17.9**
Aquatic	49	**4.33**

Sources: MLCCS; recent (2013) aerial photographs; Council field data (2015)

Wildlife Habitat

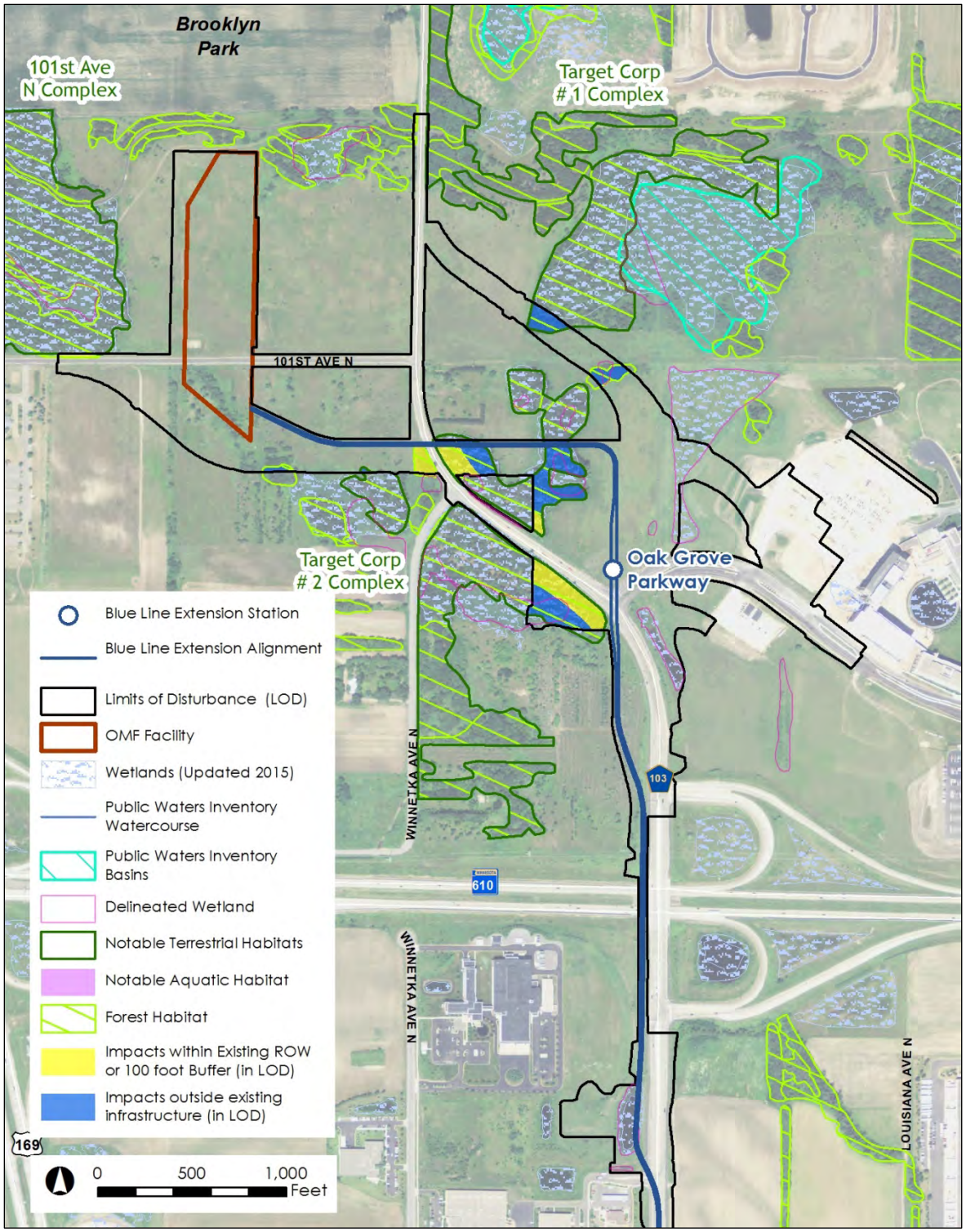
Because of the urban setting of the proposed BLRT Extension project, the wildlife that inhabits these areas are generalist species adapted to urban conditions. These species are generally more tolerant of human presence and activities, including traffic (pedestrian, rail, and vehicle) and have demonstrated by their presence that they adapt readily to the human environment. **Table 5.8-8** above lists the total impacts to notable terrestrial and aquatic habitats; these impacts are shown in **Figure 5.8-1 through Figure 5.8-5**.

The proposed BLRT Extension project could restrict the crossing of the rail corridor by wildlife compared to conditions with the existing transportation infrastructure (roads and freight rail tracks). The proposed station areas, which would generally be less than 600 feet long, could include barriers to prevent people from crossing the tracks for limited distances. The proposed corridor-protection features between the freight rail and light rail tracks include segments of wall and retained embankment that could impede the movement of wildlife. However, these segments would not be continuous along the BNSF rail corridor, and wildlife would be able to cross unimpeded at multiple locations.

Migratory Birds

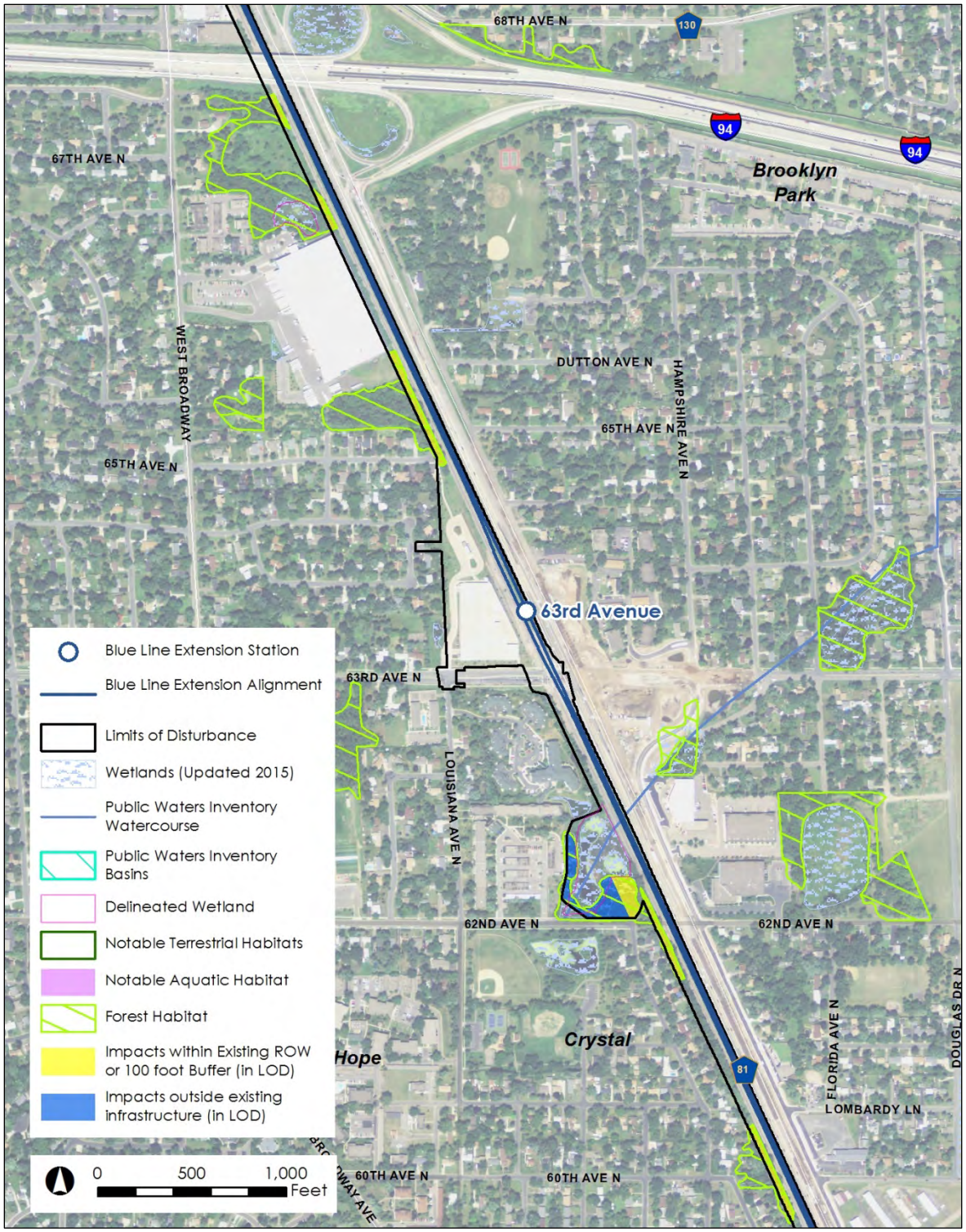
Impacts to migratory birds would be minor and limited to the loss of habitat within the LOD of the proposed BLRT Extension project.

Figure 5.8-1. Biological Environment in the Study Area (1 of 5)



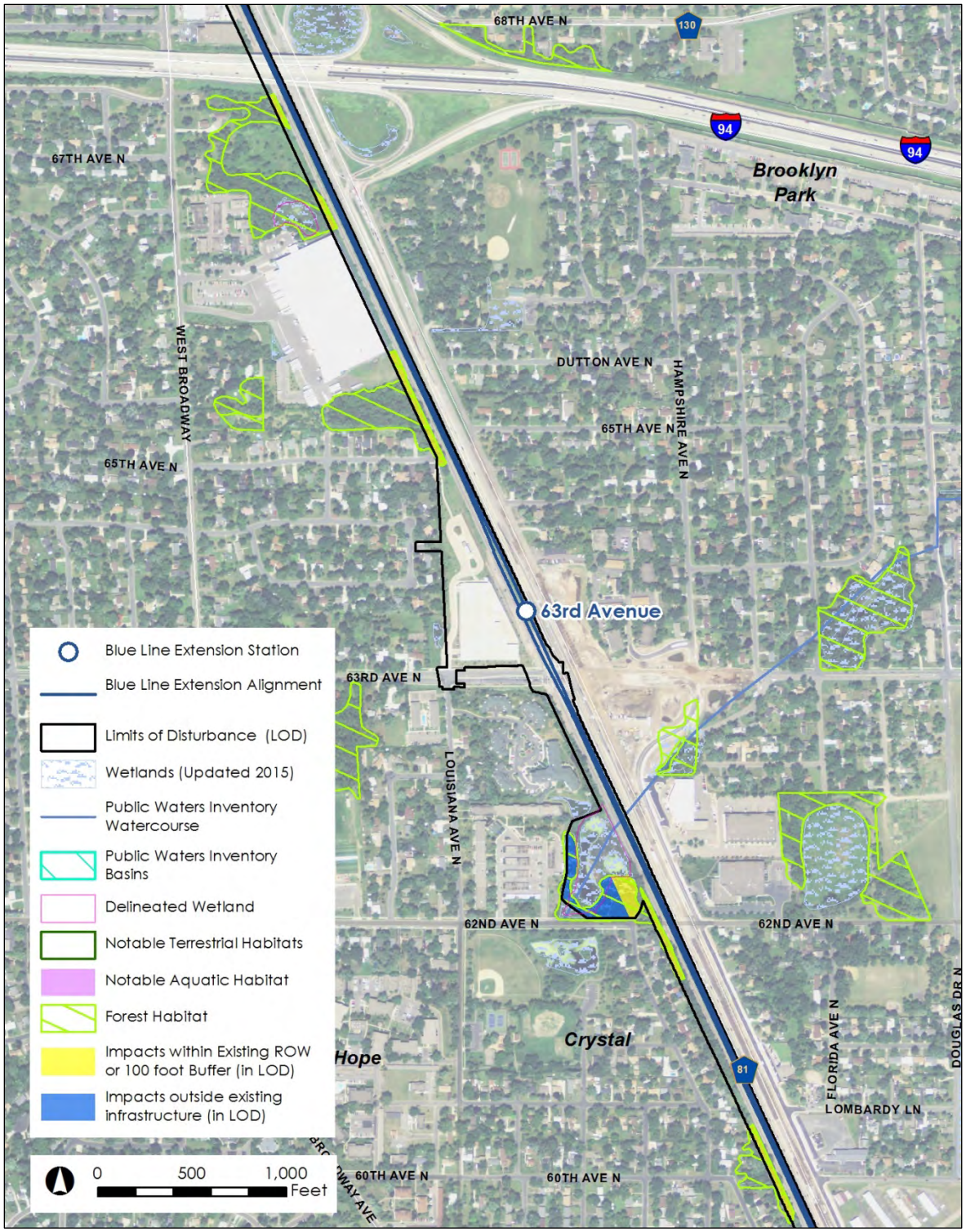
Sources: Aerial: Minnesota Geospatial Information Office, 2010; Wildlife Habitat: MLCCS (DNR), and field data (Council, 2015)

Figure 5.8-2. Biological Environment in the Study Area (2 of 5)



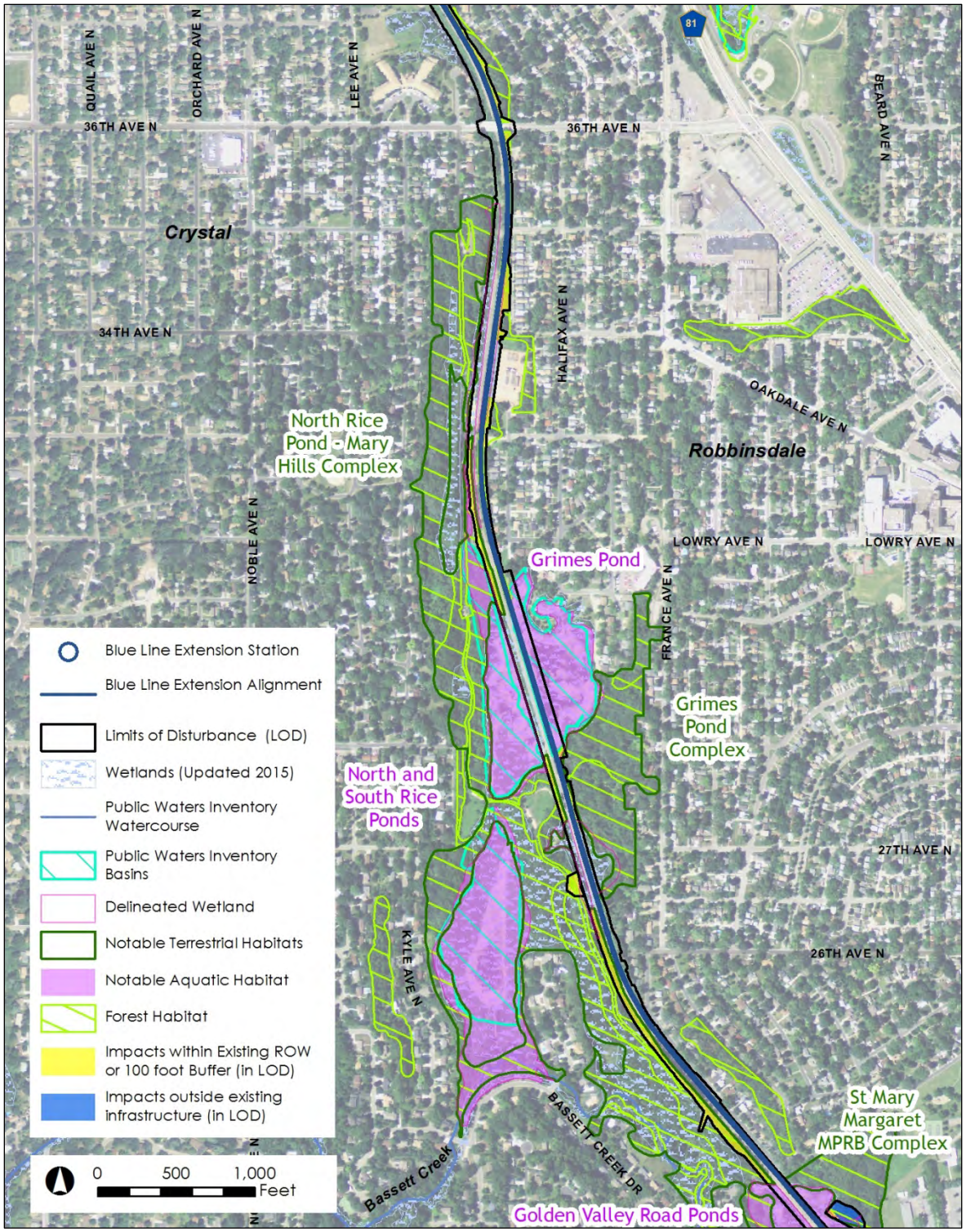
Sources: Aerial: Minnesota Geospatial Information Office, 2010; Wildlife Habitat: MLCCS (DNR), and field data (Council, 2015)

Figure 5.8-3. Biological Environment in the Study Area (3 of 5)



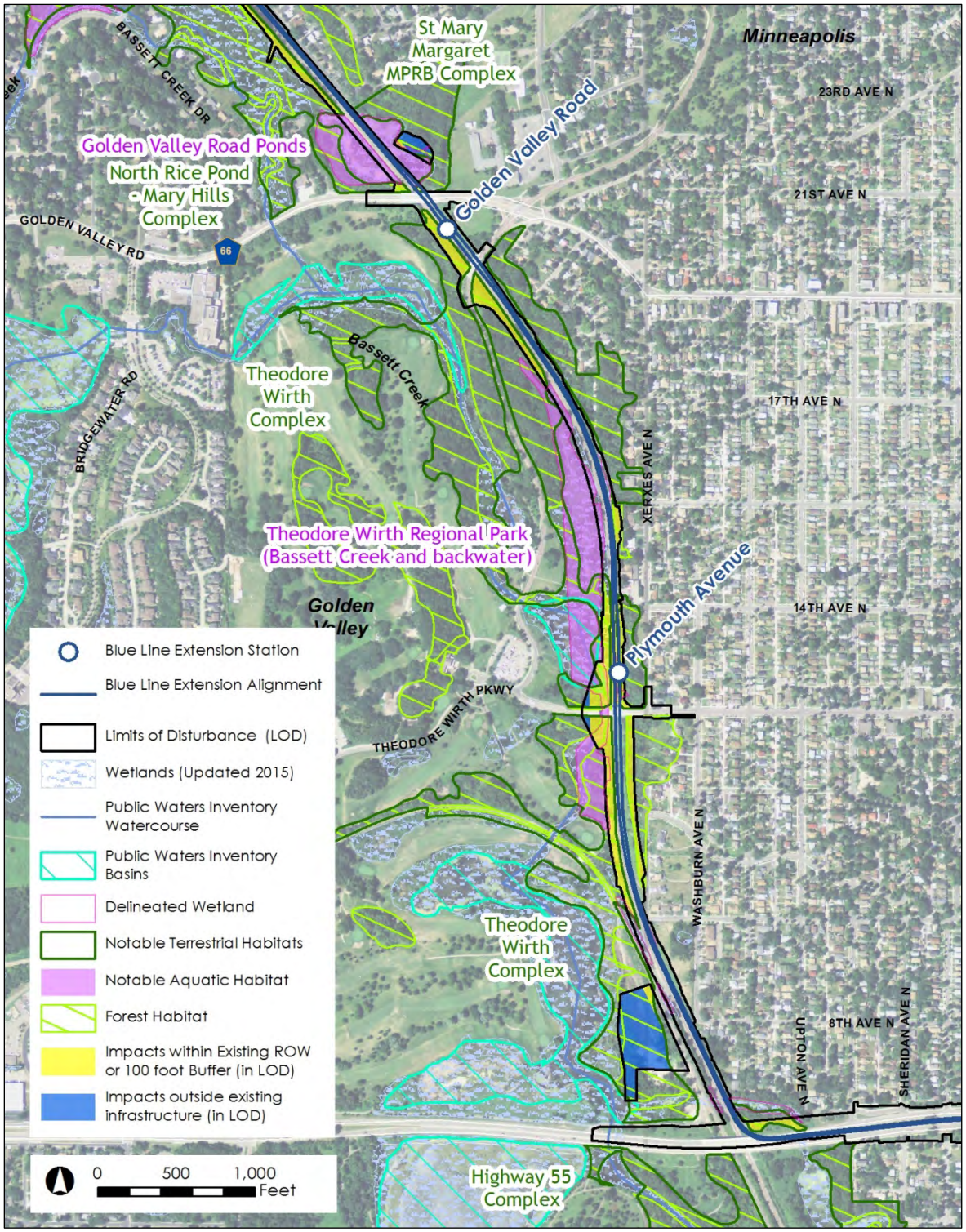
Sources: Aerial: Minnesota Geospatial Information Office, 2010; Wildlife Habitat: MLCCS (DNR), and field data (Council, 2015)

Figure 5.8-4. Biological Environment in the Study Area (4 of 5)



Sources: Aerial: Minnesota Geospatial Information Office, 2010; Wildlife Habitat: MLCCS (DNR), and field data (Council, 2015)

Figure 5.8-5. Biological Environment in the Study Area (5 of 5)



Sources: Aerial: Minnesota Geospatial Information Office, 2010; Wildlife Habitat: MLCCS (DNR), and field data (Council, 2015)

Noxious Weeds

Eight species of noxious weeds (see **Table 5.8-7** above) were observed along many areas within the LOD. Infestations are also present outside the LOD. Disturbed soils can create conditions in which infestation of noxious and invasive species can increase. Infestations could be controlled during the operating phase of the project by spot-spraying appropriate herbicides.

OMF

The OMF north of 101st Avenue would have no impacts to wetlands or forested habitat. The OMF would impact highly disturbed non-native grassland that was previously agricultural.

TPSS

TPSS sites would be placed within the existing railroad right-of-way or on publicly owned land where possible. The Council does not anticipate impacts to wooded areas, wetlands, or grassland.

No known state or federally listed species have been documented in the vicinity of the proposed TPSS sites. The Council does not anticipate that TPSS locations would affect the preferred habitats of listed species or of more common generalist wildlife species.

5.8.4.2 Construction-Phase (Short-Term) Impacts

No-Build Alternative

There would be no construction-phase impacts to biological resources from the No-Build Alternative.

Proposed BLRT Extension Project

Construction-phase impacts to the biological environment could include temporary physical disturbances such as construction of access roads, creation of construction staging areas, and dewatering in some areas. Construction-related noise could include pile driving and noise from the engines of heavy equipment. Such physical and noise disturbances can temporarily disrupt wildlife use of habitat. The typical wildlife species that use such urban habitats are resilient habitat generalists, and they can successfully occupy habitats a safe distance from construction-related disturbances.

Temporary access roads and staging areas for construction would be restored to the pre-construction grade and replanted with suitable vegetation. Construction-related noise can be reduced with properly functioning engine muffling.

5.8.5 Avoidance, Minimization, and/or Mitigation Measures

5.8.5.1 Federally Listed Species and Federal Watchlist Species

Measures to Avoid and Minimize Impacts

Northern Long-Eared Bat. Impacts to NLEBs summer roosting habitat can be reduced by avoiding tree clearing and grubbing. The Final 4(d) Rule for the NLEB, published on January 14, 2016, and in effect as of February 16, 2016, states that there would be no seasonal restrictions placed on tree

removal that is greater than 0.25 mile from a known hibernacula entrance or greater than 150 feet from a known maternity roost tree. The Council is working closely with USFWS to ensure that impacts to NLEBs are minimized to the extent practicable. USFWS has concurred with FTA's determination the proposed BLRT Extension project may affect the NLEB, and an incidental take would not be prohibited.

Bald Eagle. Though bald eagles have been delisted from the Endangered Species Act, they are still protected under several other federal laws. Bald eagles are particularly vulnerable during the nesting season, which extends from late January to late July. The non-nesting season is from August to mid-January. Bald eagle nest locations change over time, and bald eagles could nest in the study area. Nest locations will be monitored throughout the planning and construction phases of the proposed BLRT Extension project. If new bald eagle nests are observed close to the LOD of the proposed BLRT Extension project during the planning and construction phases, the Council will consult USFWS to determine which actions or restrictions apply.

Standard guidelines for avoiding impacts to bald eagle nesting sites include limiting construction activity within at least 330 feet from the nesting habitat and limiting clearing of vegetation within 660 feet of the nest site during the nesting season (late January–July). Bald eagle nest surveys will be conducted during the final design of the proposed BLRT Extension project to determine whether any nests are present at that time. If they are, the standard guidelines would be followed.

Unavoidable Impacts and Mitigation

Northern Long-Eared Bat. Based on its analysis of proposed tree clearing in the study area and adherence to the Final "4(d) Rule," USFWS has concurred with FTA's determination that the proposed BLRT Extension project merits a determination of "may affect, Incidental Take Not Prohibited" with respect to the NLEB.

Bald Eagle. With ongoing nest reconnaissance and adherence to acceptable permit provisions and seasonal work windows, the proposed BLRT Extension project is not likely to negatively affect bald eagles.

5.8.5.2 Migratory Bird Treaty Act

Measures to Avoid and Minimize Impacts

Generally, USFWS and DNR require seasonal work windows in order to comply with the MBTA and the DNR General Permit 2004–0001 provisions. The following measures are acceptable to USFWS and DNR:

- Bridge work may be performed (started and finished) outside the nesting season; that is, before May 15 or after September 1. No permit would be required for this activity.
- Bridge work may begin before May 15, and nest completion can be prevented by removing the nests (at least three times per week) as they are being built, or through the use of barriers to prevent nests from being established. The success of this measure depends on the number of nests on a bridge and the ability to restrict access. If the bridge has only a few nests, the birds

should be easily deterred from nesting. Removing unfinished nests is acceptable to USFWS, which considers this to be nonlethal harassment. No permits would be required for this activity.

Very few swallow nests were observed on bridge structures in the study area. Therefore, it should be feasible to remove existing nests or prevent new nests from being established during a seasonal period when nests are inactive. During construction of the proposed BLRT Extension project, nest building will be prevented on the underside of bridge structures by removing nests as they are built, if needed.

Unavoidable Impacts and Mitigation

With the implementation of acceptable measures to minimize impacts, there would be no impacts from the proposed BLRT Extension project to species covered under the MBTA.

5.8.5.3 State-Listed Species and Other Element Occurrences

Measures to Avoid and Minimize Impacts

DNR has issued guidelines on measures to minimize impacts to Blanding's turtles. These measures include provisions such as observing seasonal work windows, installing and removing silt fences, and distributing educational materials to use at the construction site to inform the contractor and workers what to look for and how to handle any turtles that are present.

Unavoidable Impacts and Mitigation

Blanding's Turtle. Blanding's turtles could be present in the study area. With adherence to the DNR guidelines concerning minimization of impacts to Blanding's turtles, impacts to this species would likely be negligible.

Other Element Occurrences. The proposed BLRT Extension project would not affect any rare plant communities or animal aggregation areas (that is, colonial waterbird nesting areas) that have been inventoried by DNR.

5.8.5.4 Noxious Weeds

Given the urban and highly disturbed nature of the study area, noxious weeds are ubiquitous. Some measures, such as spot-spraying with appropriate herbicides and cleaning equipment as it enters and exits the construction area, can be used to control invasive species within construction areas and staging areas; a vegetation management plan will be developed to include measures like these to control noxious weeds along the proposed BLRT Extension project. However, permanent eradication of invasive or noxious weeds in the study area would not be feasible.

5.8.5.5 Wildlife Habitat

Measures to Avoid and Minimize Impacts

Complete avoidance of impacts to notable terrestrial and aquatic habitats in the study area is not feasible. The following opportunities to reduce impacts are being considered by the Council in the design process:

- **Elevated LRT rail platform across Grimes Pond and ponds north of Golden Valley Road.** The proposed BLRT Extension project will use a bridge to cross these ponds, which are identified notable aquatic resources. The Draft EIS design concept would have used a continuous embankment of fill, which would have caused considerably more impacts to this aquatic resource.
- **Pretreatment storm BMPs.** Several BMPs, such as infiltration, retention, and detention, will be part of the proposed BLRT Extension project. These BMPs would improve the water quality of downslope or downstream aquatic resources.
- **Design of on-site mitigation areas that would reduce impacts to forested areas and existing aquatic resources.** Two onsite mitigation areas have been identified that have the potential to restore aquatic habitat that has been lost as a result of fill or diminished hydrology. These areas would also have the potential for floodplain mitigation. These areas would require negligible tree clearing. One area is located within TWRP, and the other area is located along the east side of West Broadway Avenue. Both sites have the potential to provide on-site wetland mitigation.

Unavoidable Impacts and Mitigation

- Unavoidable impacts to aquatic habitat will be mitigated by a combination of on-site wetland mitigation and purchasing suitable wetland credits from an established wetland mitigation bank.
- Unavoidable impacts to notable terrestrial habitat will be mitigated by restoring vegetation in and around TWRP and other notable habitats to be determined during design efforts.
- Where effective and feasible, suitable wildlife crossings will be accommodated within proposed culverts to allow wildlife species to cross from one side of the LRT/freight rail tracks to the other.

5.9 Water Quality and Stormwater

This section describes the existing water quality and stormwater conditions in the study area and the stormwater impacts of the No-Build Alternative and the proposed BLRT Extension project in terms of changes to impervious surfaces. The water quality and stormwater information in this section is based on information in the *Preliminary Stormwater Management Plan Technical Memorandum* (Council, 2016a) (see **Appendix F**). The analysis for this section was conducted in coordination with BCWMC, MWMO, SCWMC, WMWMC, MnDOT, and the cities of Minneapolis, Golden Valley, Robbinsdale, Crystal, and Brooklyn Park.

5.9.1 Regulatory Context and Methodology

5.9.1.1 Approach

Stormwater impacts are studied by quantifying the changes to impervious surfaces as a result of implementing a project. Impervious surfaces are typically road and parking lot pavements, sidewalks, rooftops, and other hard surfaces that are impenetrable to water and therefore eliminate rainwater infiltration and natural groundwater and surface water recharge. Rain and snowmelt water runs off these surfaces and can pick up pollutants before it enters nearby waterbodies.

For this analysis, in order to account for the worst-case scenario in calculating impacts, the Council assumed that LRT guideway segments that include ballasted track are impervious. Track ballast is crushed stone used to support the track and facilitate drainage. However, the stormwater runoff calculations developed for the proposed BLRT Extension project assume that the ballast is slightly less impervious than asphalt or concrete pavement, because it can store more rainfall in the spaces between the crushed stones. The Council would need to coordinate with the regulating WMOs and cities to determine whether ballasted track is considered impervious or pervious surface for regulatory purposes.

Regulatory and permitting authority for stormwater management falls to the municipalities, MPCA, and the WMOs. Each watershed organization is governed by a Joint Powers Agreement that is held between the watershed organization and the member communities whose jurisdictions are located within the boundaries of the WMO. Regulations change from time to time, and the proposed BLRT Extension project would be subject to the regulations that are in effect when the project design is submitted for approval by the permitting authorities. The stormwater management system for the proposed BLRT Extension project corridor was designed to meet the most stringent requirements for that particular segment. In all cases except for the OMF and park-and-ride structures, the WMO rules were the most stringent requirements. For the OMF and the park-and-ride structures, the rate- and volume-control requirements of the Minnesota B3 Guidelines[11] are more stringent and would be applied to those sites.

[11] B3 Guidelines refer to the *Buildings, Benchmarks, & Beyond Tools and Programs for Sustainable Buildings in Minnesota* (www.b3mn.org).

5.9.1.2 Agencies

Several agencies play a role in stormwater management. The specific agencies that have jurisdiction in the study area are listed below. **Table 5.9-1** lists the specific requirements of each agency.

- MPCA
- MWMO
- BCWMC
- SCWMC and WMWMC, or SCWM WMC when referred to in reference to their joint watershed management plan
- Cities of Minneapolis, Golden Valley, Robbinsdale, Crystal, and Brooklyn Park

Table 5.9-1. Regulatory Matrix of Stormwater Requirements

WMC/WMO	Rate Control[1]	Water Quality[1]	Volume Control[1]
BCWMC	2-, 10-, and 100-year storm peak discharge rate < pre-development rates	The greater of: ■ 0.55 inch of runoff from the new and fully reconstructed impervious surfaces, or ■ 1.1 inches of runoff from the net increase in impervious area	The greater of: ■ 0.55 inch of runoff from the new and fully reconstructed impervious surfaces, or ■ 1.1 inches of runoff from the net increase in impervious area
SCWMC/ WMWMC	2-, 10-, and 100-year storm peak discharge rate < pre-development rates	Remove 60% of phosphorus and 85% of total suspended solids (TSS) National Urban Runoff Program (NURP) Ponds or infiltrate all runoff from 1.3-inch event NURP pond storage must equal runoff from 2.5-inch storm event over the contributing drainage area	1.0 inch of runoff from impervious surfaces or 1.3 inches if using infiltration to also perform water quality treatment
MWMO[2]	2-, 10-, and 100-year storm peak discharge rate < pre-development rates	Remove 90% of TSS from 95th-percentile daily rainfall total over entire study area	A volume standard would be put into place in the future
MPCA	5.66 cubic feet per second, per acre of surface area for the water quality event	Water quality volume of 1 inch of runoff must be retained on site. If infiltration is infeasible, must use other methods to retain water If wet sedimentation pond is used, dead storage requirement is 1,800 cubic feet per acre of surface area drained; the water quality volume of 1 inch of runoff from the net new impervious is in addition to the permanent pool	1.0 inch of runoff from the new impervious surfaces created by the project

Table 5.9-1. Regulatory Matrix of Stormwater Requirements

WMC/WMO	Rate Control[1]	Water Quality[1]	Volume Control[1]
City of Minneapolis	Maintain discharge rates at or below existing rates	Remove 70% of TSS	Not applicable
City of Golden Valley	Must meet BCWMC standards (see above)	Must meet BCWMC standards (see above)	Must meet BCWMC standards (see above)
City of Robbinsdale	Must meet SCWMC and BCWMC standards (see above)	Must meet SCWMC and BCWMC standards (see above)	Must meet SCWMC and BCWMC standards (see above)
City of Crystal	2-, 10-, and 100-year storm peak discharge rate < pre-development rates	If infiltration is infeasible, permanent pond surface area = 2% of impervious area draining to pond, or 1% of entire area draining to pond, whichever is greater; or, permanent pool volume should be greater than runoff from 2.0 inch rainfall for fully developed event	City ordinances should be revised to include volume-control standard in line with most restrictive between SCWMC and MPCA
City of Brooklyn Park	Must meet SCWMC standards (see above)	Must meet SCWMC standards (see above)	Must meet SCWMC standards (see above)

[1] For rate/volume control and treatment, detention may be used as a BMP only when infiltration is infeasible because of poor soils or because of shallow depth to groundwater or bedrock, or when the detention pond is located in karstic areas, Drinking Water Management Supply Areas, Wellhead Protection Areas, or areas with contaminated soils. Detention BMPs may also be used as pretreatment upstream of infiltration or filtration practices.

[2] MWMO does not review plans and relies on the city of Minneapolis to enforce its stormwater ordinances.

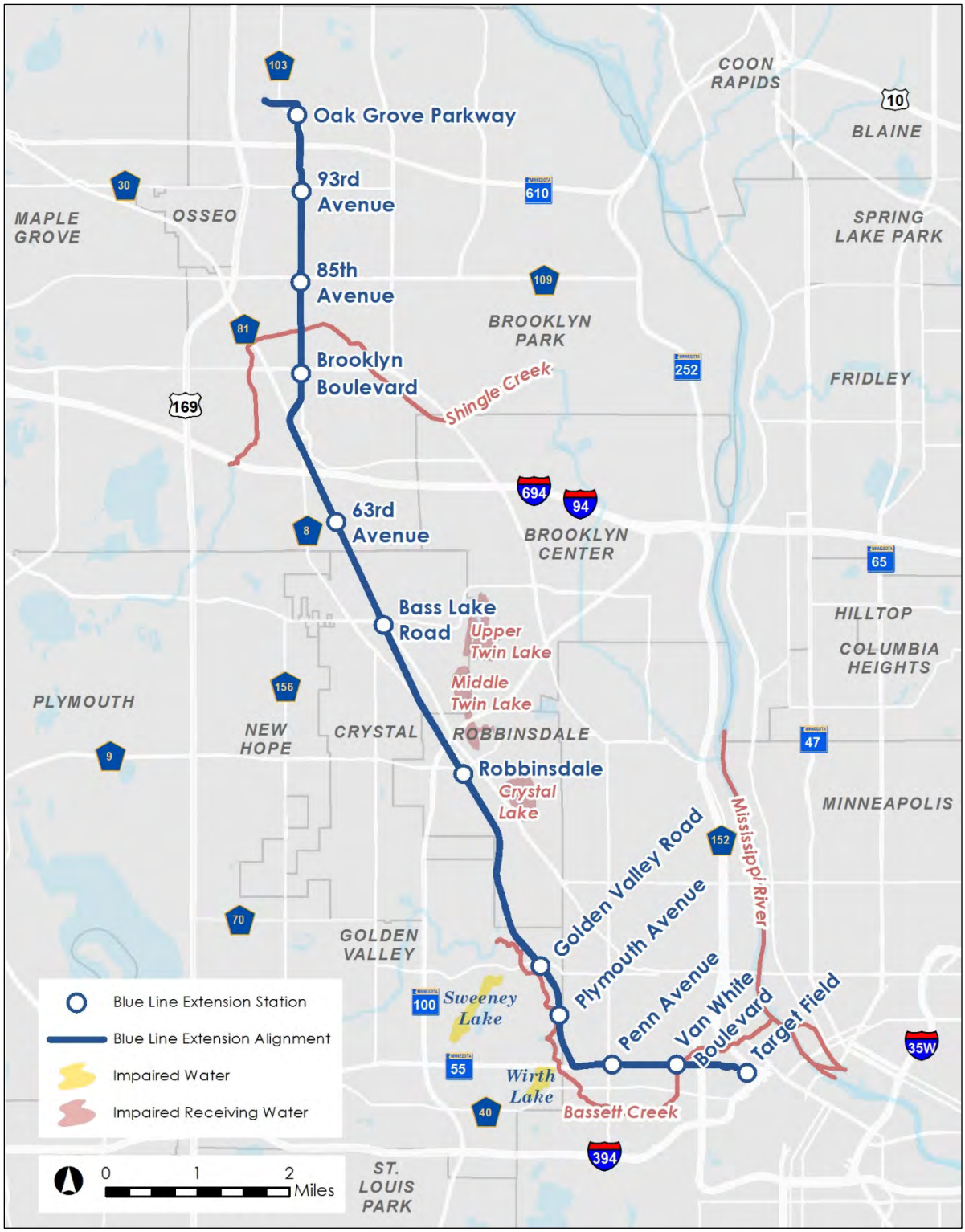
5.9.2 Study Area

The study area for stormwater is defined as the LOD for the proposed BLRT Extension project and the receiving waters within and immediately adjacent to the proposed BLRT Extension project alignment. The study area includes impaired waters that are located within 1 mile on either side of the proposed BLRT Extension project alignment and that would receive stormwater discharge from the proposed BLRT Extension project alignment as per state regulation and as shown in **Table 5.9-2** and **Figure 5.9-1**.

Table 5.9-2. Downstream Impaired Waters within 1 Mile of the Proposed BLRT Extension Project

Impaired Receiving Water	Impairments	Total Maximum Daily Load (TMDL) Status
Mississippi River	Mercury In fish tissue; fecal coliform; polychlorinated biphenyls (PCB) in fish tissue	*Upper Mississippi River Bacteria TMDL and Protection Plan* (2014)
Bassett Creek	Chloride; fecal coliform; fishes bioassessments	Included in the above TMDL plan
Crystal Lake	Nutrient/eutrophication biological indicators	*Crystal Lake Nutrient TMDL Implementation Plan* (2009)
Twin Lakes: Lower, Middle, and Upper	Mercury in fish tissue; nutrient/ eutrophication biological indicators; PCB in fish tissue; perfluorooctane sufonate (PFOS) in fish tissue	*Twin and Ryan Lakes Nutrient TMDL* (2007); plans are required for mercury, PCB, and PFOS
Shingle Creek	Aquatic macroinvertebrate bioassessments; chloride; dissolved oxygen	*Shingle and Bass Creeks Biota and Dissolved Oxygen TMDL Implementation Plan* (2012); *Shingle Creek Chloride TMDL Implementation Plan* (2007)

Figure 5.9-1. Receiving and Impaired Waters



Sources: Minnesota Pollution Control Agency 2014; Council 2015

5.9.3 Affected Environment

The study area is generally urbanized, is highly altered compared to natural conditions, and is characterized by commercial, industrial, and residential development. The intensity of development ranges from suburban to urban and also includes farmland in the northern part of the study area. **Figure 5.9-1** above identifies the receiving waters (including impaired waters) in the study area, including the Mississippi River; Bassett Creek; Crystal Lake; Lower, Middle, and Upper Twin Lakes; Twin Creek; and Shingle Creek. Additional smaller receiving waters include Heritage Park South Pond, North and South Rice Ponds, Grimes Pond, Setzler Pond, Century Channel, and the TH 610 Ponds. **Table 5.9-2** above provides specific information on the impairment and total maximum daily load (TMDL) status of these waterbodies.

Currently, the majority of the study area has no formal stormwater treatment to meet current water quality regulatory requirements. Within the BNSF rail corridor, stormwater typically flows directly into surrounding vegetated ditches, which provide water quality benefits such as stabilizing sediment and filtering out waterborne sediments, and into existing wetlands, thereby conveying the water into adjacent watercourses, some of which are impaired (**Figure 5.9-1** above). Within the Olson Memorial Highway and West Broadway Avenue corridors, stormwater is collected in storm sewer systems and conveyed directly to receiving waters, frequently with little or no water quality treatment or flow rate attenuation.

A few existing stormwater management and treatment facilities are near the proposed BLRT Extension project corridor. These include but are not limited to:

- Target Field stormwater management
- South Treatment System at the Heritage Park redevelopment project
- Hydrodynamic separators at the intersection of Xerxes Avenue and 14th Avenue North in the City of Minneapolis
- Crystal Airport infiltration basin
- Cub Foods/Target parking lot BMPs (southwest quadrant of the West Broadway Avenue/ Brooklyn Boulevard intersection)
- Brooklyn Park wetland regrading and outlet structure improvement (just north of the West Broadway Avenue/Candlewood Drive intersection; primarily intended to mitigate wetland and floodplain fill impacts immediately to the south)
- Setzler Pond, a regional rate-control pond (south and west of the West Broadway Avenue/ 93rd Avenue intersection)
- A stormwater quality pond in the northwest quadrant of 94th Avenue and West Broadway Avenue
- A stormwater quality pond in the southeast quadrant of Oak Grove Parkway and West Broadway Avenue
- Target North Campus BMPs

Table 5.9-1 above summarizes the water management commission (WMC), WMO, and municipal regulatory requirements. Detailed descriptions of the regulatory requirements of the various agencies are provided in the *Preliminary Stormwater Management Plan Technical Memorandum* (Council, 2016a) (see **Appendix F**).

5.9.4 Environmental Consequences

5.9.4.1 Operating-Phase (Long-Term) Impacts

No-Build Alternative

There would be no operating-phase impacts to stormwater from the No-Build Alternative.

Proposed BLRT Extension Project

The proposed BLRT Extension project would increase the impervious area within the LOD by 83 percent (**Table 5.9-3**). The impervious surfaces constructed would include ballasted track, platforms, park-and-ride facilities, an OMF, aerial structures for the LRT guideway, roadway, and sidewalk improvements. These additional impervious surfaces and drainage systems (that is, curb, gutters, and storm drain pipes) would increase the volume of stormwater runoff from the sites within the proposed BLRT Extension project footprint. Several culvert extensions would also be necessary to accommodate the proposed BLRT Extension project. The Council would coordinate these extensions with the appropriate jurisdictional agency.

Table 5.9-3. Increase in Impervious Surface by Segment

Alternative	Segment	Total Area (acre)	Existing		Proposed		Increase in Impervious
			Impervious Area (acre)	Percent Impervious	Impervious Area (acre)[1]	Percent Impervious	
No-Build Alternative	—	245	103	42%	103	42%	0%
Proposed BLRT Extension project	Total	245	103	42%	189	77%	83%
Proposed BLRT Extension project (by segment)	Minneapolis	44	30	68%	36	82%	20%
	Golden Valley	21	6	29%	16	76%	167%
	Robbinsdale	36	18	50%	28	78%	56%
	Crystal	29	8	28%	21	72%	163%
	Brooklyn Park 2	45	20	44%	33	73%	65%
	Brooklyn Park 1	70	21	30%	55	79%	162%

[1] The impervious surface acreage includes proposed ballasted track areas.

TPSS

There are 17 potential TPSS locations along the proposed BLRT Extension project. The majority of the TPSSs would be located on the east side of the proposed LRT tracks, with some associated with the LRT platforms and stations. Individually, TPSS sites would generally not need to meet the various watershed requirements because of the small size of the sites (less than 10,000 square feet). TPSSs are included as part of the overall proposed BLRT Extension project when considering various WMO and/or city requirements for addressing stormwater.

5.9.4.2 Construction-Phase (Short-Term) Impacts

No-Build Alternative

There would be no construction-phase impacts to stormwater from the No-Build Alternative.

Proposed BLRT Extension Project

Construction activities associated with constructing utilities, the LRT guideway, track platforms, park-and-ride facilities, an OMF, aerial structures for the LRT guideway, roadway, and sidewalk improvements for the proposed BLRT Extension project would disturb soils and cause runoff that could erode slopes and drainageways, form gullies, and deposit sediment in storm drain systems and receiving waterbodies. This could destabilize slopes and reduce water quality if temporary BMPs, which are required through the permitting process, are not in place prior to a storm event.

5.9.5 Avoidance, Minimization, and/or Mitigation Measures

Long-Term Mitigation Measures will include the design and construction of permanent BMPs, such as detention and infiltration facilities, which would control and treat stormwater runoff caused by an increase in impervious surfaces as a result of the proposed BLRT Extension project. Various BMPs, including ponds and infiltration areas, are described below.

Stormwater treatment ponds provide rate control and water quality treatment. To the extent practicable, ponds will be sited near low points or adjacent to outfalls within the proposed right-of-way. The Council might consider opportunities to collaborate with corridor cities on combined stormwater management as specific mitigation needs are refined. A wet detention pond, also commonly called a NURP (National Urban Runoff Program) pond, is an example of this type of BMP. In locations where surface ponds are not practicable, underground storage can provide rate control.

Infiltration BMPs are used to provide volume control and water quality treatment. Certain areas might be suitable for infiltration BMPs based on soil types at the site. Based on the National Cooperative Soil Survey from NRCS, a large portion of the proposed BLRT Extension project corridor contains soils appropriate for this type of BMP. Infiltration basins and infiltration trenches that are integrated into the guideway and sidewalk areas in urban areas will be considered in final design. In areas where infiltration is not feasible (areas with contaminated soils, shallow and/or sensitive groundwater resources, or low soil porosity), filtration BMPs will be considered instead of infiltration. Examples of infiltration BMPs include bioinfiltration basins, bioswales, ditch treatment using ditch blocks, tree trenches, and underground infiltration systems.

Filtration BMPs can be used in locations where poorly draining soils or proximity to groundwater preclude the use of infiltration BMPs. They can also be used at treatment pond locations by using the 10-foot bench above the normal water level as a filtration bench. This would allow a certain volume of water in the pond to filtrate through engineered soils and collect in a drain tile that flows to the pond outfall. Soil borings will be taken during design to determine where infiltration or filtration BMPs are being considered. Examples of filtration BMPs include biofiltration basins, ditch treatment using ditch blocks and perforated underdrains, and underground sand or media filtration systems.

Outside ditches along the proposed railway corridor can be used for infiltration or filtration of stormwater. Ditch blocks will be installed along the east side of the railway corridor to provide storage capacity and encourage infiltration or filtration. The Council proposes that the corridor protection ditches located between the BNSF tracks and the LRT tracks be used for infiltration or filtration of stormwater.

Table 5.9-4 includes a summary of BMPs and their locations by segment of the proposed BLRT Extension project alignment. **Tables 5.9-5 through 5.9-10** include a more detailed description of the BMPs being considered, the water quality volume required, and the size and volume of the BMPs being considered. **Figure 5.9-2** also shows the locations of major stormwater treatment facilities for the proposed BLRT Extension project.

Short-Term Mitigation Measures. An NPDES Construction Stormwater Permit from MPCA will be required because the proposed BLRT Extension project would disturb 1 acre or more of land. Since the proposed BLRT Extension project would disturb more than 50 acres of land and would produce discharges within 1 mile of impaired waters, the Council will submit the NPDES Construction Stormwater Permit application to MPCA at least 30 days prior to the start of construction. Other Minnesota agencies requiring permits could include watershed districts, municipalities, and soil and water conservation districts. The NPDES permit requires development of a Stormwater Pollution Prevention Plan (SWPPP), which must be submitted at the time of the permit application, and implemented during construction.

Short-term mitigation measures will include developing erosion- and sediment-control plans to control runoff and reduce erosion and sedimentation during construction and to limit the amount of sediment carried into lakes, streams, wetlands, and rivers by stormwater runoff. These plans, in combination with the SWPPP, will identify how to control runoff, stabilize slopes and exposed soils, and limit the movement of soils into drainage systems and natural areas. Construction activities would be phased in so as to disturb as small an area as possible at any one time.

Table 5.9-4. Proposed Stormwater BMPs

Segment	Section[1]	Proposed BMPs
Minneapolis (M)[2]	Olson Memorial Highway	Construct pond or underground detention and bioinfiltration or biofiltration BMPs to meet rate control, volume control, and water quality requirements. Proposed improvements have a discharge point within 1 mile of, and flow to, the Mississippi River and could require additional BMPs as required by the NPDES permit.
Golden Valley (GV)	BNSF rail corridor	Construct infiltration or filtration areas within adjacent ditches depending on the underlying soils and depth to groundwater. Proposed improvements have a discharge point within 1 mile of, and flow to, Bassett Creek and could require additional BMPs as required by the NPDES permit.
Crystal (C) and Robbinsdale (R)	Bass Lake Road park-and-ride	Construct hydrodynamic separator and underground detention and/or filtration facilities beneath park-and-ride lot. Proposed improvements have discharge points within 1 mile of, and flow to, Crystal and/or Twin Lakes and could require additional BMPs as dictated by the NPDES permit.
	Robbinsdale park-and-ride	Construct hydrodynamic separator and underground detention BMPs to meet rate control, volume control, and water quality requirements. Proposed improvements have discharge points within 1 mile of, and flow to, Crystal and/or Twin Lakes and could require additional BMPs as dictated by the NPDES permit.
	BSNF rail corridor	Construct infiltration areas within adjacent ditches; avoid existing well areas near the Robbinsdale Station. Proposed improvements have discharge points within 1 mile of, and flow to, Crystal and/or Twin Lakes and could require additional BMPs as dictated by the NPDES permit.
Brooklyn Park (BP1 and BP2)	101st Avenue OMF	Construct wet pond filtration and/or infiltration BMPs to meet rate control, volume control, and water quality requirements.
	Oak Grove Parkway park-and-ride	Construct filtration or infiltration BMPs to meet rate control, volume control, and water quality requirements.
	Roadways north of 93rd Avenue	Construct on-site pond and infiltration BMPs to meet rate control, volume control, and water quality requirements and to compensate for an existing pond being eliminated at 94th Avenue.
	Roadway section between 93rd Avenue and Candlewood Drive	BMPs for the roadway and LRT guideway would be considered as part of the Hennepin County roadway project.

Table 5.9-4. Proposed Stormwater BMPs

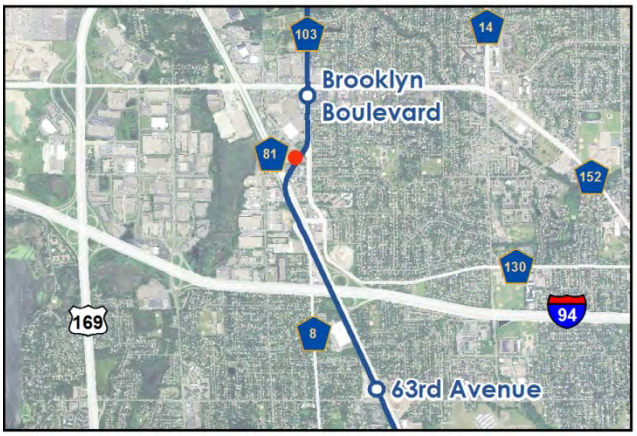
Segment	Section[1]	Proposed BMPs
	Roadway section south of Candlewood Drive	Use existing West Broadway Avenue BMPs to the extent feasible and construct additional BMPs (such as bioinfiltration basins and tree trenches) to meet rate control, volume control, and water quality requirements. Proposed improvements have a discharge point within 1 mile of, and flow to, Shingle Creek and could require additional BMPs as dictated by the NPDES permit.
	BNSF rail corridor	Construct infiltration areas within adjacent ditches. Proposed improvements have discharge points within 1 mile of, and flow to, Shingle Creek and could require additional BMPs as dictated by the NPDES permit. Modifying a wetland/stormwater basin at 62nd Avenue would be necessary.
	63rd Avenue park-and-ride	No additional construction anticipated at this location, so no additional BMPs are anticipated.

[1] Erosion-control and sediment-control BMPs would be required at all locations to meet the requirements of the cities and MPCA NPDES permits.

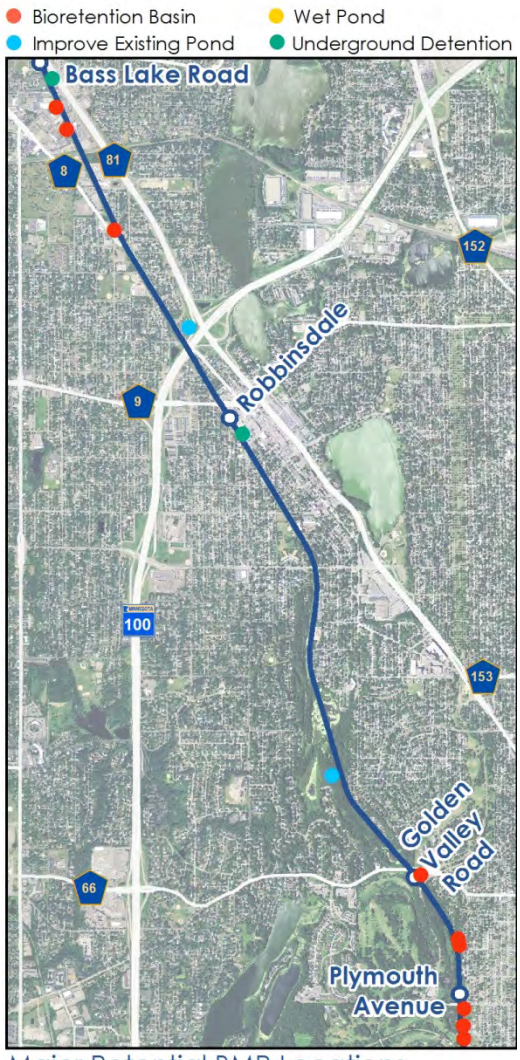
[2] Because of the right-of-way constraints, infiltration trenches within the LRT guideway and adjacent sidewalk areas will be considered to provide additional infiltration capacity.

Figure 5.9-2. Major Proposed Stormwater Treatment Facilities

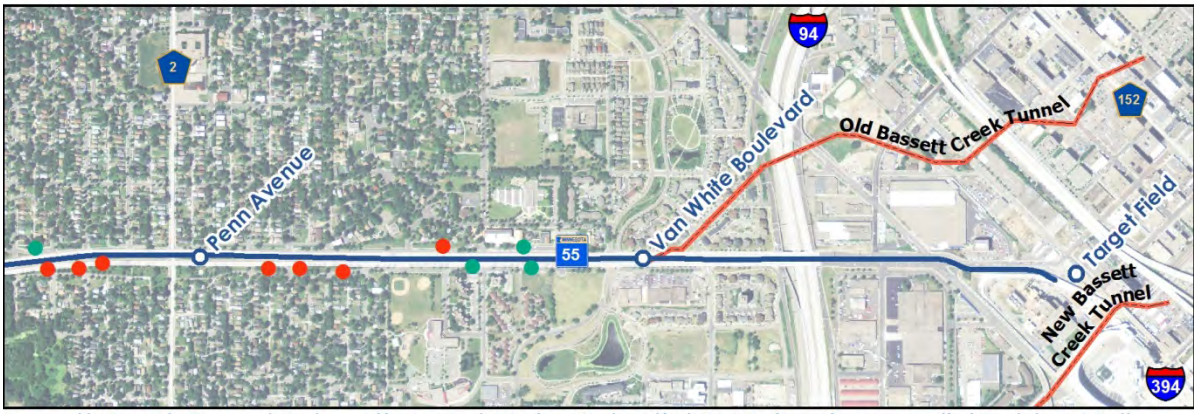
Major Potential BMP Locations Northern End



Major Potential BMP Locations in Brooklyn Park



Major Potential BMP Locations



Bassett Creek Tunnel Relocation and Major Potential BMPs in Minneapolis/Golden Valley

Table 5.9-5. Potential Stormwater BMP Strategies in Segment M – City of Minneapolis

Receiving Water/Location	Water Quality Volume Required[1] (acre-feet)	BMP Options Considered	BMP Surface Area (square feet)	BMP Volume Provided (acre-feet)
Old Bassett Creek tunnel at 7th St (east of I-94)	0.24	Tree trenches	16,850	0.31
Old Bassett Creek tunnel at Olson Memorial Hwy (west of I-94)	0.90	Bioretention Wet pond Underground detention Hydrodynamic separator	30,500 37,120 N/A N/A	0.91 0.80 1.03 N/A
Heritage Park south pond	0.09	Bioretention	4,050	0.10
East-channel Bassett Creek	0.28	Bioretention Underground storage Hydrodynamic separator	13,350 N/A N/A	0.27 0.17[3] N/A
East-channel Bassett Creek[1]	0.12	Corridor protection ditch	N/A[2]	0.05

[1] The Water Quality Volume Required calculation includes the approximate impervious area that would be added by an expansion in operational capacity by BNSF. Total impervious area associated with the future BNSF track in segment M is about 0.4 acre.

[2] The treatment BMP is incorporated into the ditches that are part of the typical section for the proposed BLRT Extension project; therefore, the surface area is not provided as a separate number.

[3] This BMP is designed for rate control only.

Table 5.9-6. Potential Stormwater BMP Strategies in Segment GV – City of Golden Valley

Receiving Water/Location	Water Quality Volume Required[1] (acre-feet)	BMP Options Considered	BMP Surface Area (square feet)	BMP Volume Provided (acre-feet)
Bassett Creek/south of Golden Valley Rd	0.61	Corridor protection ditch Biofiltration basin (Sta 2112 to Sta 2122) Biofiltration basin (Sta 2136 to Sta 2139)	2,100 18,000 3,600	0.02 1.10 0.29
Golden Valley Rd wetlands	0.22	Additional treatment volume would be provided in other portions of the segment	—	—
Bassett Creek/north of Manor D[2]	0.25	Corridor protection ditch	N/A[3]	0.05

[1] The Water Quality Volume Required calculation includes the approximate impervious area that would be added by an expansion in operational capacity by BNSF. Total area of impervious associated with the future BNSF track in segment GV is about 2 acres.

[2] Some of this area drains to the Robbinsdale (R) segment.

[3] The treatment BMP is incorporated into the ditches that are part of the typical section for the proposed BLRT Extension project; therefore, the surface area is not provided as a separate number.

Table 5.9-7. Potential Stormwater BMP Strategies in Segment R – City of Robbinsdale

Receiving Water/Location	Water Quality Volume Required[1] (acre-feet)	BMP Options Considered	BMP Surface Area (square feet)	BMP Volume Provided (acre-feet)
Bassett Creek	0.22	Treatment ditch	1,660	0.22
Grimes and Rice Ponds	0.38	Treatment ditch Corridor protection ditch	3,620 N/A[2]	0.48 0.31
Crystal Lake	0.76	Treatment ditch Underground detention	12,320 5,530	1.32 0.41
Middle Twin Lake	0.15	Corridor protection ditch Treatment ditch	N/A[2] 1,210	0.48 0.13

[1] The Water Quality Volume Required calculation includes the approximate impervious area that would be added by an expansion in operational capacity by BNSF. Total impervious area associated with the future BNSF track in segment R is about 3 acres.

[2] The treatment BMP is incorporated into the ditches that are part of the typical section for the proposed BLRT Extension project; therefore, the surface area is not provided as a separate number.

Table 5.9-8. Potential Stormwater BMP Strategies in Segment C – City of Crystal

Receiving Water/Location	Water Quality Volume Required[1] (acre-feet)	BMP Options Considered	BMP Surface Area (square feet)	BMP Volume Provided (acre-feet)
Twin Lakes/Steve O's Bar and Grill	0.32[2]	Bioretention	8,520	0.30
Twin Lakes/Corvallis Ave area	0.43	Bioretention	15,730	0.54
Twin Creek/Bass Lake Rd park-and-ride	0.33	Underground detention (filtration)	13,125	0.36
Shingle Creek/north of Bass Lake Rd	0.60[3]	Treatment ditch	N/A[4]	0.88

[1] The Water Quality Volume Required calculation includes the approximate impervious area that would be added by an expansion in operational capacity by BNSF. Total impervious area associated with the future BNSF track in segment C is about 1.6 acres.

[2] Some of this area drains to the Robbinsdale (R) segment.

[3] Some of this area drains to the Brooklyn Park 2 (BP2) segment.

[4] The treatment BMP is incorporated into the ditches that are part of the typical section for the proposed BLRT Extension project; therefore, the surface area is not provided as a separate number.

Table 5.9-9. Potential Stormwater BMP Strategies in Segment BP2 – City of Brooklyn Park 2

Receiving Water/Location	Water Quality Volume Required[1] (acre-feet)	BMP Options Considered	BMP Surface Area (square feet)	BMP Volume Provided (acre-feet)
Twin Creek/south of I-94	0.56	Treatment ditch	N/A[2]	0.61
Shingle Creek/north of I-94	0.38	Treatment ditch	N/A[2]	0.59
Shingle Creek/crossover section	0.26	Bioretention	1,800	0.05
Shingle Creek/West Broadway Ave: 75th Ave N to Brooklyn Blvd	0.50	Tree trenches	Maximize available boulevard space	0.76
Shingle Creek/north of Brooklyn Blvd	0.56	See Table 5.9-10	See Table 5.9-10	See Table 5.9-10

[1] The Water Quality Volume Required calculation includes the approximate impervious area that would be added by an expansion in operational capacity by BNSF. Total impervious area associated with the future BNSF track in segment BP2 is about 1.4 acres.

[2] The treatment BMP is incorporated into the ditches that are part of the typical section for the proposed BLRT Extension project; therefore, the surface area is not provided as a separate number.

Table 5.9-10. Potential Stormwater BMP Strategies in Segment BP1 – City of Brooklyn Park 1

Receiving Water/Location	Water Quality Volume Required (acre-feet)	BMP Options Considered	BMP Surface Area (square feet)	BMP Volume Provided (acre-feet)
Shingle Creek	See note 1	See note 1	See note 1	See note 1
Century Channel	See note 1	See note 1	See note 1	See note 1
TH 610/West Broadway Ave to existing Oak Grove Pkwy	1.13	Bioretention	38,335	1.31
West Broadway Ave north of existing Oak Grove Pkwy	1.48	Bioretention	49,660	1.72
TH 610/Baxter property, southwest of TH 610	2.68	Wet pond	32,121	2.68
Reconstructed Oak Grove Pkwy west of existing West Broadway Ave	1.16	Wet pond	16,012	1.16
Southern OMF property	1.11	Wet pond	15,444	1.11
Northern OMF property	0.33	Wet pond	6,167	0.33

[1] Stormwater runoff from the proposed BLRT Extension project corridor would drain to the BMPs being constructed as part of the Hennepin County West Broadway Avenue project. For more information, see the Environmental Assessment Worksheet for that project.

5.10 Air Quality/Greenhouse Gas Emissions

Motorized vehicles affect air quality by emitting airborne pollutants. Changes in traffic volumes, travel patterns, and roadway locations affect air quality by changing the number of vehicles and the congestion levels in a given area.

This section describes the existing air quality in the study area and analyzes the air quality impacts of the No-Build Alternative and the proposed BLRT Extension project on criteria pollutants—a group of common air pollutants regulated by EPA on the basis of information on their health and/or environmental effects—and on greenhouse gases (GHGs).

A carbon monoxide (CO) hot-spot screening assessment has been performed to satisfy the requirements of federal transportation conformity air quality rules (40 CFR Part 93, Subpart A). A qualitative evaluation of mobile-source air toxics (MSATs) has also been performed for this project in accordance with FHWA guidance. The scope and methods of these analyses were developed by the Council in collaboration with MPCA, Hennepin County, MnDOT, and FHWA.

5.10.1 Regulatory Context and Methodology

Air quality is evaluated as part of the NEPA review process for large projects receiving federal funding or approvals. This is done in accordance with the federal Clean Air Act (CAA) of 1970 and the Clean Air Act Amendments (CAAA) of 1977 and 1990. EPA regulates air quality and delegates this authority to the State of Minnesota, and MPCA monitors air quality and regulates emissions of air pollutants.

Air quality impacts are defined as an exceedance of established regulatory thresholds for certain pollutants. The criteria pollutants identified by EPA are ozone, particulate matter, carbon monoxide, nitrogen dioxide, lead, and sulfur dioxide. The Council assessed the air quality impacts of the proposed BLRT Extension project by comparing the projected pollutant concentrations with the No-Build Alternative and the proposed BLRT Extension project to the National Ambient Air Quality Standards (NAAQS).

EPA designates geographic areas based on measurements of criteria pollutant concentrations compared to the NAAQS. An *attainment* designation means that concentrations in the area are below the NAAQS, a *nonattainment* designation means that concentrations in the area are exceeding the NAAQS, and *maintenance areas* are areas that have been redesignated within the prior 20 years from nonattainment to attainment.

No areas in Minnesota are designated as nonattainment for criteria pollutants. Hennepin County, where the proposed BLRT Extension would be located, is designated as a maintenance area for CO. As a result, the Transportation Conformity Rule (40 CFR Part 93) requires the Council to demonstrate that the proposed BLRT Extension project would be in compliance with the State Implementation Plan (SIP) and would maintain compliance with the NAAQS for CO. Therefore, an evaluation of CO impacts has been performed.

For this Final EIS, the Council did not analyze the impacts of criteria pollutants other than CO. For projects affecting highway vehicle emissions, CO has historically been the only pollutant of

significance. However, with lowered particulate matter standards for fine particles (particles under 2.5 microns in diameter, or $PM_{2.5}$), greater concern has recently been focused on both $PM_{2.5}$ and PM_{10} emissions from highways, with FHWA now recommending hot-spot analyses in nonattainment areas for these pollutants if the project involves significant increases in diesel truck traffic. Because the proposed BLRT Extension project would not increase diesel truck traffic, and because the proposed BLRT Extension project area is also not in nonattainment or maintenance status for $PM_{2.5}$ or PM_{10}, no hot-spot analysis is needed for these particulate matter components. The other criteria pollutants—nitrogen oxides (NO_x), sulfur dioxide (SO_2), ozone (O_3), and lead (Pb)—are not substantial concerns given the nature of the proposed BLRT Extension project and study area, and therefore they have not been analyzed for this Final EIS.

In addition to the criteria air pollutants, EPA also regulates air toxics. Seven compounds with significant contributions from mobile sources are identified by EPA as MSATs: acrolein, benzene, 1,3-butadiene, diesel particulate matter (PM) plus diesel exhaust organic gases (diesel PM), formaldehyde, naphthalene, and polycyclic organic matter. As agreed to by FTA, the Council has applied to this project the FHWA guidance for assessing MSAT effects for transportation projects in the NEPA process.

5.10.2 Study Area

The study area for evaluating air quality effects from the proposed BLRT Extension project was established in cooperation with MPCA. The analysis performed includes consideration of CO and MSATs. The evaluation of these pollutants is typically considered in the immediate proposed BLRT Extension project area where traffic volumes, travel patterns, and roadway locations could affect air quality. Therefore, the study area for air quality includes all roadway segments adjacent to and crossing the proposed transitway.

In addition to traffic-related emissions, there would be minor amounts of emissions from a proposed OMF to be located near the northern end of the proposed BLRT Extension project. Therefore, the study area for air quality also includes the OMF.

5.10.3 Affected Environment

Air quality is evaluated based on impacts to humans in the affected environment. Humans experience air quality impacts by breathing unsafe concentrations of airborne pollutants. Exposure to CO and MSATs emitted from motor vehicles, the pollutants of primary focus for this project, can occur in homes, businesses, and recreation facilities located adjacent to affected roadway segments or on pedestrian facilities along project-area roads.

5.10.4 Environmental Consequences

5.10.4.1 Operating-Phase (Long-Term) Impacts

National Ambient Air Quality Standards (NAAQS)

The Council assessed the impacts from criteria pollutants by applying a CO hot-spot screening methodology to determine whether CO concentrations would exceed the NAAQS. The CO analysis is described below in the section **Hot-Spot Screening for CO**.

Carbon Monoxide (CO)

CO is a traffic-related pollutant that has been of concern in the Twin Cities Metropolitan Area. In 1999, EPA redesignated all of Hennepin, Ramsey, and Anoka Counties and portions of Carver, Scott, Dakota, Washington, and Wright Counties as maintenance areas for CO. This means that these counties were previously classified as nonattainment areas but were found to be in attainment and are now classified as maintenance areas. Maintenance areas are required to have actions undertaken to demonstrate continuing compliance with CO standards. Since the proposed BLRT Extension project would be located in Hennepin County, an evaluation of CO for assessing air quality impacts is required in NEPA documents.

Greenhouse Gases (GHG) and Climate Change

GHGs are different from other air pollutants evaluated in environmental reviews. Their impacts are not assessed on a local or regional basis because their effects are long-term as they disperse into the global atmosphere. Global climate change can be caused by many factors, including the cumulative effects of numerous and varied emissions sources (in terms of both absolute numbers and types), each of which makes a relatively small addition to global atmospheric GHG concentrations. It is difficult to isolate and quantify the GHG emission impacts for a particular project. Furthermore, presently there is no generally accepted scientific methodology for attributing specific climatological changes to a particular project's emissions. Therefore, the GHG and climate change analysis for this Final EIS is based on the expected emission changes in GHG emissions at a regional level instead of the project level.

Currently, neither EPA nor FTA has adopted quantitative GHG emission thresholds applicable to this project. Nevertheless, the Council estimated GHG emissions associated with regional commuting activity based on changes in the vehicle-miles traveled (VMT) because of the project operation (*Travel Demand Modeling/Transit Ridership Technical Memorandum*; Council, 2015b). GHG emissions were calculated by multiplying the VMT of each type of vehicle by the carbon dioxide (CO_2) emission factors taken from the *New and Small Starts Evaluation and Rating Process Final Policy Guidance* (FTA, 2013) based on projected carbon dioxide equivalent (CO_2e) emission factors for the planning horizon for the proposed BLRT Extension project (2040).

Table 5.10-1 shows the estimated Twin Cities area (seven counties) emissions of transportation-related GHG, expressed as CO_2e, in 2040 (freight rail and aviation are not included). Note that the light rail GHG emissions are due to generating electricity to supply power for light rail operation. The proposed BLRT Extension project would decrease transportation-related GHG emissions in the

metropolitan area by about 0.05 percent compared to the transportation-related GHG emissions with the No-Build Alternative.

Table 5.10-1. Regional Transportation CO_2 GHG Emissions in 2040

Travel Mode	Emission Factor (grams/VMT)	Vehicle-Miles Traveled (VMT)		GHG (Metric Tons of CO_2e)	
		No-Build Alternative	Proposed BLRT Extension Project	No-Build Alternative	Proposed BLRT Extension Project
Light rail	4,574	9,218	12,050	42,163	55,116
Heavy-duty vehicle (truck)	1,587	1,164,926	1,164,926	1,849,207	1,849,207
Bus (diesel)	2,721	71,684	71,856	195,052	195,520
Passenger car	397	36,303,648	36,250,920	14,412,548	14,391,615
	Total[1]	**37,549,475**	**37,499,751**	**16,498,970**	**16,491,458**

Sources: Based on VMT data provided by Council (2015) and CO_2e emission factors from FTA (2013) except for trucks. Truck emission factor calculated from BTU/VMT factor in *Transportation Energy Data Book: Edition 31* (2012), US Department of Energy Oak Ridge National Laboratory; and No. 2 oil emission factor and heating value provided by EPA in 40 CFR Part 98, Table C-1.

[1] Totals will not always match exactly the summed values, due to rounding of each of the summed values as shown in the table.

Air Quality Conformity

The 1990 CAAA require that SIPs must demonstrate how states with nonattainment and maintenance areas would meet federal air quality standards.

EPA issued final rules on transportation conformity (40 CFR Part 93, Subpart A), which describe the methods required to demonstrate that transportation projects comply with the SIP. The final rules require that transportation projects must be part of a conforming Long-Range Transportation Plan (LRTP) and 4-year Transportation Improvement Program (TIP). The proposed BLRT Extension project is part of the 2040 Transitway System shown in the Council's *2040 Transportation Policy Plan* (*2040 TPP*, adopted January 14, 2015). The proposed BLRT Extension project is included in the latest version (2016–2019) of the TIP (September 23, 2015). The *2040 TPP* was found to be in conformity by FHWA and FTA on March 13, 2015.

The *2040 TPP* supports expanding transit services as a means of improving regional air quality. Chapter 4, Transportation Finance, of the *2040 TPP* describes federal funding policies that lead to coordinated investments in transportation infrastructure to mitigate congestion and improve air quality through fewer vehicle-miles traveled in private cars. Appendix E, Additional Air Quality Information, of the *2040 TPP* demonstrates that the plan conforms to the requirements of the CAA. In summary, the proposed transitway improvements are consistent with the Council's goal of improving regional air quality.

On November 8, 2010, EPA approved a request for a limited maintenance plan for the Twin Cities maintenance area. Under a limited maintenance plan, EPA has determined that there is no

requirement to estimate projected emissions over the maintenance period and that "emissions budgets in limited maintenance plan areas may be treated as essentially not constraining for the length of the initial maintenance period because it is unreasonable to expect that such an area will experience so much growth in that period that a violation of the CO NAAQS would result" (EPA, 1995).

Therefore, no regional modeling analysis for the LRTP and TIP is required. However, federally funded and state-funded projects are still subject to isolated intersection-level, or "hot-spot," analysis requirements. The limited maintenance plan adopted in 2010 determined that the level of CO emissions and resulting ambient concentrations in the Twin Cities maintenance area will continue to demonstrate attainment of the CO NAAQS. Therefore, the Council did not perform regional emissions modeling as part of the evaluation for this Final EIS. However, the Council did perform a hot-spot screening assessment, as required, which is summarized below.

Hot-Spot Screening for CO

CO is assessed by evaluating the worst-operating (hot-spot) intersections in the proposed BLRT Extension project area. EPA has approved a screening method developed by MnDOT to determine which intersections need hot-spot analysis (dotapp7.dot.state.mn.us/edms/download?docId=647184). The hot-spot screening method uses a traffic volume threshold of 79,400 entering vehicles per day (vpd) for signalized intersections affected by a project. If an affected intersection exceeds this threshold in the design year, or if a project affects one of 10 specific intersections in the Twin Cities area, then a quantitative CO hot-spot analysis is required. If an affected intersection is not one of the listed 10, and if the total traffic through the intersection is less than the 79,400-vpd benchmark, then the intersection screens out of quantitative analysis and is considered to be no threat to the area's attaining the NAAQS.

The signalized intersections that would be affected by the proposed BLRT Extension project are not among the 10 listed intersections in the approved MnDOT hot-spot screening procedure. To determine whether any intersections would exceed the 79,400-vpd benchmark, the Council obtained the traffic projections for 2040 for the three busiest intersections along the proposed BLRT Extension project for comparison. The intersections and the 2040 vehicles-per-day projections (see the proposed BLRT Extension project *Traffic and Park-and-Ride Forecast Technical Memorandum*) for each intersection are listed below.

- West Broadway Avenue and Brooklyn Boulevard: 40,200 vpd
- Bottineau Boulevard and Bass Lake Road: 46,600 vpd
- Olson Memorial Highway and Penn Avenue: 39,250 vpd

None of the above intersections would meet or exceed the screening threshold of 79,400 vpd in 2040. Given that the screening criteria indicate no potential for CO hot spots that could approach or exceed the NAAQS, quantitative hot-spot analysis is not required for transportation conformity purposes.

Table 5.10-2 lists recent (2014) monitored CO concentrations at Twin Cities monitors. Improvements in vehicle technology and in motor fuel regulations continue to result in reductions in vehicle emission rates of CO and other pollutants. The EPA MOVES emissions model estimates that CO and other pollutant emission rates will continue to fall from existing rates through 2040. Consequently, year 2040 vehicle-related CO concentrations in the study area are likely to be lower than existing concentrations, even after considering the projected increases in development-related and background traffic.

Table 5.10-2. Monitored 2014 Carbon Monoxide Concentrations vs. NAAQS

In parts per million

Monitor Site	1-Hour (2nd Maximum)	8-Hour (2nd Maximum)
9399 Lima St, Blaine	0.9	0.7
12821 Pine Bend Trail, Rosemount	0.6	0.5
2142 120th St E, Inver Grove Heights	1.0	0.9
528 Hennepin Ave, Minneapolis	1.8	0.9
1444 18th St E, Minneapolis	1.6	1.2
1088 West University Ave, St. Paul	2.7	1.6

Source: EPA AirData (www3.epa.gov/airdata) – NAAQS compliance based on 2nd maximum

The CO screening assessment and existing monitoring data show that the proposed BLRT Extension project would not cause CO concentrations that exceed state or federal standards.

Mobile-Source Air Toxics (MSATs)

Controlling air toxic emissions became a national priority with the passage of the CAAA of 1990, whereby Congress mandated that EPA regulate 188 air toxics, also known as hazardous air pollutants. EPA has assessed this list in its latest rule on the Control of Hazardous Air Pollutants from Mobile Sources (Federal Register, Vol. 72, No. 37, page 8430, February 26, 2007) and identified a group of 93 compounds emitted from mobile sources that are listed in its Integrated Risk Information System (www.epa.gov/ncea/iris).

In addition, EPA identified seven compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers from its 1999 National Air Toxics Assessment (www.epa.gov/ttn/atw/nata1999). These are acrolein, benzene, 1,3-butadiene, diesel particulate matter plus diesel exhaust organic gases (diesel PM), formaldehyde, naphthalene, and polycyclic organic matter.

FHWA provides guidance on evaluating MSATs for highway projects as part of the NEPA process, which FTA is applying to the proposed BLRT Extension project. This guidance specifies a tiered approach for MSAT evaluation.

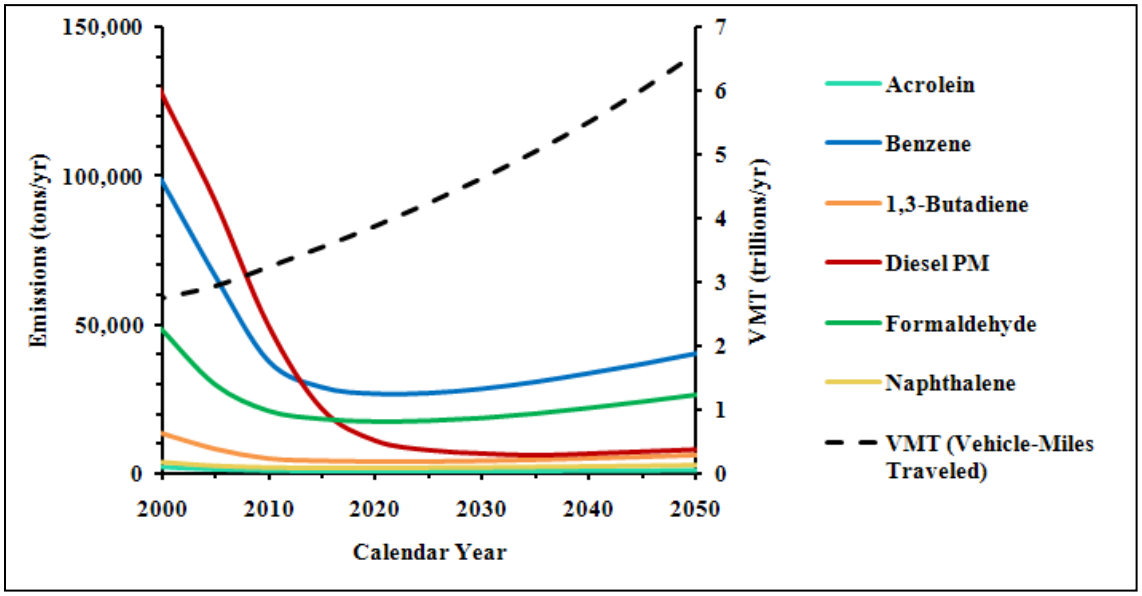
- No analysis is required for projects with no meaningful MSAT effects. These are projects qualifying as a categorical exclusion under 23 CFR Part 771.117(c), that are exempt under the CAA conformity rule, or that would have no meaningful impacts on traffic volumes or vehicle mix.
- Qualitative analysis is prescribed for projects with low potential MSAT effects. Most projects fall into this category if they do not meet the criteria for the other two categories.
- Quantitative analysis is required for major highway-capacity projects on facilities with more than 140,000 to 150,000 vpd or for intermodal freight terminal projects with high levels of diesel particulate matter.

The Council performed a qualitative evaluation of MSAT impacts for the proposed BLRT Extension project according to the FHWA guidance. This is appropriate based on the scope of improvements contemplated as part of this project, particularly modifications to roads and intersections through the proposed BLRT Extension project area. FHWA guidance states that the qualitative assessment should compare, in narrative form, the expected effects of the project on traffic volumes, vehicle mix, or routing of traffic and the associated changes in MSATs for the project alternatives, including the No-Build Alternative, based on traffic volumes, vehicle mix, and speed. The assessment should also discuss national trend data projecting substantial overall reductions in emissions because of stricter engine and fuel regulations issued by EPA.

Summary of MSAT Information

The 2007 EPA rule further requires controls that would dramatically decrease MSAT emissions through cleaner fuels and cleaner engines. According to an FHWA analysis using EPA's MOBILE6.2 model, even if vehicle activity (VMT) were to increase by 145 percent as assumed, a combined reduction of 72 percent in the total annual emission rate for the priority MSATs is projected from 1999 to 2050, as shown in **Figure 5.10-1**.

Figure 5.10-1. National MSAT Emission Trends for 1999–2050 from EPA's MOBILE6.2 Model for Vehicles Operating on Roads



Source: US Environmental Protection Agency, MOBILE6.2 model run, August 20, 2009

Note 1 Annual emissions of polycyclic organic matter are projected to be 561 tons/year for 1999, decreasing to 373 tons/year in 2050.

Note 2 Trends for specific locations might be different, depending on locally derived information on VMT, vehicle speeds, vehicle mix, fuels, emission-control programs, meteorology, and other factors.

Air toxics analysis is a continuing area of research. Although much work has been done to assess the overall health risk of air toxics, many questions remain unanswered. In particular, the tools and techniques for assessing project-specific health outcomes as a result of lifetime MSAT exposure remain limited. These limitations impede the ability to evaluate how the potential health risks posed by MSAT exposure should be factored into project-level decision-making within the context of NEPA.

Information is incomplete or unavailable to credibly predict project-specific health impacts that could occur as a result of changes in MSAT emissions associated with a proposed set of transportation alternatives. FHWA, EPA, the Health Effects Institute, and others have funded and conducted research studies to try to more clearly define potential risks from MSAT emissions associated with transportation projects. However, technical tools are not available to predict the project-specific health impacts of MSAT emissions. In compliance with 40 CFR Part 1502.22(b), FHWA has provided a discussion demonstrating that scientific techniques, tools, and data are not sufficient to accurately estimate human health impacts that could result from a transportation project in a way that would be useful to decision-makers.

Qualitative MSATs Analysis

There are two ways that highway vehicle MSAT emissions would change, as compared to the No-Build Alternative, if the proposed BLRT Extension project were implemented. One is that the passing light rail trains would briefly impede traffic near at-grade rail-highway crossings, causing more MSAT emissions in these locations because of vehicle idling, acceleration, and deceleration. The second is that, by having people ride the light rail system instead of driving to their destinations, the MSAT emissions from highway travel would tend to decrease. The second effect would outweigh the first effect, meaning that regional MSAT emissions would decrease for the proposed BLRT Extension project as compared to the No-Build Alternative.

While regional MSAT emissions would decrease with project implementation, localized emissions would tend to increase in the vicinity of at-grade rail-highway crossings. However, given that the light rail trains pass very quickly, emissions associated with idling, accelerating, or decelerating highway vehicles near these crossings should be far less than MSAT emissions near typical signalized intersections on busy streets in urban areas. (For an analysis of traffic operations at intersections along the proposed BLRT Extension project alignment, see **Section 3.3**.)

With the No-Build Alternative and the proposed BLRT Extension project, MSAT emissions would likely be lower than present levels in the design year (2040) as a result of EPA's national control programs, which are projected to reduce annual MSAT emissions by 72 percent between 1999 and 2050. On a regional basis, EPA's vehicle and fuel regulations, coupled with fleet turnover, will over time cause substantial reductions that, in almost all cases, will cause region-wide MSAT levels to be significantly lower than they are today. The magnitude of the EPA-projected reductions is so great (even after accounting for traffic growth) that MSAT emissions in the study area are likely to be lower under a wide variety of future conditions.

5.10.4.2 Construction-Phase (Short-Term) Impacts

No-Build Alternative

Construction of the proposed BLRT Extension project would have the potential to emit GHGs from construction equipment and vehicles. The short-term GHG emissions during the construction period of the proposed BLRT Extension project would be temporary, and implementation of BMPs (such as using energy-efficient construction equipment and vehicles, and limiting equipment and vehicle idling time during construction) would reduce GHG emissions from construction activities.

The FHWA Infrastructure Carbon Estimator (ICE) model was used by the Council to estimate construction and maintenance GHG emissions. The ICE model estimates the lifecycle energy and GHG from the construction and maintenance of transportation facilities.

Construction activities for the proposed BLRT Extension project are planned between 2018 and 2021, with the majority of heavy construction occurring in 2018 through 2020. Therefore, the Council assumed that a 3-year period of construction would be appropriate for use in the model. Construction project components (miles of light rail, number and type of bridges, number of stations, type and size of park-and-rides, and other project components) as input into the ICE model were based on the project definition presented in **Chapter 2 – Alternatives** (see **Table 2.5-2**).

GHG emissions are categorized as upstream emissions materials or direct emissions for routine construction activities. Model results are shown in **Table 5.10-3** as metric tons (MT) of carbon dioxide equivalent (CO_2e) per year. Changes in GHG emissions due to direct emissions from the construction of the proposed BLRT Extension project would be minimal. Most of the GHG emissions presented in **Table 5.10-3** would be from the indirect upstream emissions caused by the development of construction materials, including raw material extraction, production, and transportation.

Table 5.10-3. Annual Greenhouse Gas Emissions during Construction

Emission Type	Roadway Reconstruction/ Park-and-Ride Construction (MT CO_2e/year)	Bridges (MT CO_2e/year)	Rail (MT CO_2e/year)	Total (MT CO_2e/year)
Upstream emissions – materials	1,827	314	15,295	17,436
Direct emissions – construction	996	83	2,297	3,376
Direct emissions – routine maintenance	N/A	N/A	N/A	379
Total	**2,823**	**397**	**17,592**	**21,191**

Source: Council, 2016f

Currently, no quantitative GHG emission thresholds at federal or state levels are applicable to the proposed BLRT Extension project. The proposed BLRT Extension project's construction emissions would be temporary, and the Council would make an effort to minimize the amount of emissions generated during construction. If amortized over the life of the proposed BLRT Extension project, the GHG emissions would be minimal. In addition, the proposed BLRT Extension project is included in the Regional Transportation Plan and the Transportation Improvement Program. These transportation plans consider climate change mitigation, adaptation, and resilience for sustainable development of the region. Therefore, GHG emissions from the proposed BLRT Extension project would not hinder the region's GHG emission-reduction efforts.

No other construction-phase impacts to air quality are anticipated.

Proposed BLRT Extension Project

Constructing the proposed BLRT Extension project would affect traffic volumes and operations on roads in and around the study area. During construction, some intersections might need to temporarily operate with reduced capacities or be temporarily closed. The Council expects that, under these conditions, traffic would detour to parallel roads near the construction area. This increased traffic would temporarily increase emissions and concentrations of air pollutants near homes and businesses.

In addition to traffic-related emission increases, construction activities can also cause higher concentrations of air pollutants. Construction equipment powered by fossil fuels emits the same air

pollutants as highway vehicles. Exposed earthen materials can also produce increased particulate matter when they are moved or disturbed by wind. The BMPs described in **Section 5.10.5** would ensure that concentrations of air pollutants are kept at the lowest possible levels during the construction phase.

5.10.5 Avoidance, Minimization, and/or Mitigation Measures

Long-Term Mitigation Measures. The analysis presented in this Final EIS demonstrates that air pollutant concentrations during the operating phase of the proposed BLRT Extension project would not exceed the NAAQS; therefore, no mitigation measures are necessary. The State of Minnesota does not require permits related to air quality for projects of this type.

The Council estimates that operation of the proposed BLRT Extension project would slightly reduce GHG emissions compared to the No-Build Alternative because of the reduction in automobile traffic. Thus, the proposed BLRT Extension project would help reduce any effects of GHG emissions on climate.

Short-Term Mitigation Measures. Given the scattered, intermittent, and temporary nature of construction activities, the Council does not expect any exceedances of ambient air quality standards during the construction phase of the proposed BLRT Extension project. However, the contractor will implement a series of BMPs during construction to control dust. These BMPs could include the following preventive and mitigation measures:

- Minimize land disturbance during site preparation
- Use watering trucks to minimize dust
- Cover trucks while hauling soil or debris off site or transferring materials
- Stabilize dirt piles if they are not removed immediately
- Use dust suppressants on unpaved areas
- Minimize unnecessary vehicle and machinery idling
- Revegetate any disturbed land post-construction

The Council will develop traffic-control measures in subsequent stages of the project to address detours and the flow of traffic.

Construction would cause an unavoidable temporary increase in GHG emissions because of both direct emissions from construction equipment exhaust and indirect emissions from production of construction materials such as steel and concrete. However, in the long term, these emissions would tend to be offset by the net reductions in emissions from project operation.

5.11 Energy

This section reports the estimated changes in regional energy consumption due to the No-Build Alternative and the proposed BLRT Extension project.

5.11.1 Regulatory Context and Methodology

The analysis results are reported in British thermal units (BTU) per mile as calculated from the VMT reported for each alternative by the Twin Cities Regional Travel Demand Model. A BTU is a commonly used unit of energy that represents the amount of heat energy needed to raise the temperature of 1 pint of water by 1 degree Fahrenheit. Energy consumption factors are based on estimates of average energy consumption rates.

The energy impact of the proposed BLRT Extension project was determined by comparing the total energy consumption of the proposed BLRT Extension project to that of the No-Build Alternative. The amount of energy used per mile by each mode of transportation is presented in **Table 5.11-1**. By multiplying these energy-use factors by the total miles traveled, annual energy use can be estimated.

Table 5.11-1. Energy Consumption Factors

Travel Mode	Factor (BTU/Vehicle-Mile)
Light rail transit	61,645
Heavy duty vehicles	21,463
Bus	35,958
Passenger vehicles	5,692

Source: Transportation Energy Data Book: Edition 31 (2012), US Department of Energy, Oak Ridge National Laboratory

5.11.2 Study Area

The study area for energy includes the seven-county metropolitan area, with an emphasis on anticipated changes in travel patterns and bus operations associated with the proposed BLRT Extension project. The focus is on direct energy use; that is, the energy consumed through the operation of vehicles including automobiles, buses, and trucks.

5.11.3 Affected Environment

The study area is primarily urban with undeveloped land at the north end. Development along the proposed BLRT Extension project alignment includes residential, business, industrial, institutional, park, and transportation uses. Existing land uses along the proposed BLRT Extension project alignment are identified and described in **Section 4.1**.

5.11.4 Environmental Consequences

5.11.4.1 Operating-Phase (Long-Term) Impacts

The long-term operational effects of the No-Build Alternative and the proposed BLRT Extension project are presented in **Table 5.11-2** and are discussed below.

Table 5.11-2. Energy Use in 2040

Vehicle Type	No-Build Alternative	Proposed BLRT Extension Project
2040 Annual VMT (in thousands)[1]		
Light rail	9,218	12,050
Heavy-duty vehicle	1,164,926	1,164,926
Bus	71,684	71,856
Passenger car	36,303,648	36,250,920
Total[2]	**37,549,475**	**37,499,751**
2040 Annual Energy Consumption (billion BTU)		
Light rail	568	743
Heavy-duty vehicle	25,003	25,003
Bus	2,578	2,584
Passenger car	206,640	206,340
Total	**234,789**	**234,670**
Difference from No-Build	—	(119)

[1] Based on VMT data for seven-county metro area (Council, 2015b).
[2] Totals will not always exactly match the summed values, due to rounding of each of the summed values as shown in the table.

No-Build Alternative

The annual regional direct energy consumption for on-road and light rail activity under the No-Build Alternative is estimated at about 234.789 trillion BTU based on output from the Twin Cities Regional Travel Demand Model as modified for the proposed BLRT Extension project.

Proposed BLRT Extension Project

The proposed BLRT Extension project would have slightly lower energy consumption than the No-Build Alternative, primarily because of reduced passenger car miles and energy use, which would more than offset the energy use of the light rail vehicles and the slight increase in energy use for buses. The estimated annual regional direct energy consumption for the proposed BLRT Extension project is 234.670 trillion BTU. The energy savings in 2040 for the proposed BLRT Extension project compared to the No-Build Alternative are estimated at 119 billion BTU annually.

5.11.4.2 Construction-Phase (Short-Term) Impacts

No-Build Alternative

There would be no construction-phase impacts to energy use from the No-Build Alternative.

Proposed BLRT Extension Project

Energy would be required to construct the proposed BLRT Extension project, to produce the raw materials used in construction, and to operate construction equipment. Energy use would be local and temporary. Compared to the energy consumption of the entire Twin Cities Metropolitan Area, the construction of the proposed BLRT Extension project would not have a substantial effect on regional energy consumption.

5.11.5 Avoidance, Minimization, and Mitigation Measures

Long-Term Mitigation Measures. No mitigation measures are warranted for long-term impacts to energy, because, unlike the No-Build Alternative, the proposed BLRT Extension project would decrease total annual regional energy consumption. During operation, the proposed BLRT Extension project would use regenerative braking, similar to the Blue and Green Lines currently in operation. Energy generated by light rail vehicle (LRV) braking can be used by another LRV if they are in the same power section at the same time; otherwise, the energy would dissipate as heat from the top of the LRV.

Although not required, there are opportunities to reduce energy consumption, which include constructing energy-efficient structures such as park-and-ride facilities, light rail stations, and the OMF. The Council assessed these energy-saving opportunities and appropriate energy-saving measures, and the following have been incorporated into the proposed BLRT Extension project:

- Follow the State of Minnesota Sustainable Building Guidelines (MSBG-B3) (similar to standards required to achieve Leadership in Energy and Environmental Design [LEED] certification).
- Use highly efficient LED (light-emitting diode) lighting for the proposed BLRT Extension project (street lighting to building lighting).
- Maximize use of daylight at the OMF, supplemented with lighting control management software.
- Coordinate with Xcel Energy for efficient OMF heating, cooling, and lighting control systems.
- Use energy recovery units in the OMF.
- Use a high-efficiency chiller at the OMF.
- Use condensing boilers at the OMF.
- Use a closed-cell cooling tower (free winter cooling).

Short-Term Mitigation Measures. No mitigation measures are warranted for short-term impacts to energy because the impacts would be local and minor compared to regional energy consumption.