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1 Introduction

1.1 Purpose of Feasibility Study

The purpose of this Feasibility Study is to pursue the stated goals and guiding principles for the Central Corridor. The University of Minnesota has undertaken this study to investigate the feasibility and potential benefits of an alternate “Northern” Alignment for the CCLRT through the U of M. This Feasibility Study is not intended to be an exhaustive or definitive analysis of the Northern Alignment. Additional engineering, design, environmental, and cost effectiveness analysis is required to further advance the Northern Alignment through the regional, state, and federal project development process.

1.2 Background

The 11-mile Central Corridor Light Rail Transit (CCLRT) line runs between downtown St. Paul and downtown Minneapolis, serving the heart of the Twin Cities Metropolitan Area. It connects some of the largest traffic generators in the Twin Cities, notably the two downtowns, Midway area, and the University of Minnesota (U of M or University). The University is the third largest trip generator in the State of Minnesota, with over 80,000 people coming to its Twin Cities campus daily. Approximately two-thirds of daily commuters to campus walk, bike, bus, or carpool. The U of M generates an estimated one-third of the projected daily riders for CCLRT. This high modal split makes the U of M’s population more transit dependent than other parts of the region.

As part of the Environmental Impact Statement (EIS) Scoping process, the Central Corridor Transit Study stakeholders group adopted the following three project goals. These three goals were the basis for determining the preferred alternative and corridor alignment.

The Central Corridor Transit Study stakeholders group adopted three project goals for determining the preferred alternative and corridor alignment:

Goal 1: Economic Opportunity and Investment

Goal 2: Communities and Environment

Goal 3: Transportation and Mobility

Goal 1: Economic Opportunity and Investment – The Central Corridor should support investments in infrastructure, business, and community that sustain the heart of the region. It should promote a reliable transit system that allows an efficient, effective land use development pattern in major activity centers which minimizes parking demand, facilitates the highest and best use of adjacent properties, and gives employers confidence that employees can travel to and from work.

Goal 2: Communities and Environment – The Central Corridor should facilitate the preservation and enhancement of neighborhoods within the corridor; acknowledge the individual character and aspirations of each place served and of the region as a whole; and support regional goals for cleaner air and water, more efficient energy use, and a safer and healthier environment.

Goal 3: Transportation and Mobility – The Central Corridor should create transportation improvements that add people carrying capacity, minimize operating costs, improve operating efficiency, provide high quality modal alternatives, and reinforce the region’s transportation system. It should expand opportunities for all users to move freely to, through, and within the Central Corridor as well as enhance the existing transportation infrastructure to serve the high number of transit dependent persons in the corridor.

The appropriate placement of transit service, in particular a future CCLRT line that connects the Minneapolis campus to the regional transit system, is paramount to the continued functioning of the University and its community. The existing U of M roadway and transit system functions adequately today. Placement of the CCLRT line will affect existing mission-critical activities, including academic and research programs, access to the U of M hospital and clinics, and future campus redevelopment and expansion opportunities. To mitigate the potential impacts on the campus, the University had been supporting an alternative that placed the LRT line through the University in a tunnel following the alignment of Washington Avenue.

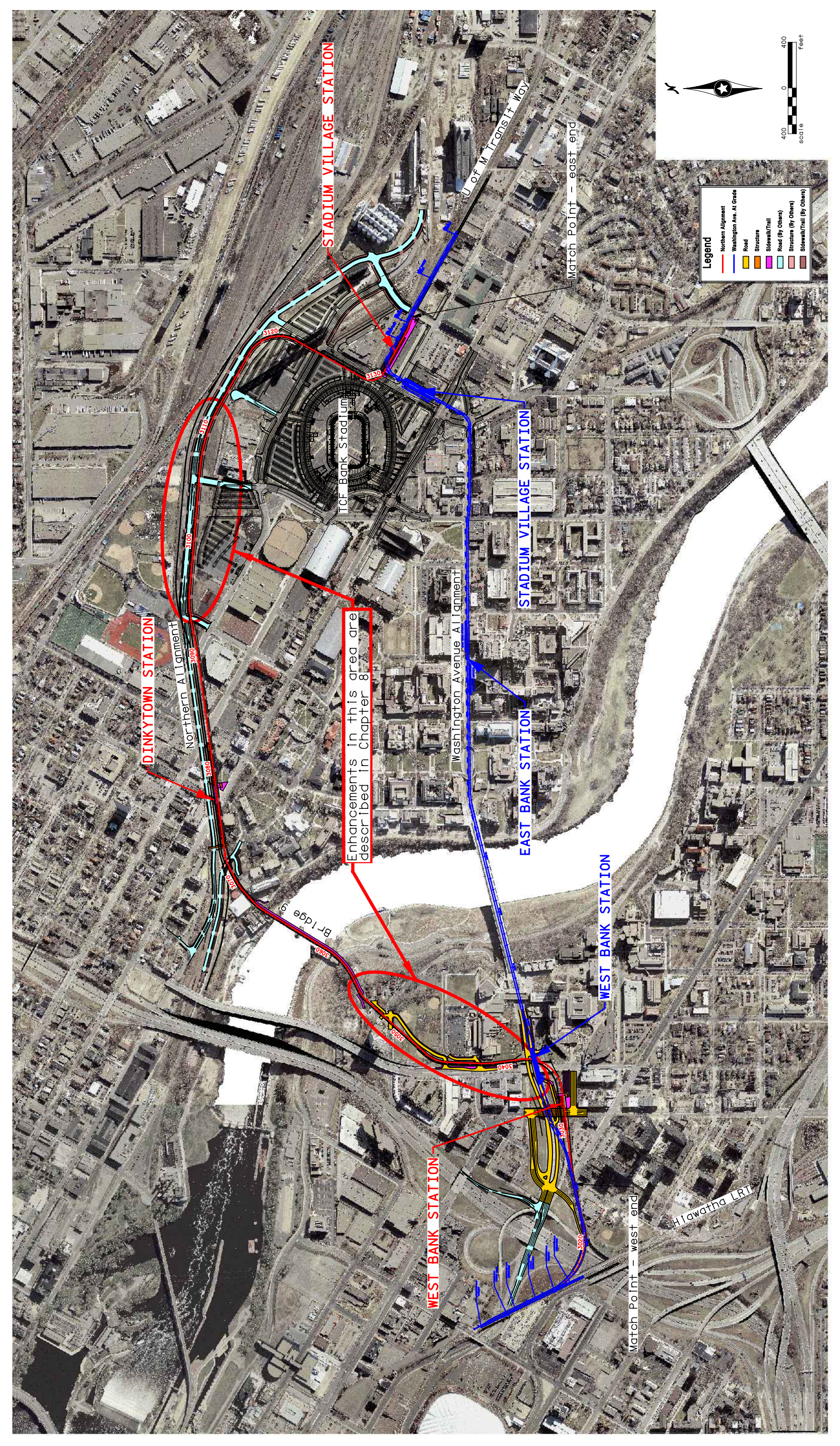
On February 27, 2008, the Metropolitan Council approved an at-grade Washington Avenue Alignment for the CCLRT, citing that a CCLRT tunnel under Washington Avenue would be cost prohibitive. The current CCLRT Alignment in the vicinity of the U of M, referred to as the “Washington Avenue” Alignment is completely at-grade and connects to the existing Hiawatha LRT line west of I-35W. It then follows Washington Avenue through the West Bank campus, across the Mississippi River, and through the East Bank campus. On the east end of campus, the alignment shifts to the northeast, providing a station at the new TCF stadium, then enters the U of M Transitway enroute to University Avenue and downtown St. Paul. This alignment is shown in blue in Figure 1.

Based upon expressed concerns from the U of M with the ability of the current at-grade CCLRT Washington Avenue Alignment to meet the Central Corridor’s stated project goals, impacts to the University’s mission-critical services, safety, and traffic circulation in and around the U of M’s Minneapolis campus, consideration of an alternate route from the current Washington Avenue Alignment between I-35W and the U of M Transitway was undertaken. Identification and due diligence of the Northern Alignment (depicted in red in Figure 1) as a potentially feasible alternative to the Washington Avenue Alignment is being pursued by the U of M in good faith to better understand the potential impacts and benefits of the Northern Alignment.

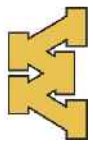


View of the proposed Northern Alignment, west toward the 5th Street SE Bridge, Dinkytown and downtown Minneapolis.

The Northern Alignment joins the Hiawatha line at the same location as the Washington Avenue Alignment. From there the Northern Alignment crosses over I-35W to the south side of Washington Avenue to a station located under Cedar Avenue S. Exiting this first station, the alignment turns north, crossing Washington Avenue to parallel 19th Avenue S to 2nd Street S after which the alignment swings to the northeast to the site of the existing Mississippi River Bridge 9. After crossing a new bridge at this site, the alignment enters the right-of-way of an existing railroad and follows this path to 21st Avenue SE. A second station is located on this right-of-way at 14th Avenue. The alignment leaves the railroad right-of-way at 23rd Avenue SE and proceeds south to the University of Minnesota Transitway, curving to the east where a third station is located between 23rd Avenue SE and 25th Avenue SE. At 25th Avenue SE, the alignment rejoins the current CCLRT Alignment and continues east along the U of M Transitway. A more detailed description of the Northern Alignment, its stations, and operations are discussed in the subsequent chapters of this feasibility study.



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Washington Avenue Alignment and Northern Alignment

Central Corridor LRT Northern Alignment Alternative
University of Minnesota

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Figure 1

Since the Central Corridor Management Committee meeting of April 30, 2008, continued feasibility design development of the Northern Alignment has resulted in further enhancements which are described in Chapter 8 of this report.

1.3 University's Guiding Principals

In an effort to support and complement the stated goals for the Central Corridor and the region in the Draft Environmental Impact Statement (DEIS), the University adopted the following five guiding principles for the CCLRT.

1. The optimal operation of the CCLRT line is vital to a strong, regional, and multi-modal transportation system.
2. Safety is fundamental to the success of the operation of the CCLRT line.
3. The CCLRT should realize development opportunities while reducing impact to the urban environment.
4. The CCLRT should support a balanced, integrated and multi-modal transportation system in the vicinity of the U of M campus.
5. The functionality and aesthetics of the University campus must be enhanced by the CCLRT.

1.4 Northern Alignment Feasibility Criteria

In order to determine the feasibility of the Northern Alignment, the following four feasibility criteria and respective questions were used to evaluate the Northern Alignment's overall feasibility.

1. Engineering, Safety, and Accessibility

- Is the Northern Alignment feasible from an engineering basis?
- Does it meet FTA standards for light rail systems?
- Does the Northern Alignment accommodate existing and planned roadways and trails?
- Does the Northern Alignment ensure safe, inter-modal interactions by minimizing the number of potential LRT conflict points with public roads, private driveways and pedestrian crossings?
- Are the three Northern Alignment stations accessible to pedestrians, bicyclists, and people with disabilities?

2. CCLRT and Roadway Traffic Network Operations

- Does the Northern Alignment enhance or adversely impact the overall operations of the CCLRT with regard to ridership, travel time, and equipment requirements?
- Does the Northern Alignment provide reasonable and appropriate roadway circulation in and around the vicinity of the U of M that does not result in failing intersections?

3. Environmental and Land Use Impacts

- Do reasonable mitigation measures exist to address potential environmental impacts to make the Northern Alignment feasible?
- Do compatible land uses currently exist and is their potential for future development along the Northern Alignment?

4. Cost Effectiveness

- Is the fully-loaded capital cost for the Northern Alignment reasonable?
- Does the proposed Northern Alignment have a Cost Effectiveness Index (CEI) that qualifies for federal funding?

2 Northern Alignment

2.1 Proposed Track Alignment ⁴

The proposed CCLRT Alignment in the vicinity of the University of Minnesota, known as the “Northern” Alignment is an alternative to the current CCLRT Alignment from I-35W to the U of M Transitway (Figure 1). The Northern Alignment joins the Hiawatha line at the same location as the CCLRT Alignment. From there it crosses over I-35W to the south side of Washington Avenue to a station located under Cedar Avenue. Exiting this first station, the alignment turns north, crossing Washington Avenue to parallel 19th Avenue S to 2nd Street S, after which the alignment swings to the northeast to the site of an existing Mississippi River bridge (Bridge 9). After crossing a new bridge at this site, the alignment enters the right-of-way of an existing railroad and follows this path to 23rd Avenue. A second station is located on this right-of-way in the vicinity of 14th Avenue SE. The alignment continues east to 23rd Avenue SE where it turns south and parallels 23rd Avenue SE to the U of M Transitway, curving to the east where a third station is located between 23rd Avenue SE and 25th Avenue SE, just south of the Transitway. From this point, the alignment rejoins the current CCLRT Alignment. In order to facilitate discussion of the Northern Alignment, it is separated into the following three segments:

1. **West Bank** – From I-35W to the East Bank of the Mississippi, including West Bank Station and the river crossing at Bridge 9 (Figure 2).
2. **East Bank** – From the East Bank of the Mississippi through Dinkytown to 21st Avenue SE, including the Dinkytown Station (Figure 3).
3. **Stadium Village** – From 21st Avenue SE to the U of M Transitway, including the Stadium Village Station (Figure 4).

The entire Northern Alignment would be double-track and conform to the design specifications of the CCLRT in all other respects.

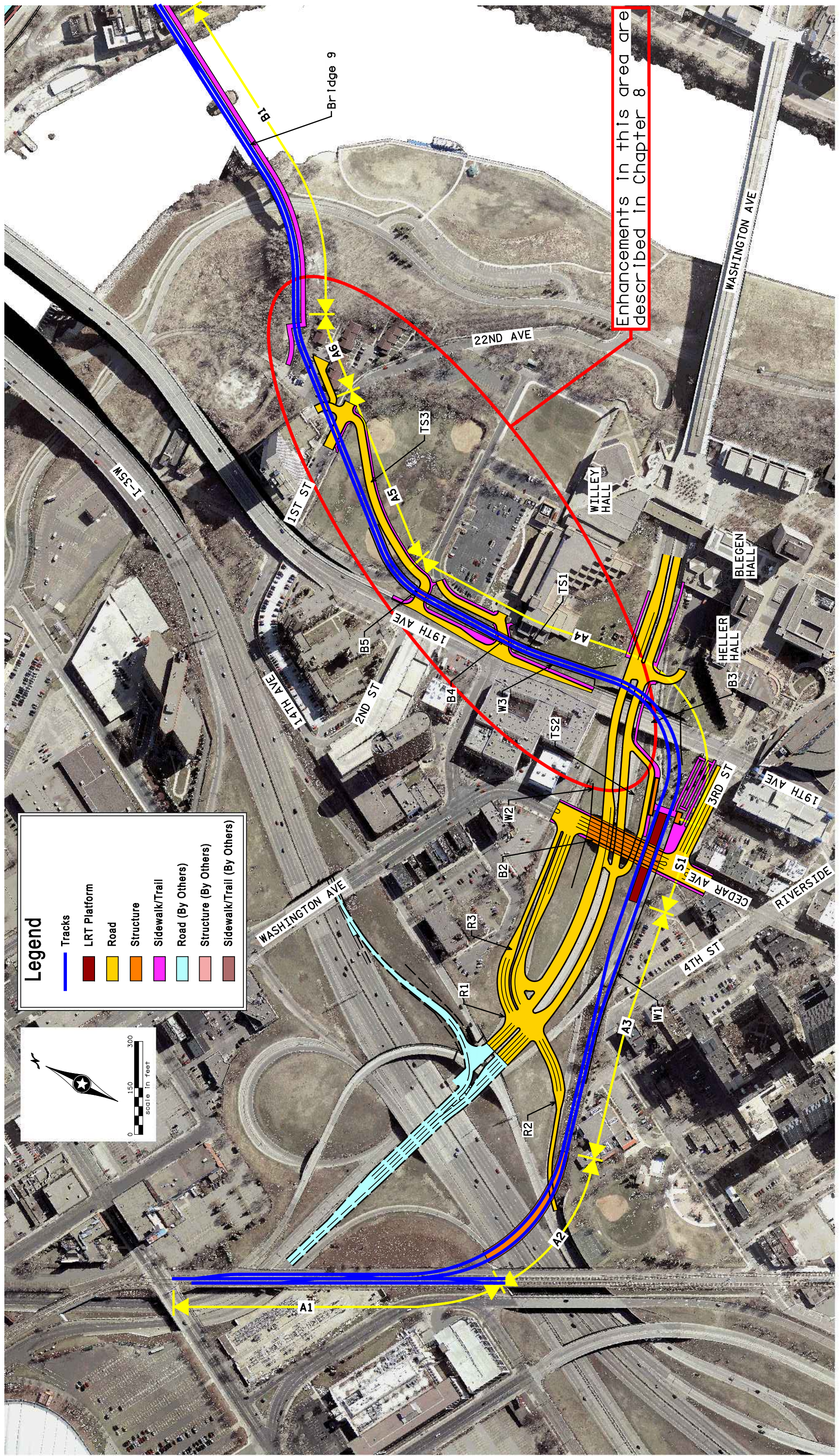
2.1.1 Track Constructability

The entire Northern Alignment would be double-track and conform to the design specifications of the CCLRT in all respects. Most of the alignment will be ballasted, although some sections will be embedded or direct fixation (Figure 5). The embedded track sections are located as follows:

- East of the West Bank Station platform to accommodate the pedestrian crossing that provides access to the station.
- At the grade crossing of Washington Avenue.
- Between the eastbound (EB) and westbound (WB) platforms at the Dinkytown Station to accommodate the pedestrian crossing that provides access to the station.
- Along 23rd Avenue SE and within the Stadium Village Station.

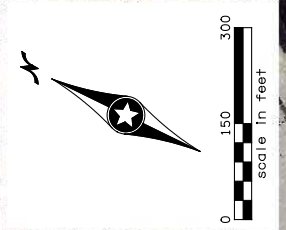
The direct fixation section is the portion of the alignment that is on the Mississippi River Bridge.

⁴ **Note:** Additional enhancements are proposed in Chapter 8 that refines the alignment and mitigates potential impacts.

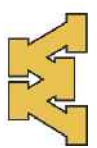


Legend

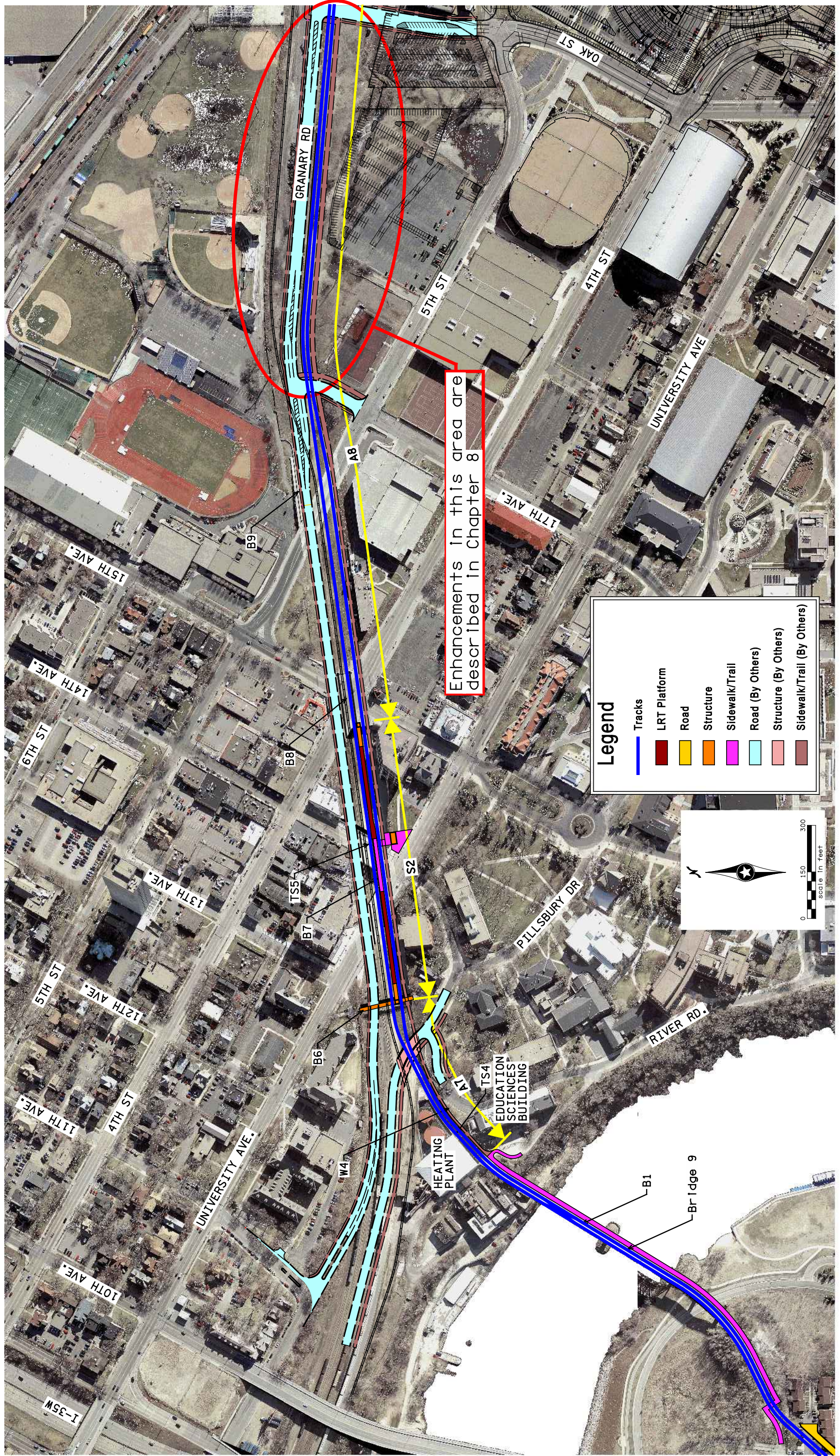
Blue line	Tracks
Red line	LRT Platform
Yellow line	Road
Orange line	Structure
Pink line	Sidewalk/Trail
Light blue line	Road (By Others)
Light pink line	Structure (By Others)
Light orange line	Sidewalk/Trail (By Others)



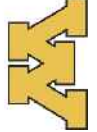
Enhancements in this area are described in Chapter 8



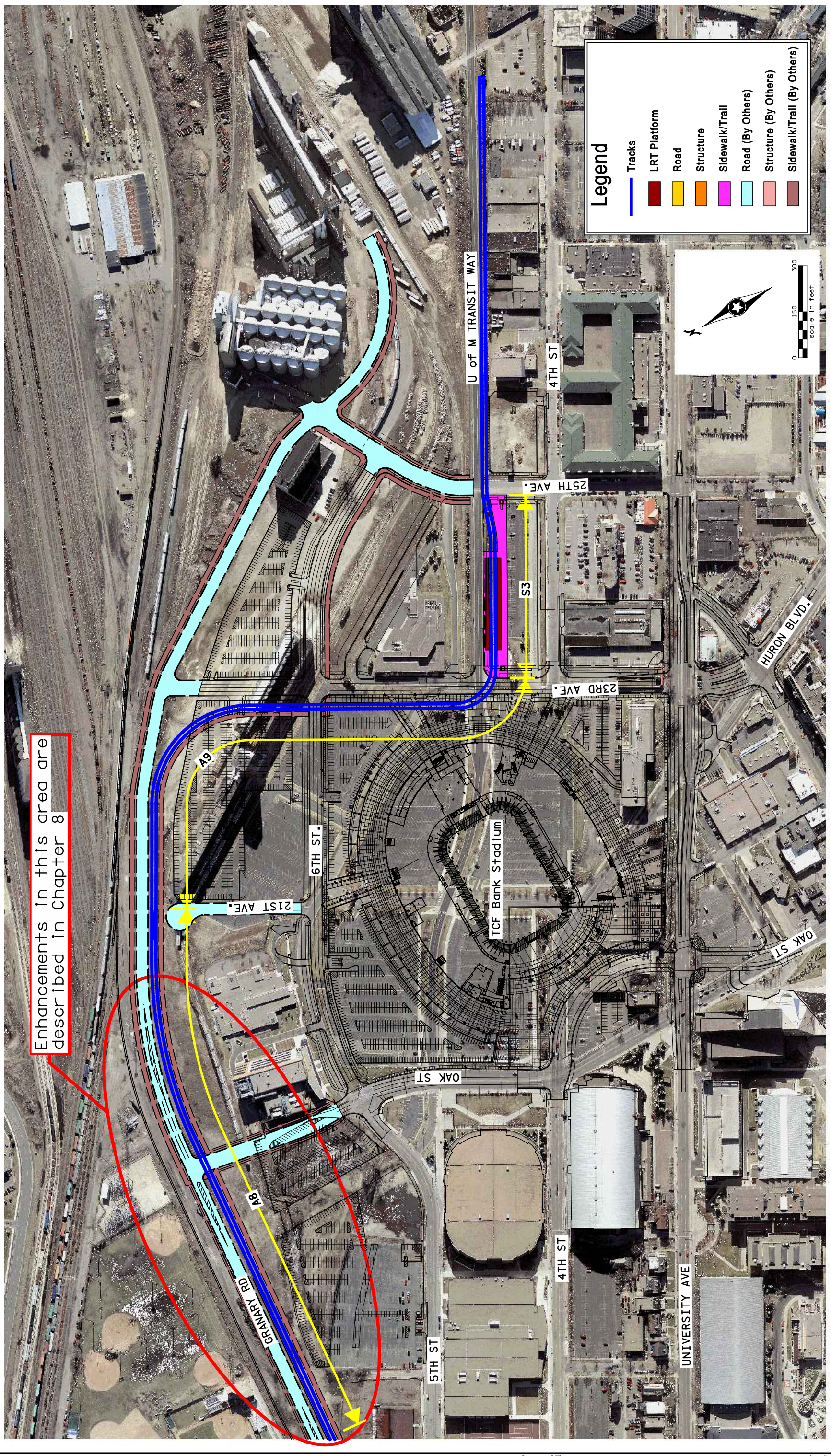
Since the Central Corridor Management Committee meeting of April 30, 2008, continued feasibility design development of the Northern Alignment has resulted in further enhancements which are described in Chapter 8 of this report.



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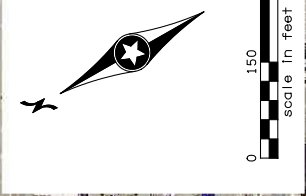
Since the Central Corridor Management Committee meeting of April 30, 2008, continued feasibility design development of the Northern Alignment has resulted in further enhancements which are described in Chapter 8 of this report.



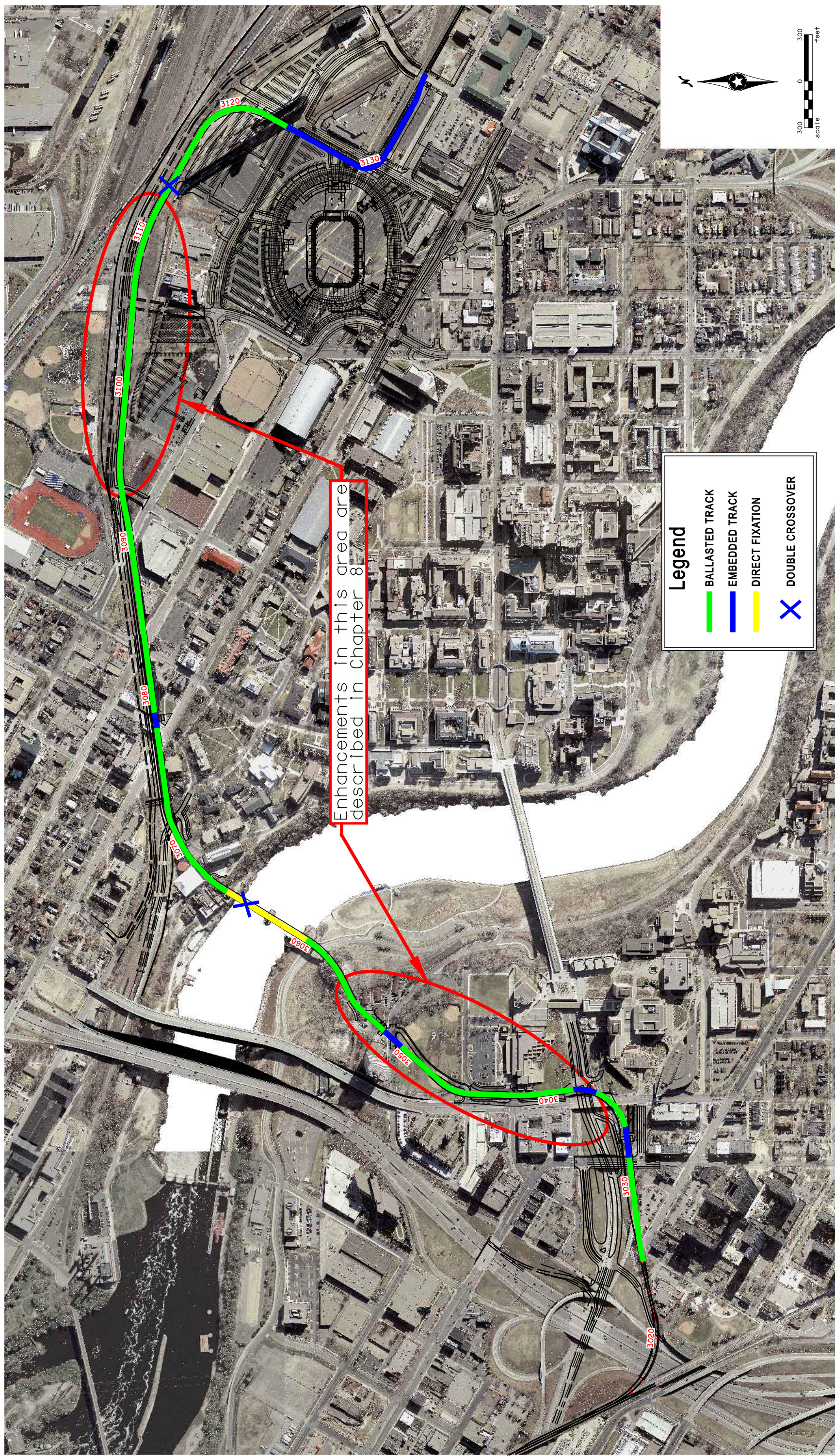
Enhancements in this area are described in Chapter 8

Legend

—	Tracks
■	LRT Platform
■	Road
■	Structure
■	Sidewalk/Trail
■	Road (By Others)
■	Structure (By Others)
■	Sidewalk/Trail (By Others)



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Legend

- BALLASTED TRACK
- EMBEDDED TRACK
- DIRECT FIXATION
- X DOUBLE CROSSOVER



TRACK TYPES

Central Corridor LRT Northern Alignment Alternative
University of Minnesota

Since the Central Corridor Management Committee meeting of April 30, 2008, continued feasibility design development of the Northern Alignment has resulted in further enhancements which are described in Chapter 8 of this report.



Figure 5

The number, design and location of crossovers would conform to Central Corridor design and Metro Transit operational requirements. Two double crossovers have been assumed within the Northern Alignment. (The number, design and location of crossovers would be determined during preliminary/final design.)

2.2 Rail Crossings

There are considerable differences between the number of impacted crossing points for the two alignments as shown in Table 1. The Washington Avenue Alignment has nine at-grade intersecting streets whereas the Northern Alignment only has four. Furthermore, there are seven private access points onto Washington Avenue compared to one on the Northern Alignment. Finally, the proposed Washington Avenue transit mall will create at-grade pedestrian crossing points along the Washington Avenue Alignment at each of the nine grade crossings. In contrast, the Northern Alignment will only intersect four pedestrian crosswalks.

As previously discussed, there are four locations where there are intersecting streets and pedestrian crossings along the Northern Alignment. Two of these at-grade public street/pedestrian crossings occur near the Stadium Village Station at the track’s intersection with 23rd Avenue SE and 6th Street SE. The other two crossings occur on the West Bank at the track’s intersection with 1st Street S and Washington Avenue. With the addition of the proposed Granary Road (including accompanying street connections) and trails/sidewalks alongside portions of the Northern Alignment, there will be two additional at-grade public intersecting streets and two more pedestrian crossings of the tracks.

**Table 1 –
Crossing Comparison***

Crossings	Northern Alignment	Washington Avenue Alignment
Intersecting At-Grade Public Streets	4	9
Intersecting At-Grade Private Access Points	0	7
Intersecting Pedestrian Crossings	4	N/A

*This table does not include pedestrian crosswalks that lead onto a station platform or crossings associated with the future construction of Granary Road.

2.3 West Bank⁵

2.3.1 Track Alignment

Beginning on the West, the CCLRT Alignment joins the Hiawatha LRT on the west side of I-35W, near the Xcel Energy sub-station (Figure 2; A1). With the addition of a single crossover, a double crossover and a third track, the junction of these two alignments allows trains from the CCLRT to interchange with the existing Hiawatha line. The Northern Alignment would join the Hiawatha line in the same manner. The CCLRT, after leaving the existing Hiawatha Alignment, crosses I-35W on a new bridge to the side slope of the northbound (NB) to eastbound (EB) ramp from I-35W to Washington Avenue (Figure 2; A2). It is at this point that the Northern Alignment deviates from the Washington Avenue Alignment.

After crossing over I-35W, the Northern Alignment would drop to the level of Washington Avenue, which is below the elevation of the surrounding development (Figure 2, A3). This would allow the track to pass underneath both the new Cedar Avenue S Bridge and the existing 19th Avenue S Bridge. The West Bank Station would be located under the Cedar Avenue S Bridge (Figure 2; S1).

After leaving the West Bank Station, the track alignment would curve to the north, cross Washington Avenue at-grade and enter what would be a 30-foot wide cut, with retaining walls on each side, passing between 19th Avenue S and the University of Minnesota Law School (Figure 2; A4). A cross-section of this cut is shown in Figure 6. The track follows this alignment to 2nd Street S, where it leaves the law school cut and crosses an open area that is owned by the University of Minnesota (Figure 2; A5).

In the vicinity of 1st Street S and 22nd Avenue S are located a group of two-story townhomes buildings (Riverbluff) and a 27-story high rise condominium building called Riverview Tower (Figure 2; A6). The 206-unit Riverview Tower would not be affected, but four of the 30 Riverbluff HUD subsidized units would be impacted to accommodate the Northern Alignment. Access to townhomes and high-rise would be re-organized off a new local road constructed in this area. Further analysis is underway regarding the impacts to the housing units to minimize the impact and provide the optimum rail separation (see Chapter 8: Northern Alignment Enhancements).

North of these apartment buildings, the alignment crosses from the West Bank to the East Bank of the Mississippi River at the site of a former railroad bridge (now carrying a recreational trail) called Bridge 9 (Figure 2; B1). West of the bridge, the former railroad alignment, which used to provide a rail connection to downtown Minneapolis, is now permanently blocked. However, to the east, the railroad alignment remains in place. The Northern Alignment would cross this bridge and enter the existing railroad corridor east of the river.

The 206-unit Riverview Tower would not be affected, but four of the 30 Riverbluff HUD subsidized units would be impacted by the Northern Alignment.

⁵ **Note:** additional enhancements are proposed in Chapter 8 that refines the alignment and mitigates potential impacts.

2.3.2 Structures

2.3.2.1 Bridges

Bridge 9

The existing Bridge Number 9, as it is commonly referred to, is not structurally capable of accommodating LRT (Figure 2; B1). Bridge 9 is a fracture critical steel Pratt truss that spans the Mississippi River and steel girder approach spans on each bank between the University of Minnesota's east and west bank campuses. The bridge is owned and maintained by the City of Minneapolis and carries the designation of City Bridge Number 7214 and Minnesota Department of Transportation Bridge Number 94246. The bridge was built in 1922 by Northern Pacific Railway. Railroad use of the bridge ended in 1981, and in 1999 the bridge was converted to bicycle and pedestrian use.



View northeast along the existing trail as it approaches Bridge No. 9 and the Mississippi River.

The existing bridge is considered fracture-critical due to the non-redundant nature of this type of structure. Fracture critical bridges are generally recommended to be replaced as they approach the end of their design life instead of being rehabilitated since the failure of a single member would likely lead to the catastrophic failure of the entire bridge. Given the age of the bridge and its fracture critical status, full replacement is proposed as part of the feasibility study. Figure 6 shows the replacement concept for Bridge 9.

Full replacement of Bridge 9, with the potential reuse of the ornamental railing or other accoutrements, is assumed for purposes of this study. The proposed replacement bridge is a four-span steel girder bridge with a concrete deck to accommodate two LRT tracks and a 15-foot wide trail for bicycle and pedestrian use. The new bridge will lie on the same alignment as the existing bridge. The new bridge would have one pier in the middle of the river utilizing the same cofferdam as the existing bridge. There would be one less pier on each bank of the river by using a deeper steel girder section than the original approach spans. It should also be noted that the existing center pier in the river has a cofferdam that was constructed in 1955 to protect the pier. This existing cofferdam will help aid the construction of the new pier.

Cedar Avenue

The Cedar Avenue Bridge across Washington Avenue would need to be replaced as part of this project (Figure 2; B2). The new bridge would be similar in size and function as the existing bridge but slightly longer to accommodate the CCLRT alignment crossing underneath on the south side. There would be sufficient width for five traffic lanes (four travel lanes and one center left turn lane) and sidewalks on each side.

The Cedar Avenue Bridge across Washington Avenue would need to be replaced as part of this project.

There would be sufficient width for five traffic lanes and sidewalks on each side.