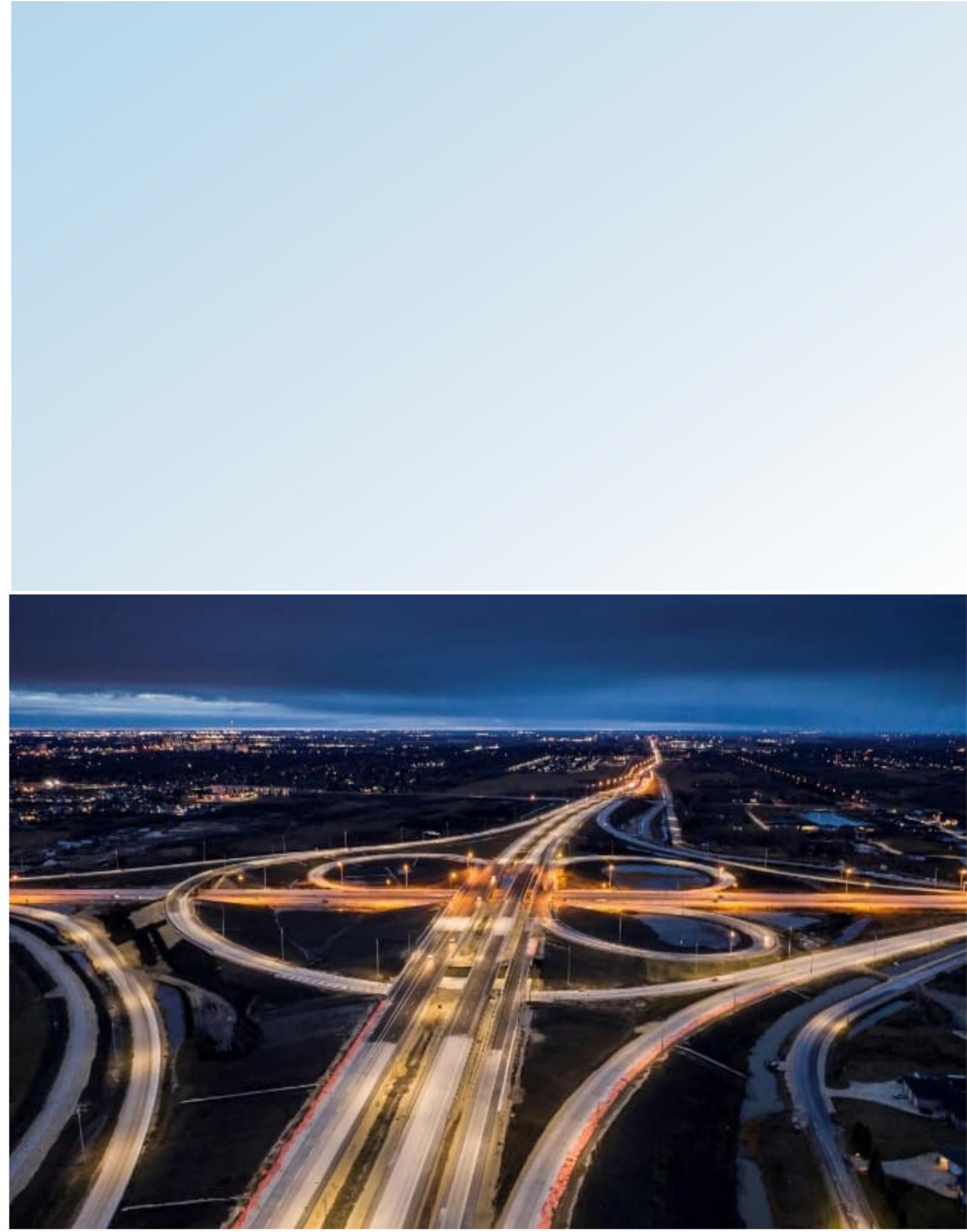


MANITOBA TRANSPORTATION AND INFRASTRUCTURE

# PTH 101 FUNCTIONAL DESIGN STUDY SUMMARY

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JANUARY 2026





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MANITOBA TRANSPORTATION AND INFRASTRUCTURE

FINAL REPORT

PROJECT NO.: 221-08250-00

DATE: JANUARY 9, 2026

WSP  
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Human Factors North	Human Factors Review

# TABLE OF CONTENTS

- 1 INTRODUCTION ..... 1**
- 1.1 Project Background ..... 1
- 1.2 Study Team & Project Oversight..... 1
- 1.3 Study Reports ..... 2
- 1.4 Public Engagement ..... 2
- 2 EXISTING CONDITIONS ..... 5**
- 3 PTH 101 DESIGN ALTERNATIVES ..... 9**
- 3.1 PTH 101 Mainline Alternatives ..... 9
- 3.2 Alignment Alternatives ..... 9
- 3.3 PTH 101 Interchange and Rail Overpass Alternatives..... 9
- 4 RECOMMENDED NETWORK .....11**
- 5 FUNCTIONAL DESIGN.....14**
- 6 FUTURE CONSIDERATIONS.....28**

## TABLES

- TABLE 4.1: PTH 101 FUTURE CAPACITY UPGRADES (ADDITIONAL LANES) ..... 11
- TABLE 4.2: PTH 101 INTERSECTION UPGRADES ..... 11

## FIGURES

- FIGURE 1-1: PTH 101 STUDY AREA ..... 4
- FIGURE 4-1: INTERCHANGE AND REALIGNMENT RECOMMENDATIONS ..... 12
- FIGURE 4-2: INTERCHANGE AND FUTURE LANE UPGRADE RECOMMENDATIONS..... 13
- FIGURE 5-1: ACCESS CLOSURE AT ASSINIBOIA DOWNS .... 15
- FIGURE 5-2: PARTIAL CLOVERLEAF INTERCHANGE AT PR 221 ..... 16
- FIGURE 5-3: PARTIAL CLOVERLEAF INTERCHANGE AT PTH 6 AND RAIL OVERPASS..... 17
- FIGURE 5-4: SEMI DIRECT INTERCHANGE AT PTH 7 ..... 18
- FIGURE 5-5: DIAMOND INTERCHANGE AT PR 409 ..... 19
- FIGURE 5-6: PARTIAL CLOVERLEAF INTERCHANGE AT PTH 8 ..... 20
- FIGURE 5-7: PARTIAL CLOVERLEAF INTERCHANGE AT PTH 9 AND PARTIAL CLOVERLEAF INTERCHANGE AT PR 204 ..... 21
- FIGURE 5-8: DIAMOND INTERCHANGE AT WENZEL ROAD.. 22
- FIGURE 5-9: DIAMOND INTERCHANGE AT GUNN ROAD ..... 23
- FIGURE 5-10: PARTIAL CLOVERLEAF INTERCHANGE AT PTH 15 ..... 24
- FIGURE 5-11: PROPOSED SEQUENCE OF CONSTRUCTION PRIORITY ..... 25

# 1 INTRODUCTION

## 1.1 PROJECT BACKGROUND

Provincial Trunk Highway (PTH) 101 is part of the ring road originally constructed in the 1950s and 1960s as a bypass route around the City of Winnipeg, and, together with PTH 100, is known as the Perimeter Highway. Prior to the construction of the Perimeter Highway, traffic not destined for Winnipeg had to use the City of Winnipeg street system and was often delayed by urban traffic congestion. The Perimeter Highway was constructed to allow through traffic on the Trans Canada Highway 1 (PTH 1) to bypass the municipal street system. PTH 101 extends from Portage Avenue at the west to Fermor Avenue at the east and is accessed via stop-controlled and signalized at-grade intersections, and interchanges.

Since the original construction of PTH 101, residential, commercial, and industrial growth in the bordering municipalities has expanded and is now adjacent to PTH 101 in several locations. This growth has resulted in an increase in urban traffic demand on PTH 101 and a decline in the percentage of traffic that is using PTH 101 as a bypass around Winnipeg.

Several studies have occurred along PTH 101, including work that led to the recent construction of the PR 425 (Saskatchewan Avenue) / Canadian Pacific Kansas City (CPKC) Glenboro Subdivision grade-separated structure, PTH 190 interchange, Northeast Pioneers Greenway / Raleigh Street grade-separated structure, and PTH 59N interchange. The most recent review of PTH 101 was the Safety Plan undertaken by Manitoba Transportation and Infrastructure (MTI), with implementation beginning in 2021 and continued in 2022 and 2023. MTI identified 13 connections for closure as part of the Safety Plan and has identified seven intersections and six rail crossings that have a potential for a future interchange/rail grade separation with PTH 101 to meet the criteria for freeway operation. In addition, there are seven existing interchanges within the study area, five of which will be examined as part of this study to determine if they require upgrading, and one existing rail overpass that will require upgrading. The MTI Safety Plan also identified three additional locations for potential AT crossings that will be examined as part of this study: along PR 425 – Saskatchewan Avenue; along PTH 9 – Main Street; and along PTH 15 – Dugald Road.

PTH 101 is:

- Part of the province’s Strategic Highway Network.
- A key link in the CentrePort Transportation hub;
- A part of the Winnipeg One Million Perimeter Highway Freeway initiative (Manitoba News Release, April 28, 2022 “Province Commits \$1.5 Billion to Highway Network Projects”);
- A key route for trade and commerce; and
- Part of the National Highway System.

The outcome of this study will be a plan that will strengthen PTH 101’s ability to support the above roles and will enhance safety for all users, ensure operational capacity to meet current and forecast traffic,

accommodate crossings by active transportation users, and accommodate truck movements (both for vehicle weight and operational safety). Addressing these issues will help reduce fuel consumption, vehicle emissions and driver delay for those using, or crossing, PTH 101. To meet the goals noted above it is necessary to develop a functional plan, including Class D cost estimates, for PTH 101 to a freeway standard and develop conceptual designs for the associated structures.

The intent is that PTH 101 will act as a fully access-controlled freeway, consistent with the recently completed plan for PTH 100; therefore, another key objective was to confirm which existing connections along PTH 101 are to be closed, as well as prepare plans for grade separations at existing rail lines. Some closures are due to an intersection being replaced with an interchange, while other closures are to meet spacing criteria for a fully access controlled facility to ensure the interchanges function as intended, maintaining traffic capacity, and maximizing safety for road users. Modifications to the existing overpass structures and PTH 101 are also required to accommodate the interim (four-lane) and ultimate (six-lane) cross-sections and current design guidelines, as well as to address operational and safety issues identified at the existing locations. **Figure 1-1** shows the PTH 101 study area.

## 1.2 STUDY TEAM & PROJECT OVERSIGHT

The PTH 101 Functional Design Study Team included individuals from the following consulting firms:

- WSP Canada Inc. – project management; transportation planning and analysis; in-service road safety review; land development and property services; roadway and bridge surveying; roadway, land drainage, utility, and structural design; railway crossings; construction staging and scheduling; cost estimating; illumination; environmental site assessments and public engagement.
- KGS Group (KGS) – geotechnical and hydrologic / hydraulics.
- ITC – noise analysis and forecasts.
- Fireseeds North Infrastructure – independent road safety audit and video traffic conflict analysis.
- Human Factors North – human factors review for in-service road safety review.

Direction for the study was provided by the MTI Steering Committee comprised of the following departmental representatives:

- Sagar Trapasia, Project Manager, Projects Management Branch, Infrastructure, Capital Projects Division.
- Olubiyi Salami, A/Director, Projects Management Branch, Infrastructure, Capital Projects Division.
- Manjit Chana, Technical Services Engineer, Eastern Region.
- Nicole Fleury, Technical Services Engineer, Eastern Region.
- Russell Andrushuk, Assistant Deputy Minister, Engineering and Technical Services Division.
- Dustin Booy, Executive Director, Highway Engineering Services.

- Blair McTavish, Assistant Deputy Minister, Transportation Operations.
- Cynthia Ritchie, Assistant Deputy Minister, Infrastructure, Capital Projects Division.
- Ryan Coulter, Director, Regional Operations, Eastern Region.
- Tara Liske, Executive Director, Regional Operations.

## 1.3 STUDY REPORTS

The study included the following project deliverables:

- **North Perimeter Highway Design Study: PTH 101 Functional Design Report** – This report outlines the functional design study completed for PTH 101 from immediately north of PTH 1W / Portage Avenue to immediately north of PTH 1E / Fermor Avenue. The recommended functional design features a fully access controlled PTH 101 with access limited to highway interchanges.
- **PTH 101 Environmental Assessment Plan** – This report outlines the Environmental Assessment (EA) completed for the study. The EA includes a desktop review and ecological field surveys to supplement existing information where practical. The objectives of the EA are to identify potential environmental concerns or sensitivities and any sites that may require additional investigations to support future land acquisition or construction.
- **PTH 101 Independent Road Safety Audit** – This report provides the results of an independent road safety audit of the proposed PTH 101 functional design and identifies possible risk factors and risk mitigations.
- **PTH 101 Traffic Operations and Safety Review Report** – This report includes the traffic volumes and operational analysis for the existing road network, future road network alternatives and future recommended functional design for PTH 101, as well as the results of the in-service road safety review and the development of potential safety countermeasures and an implementation strategy for PTH 101.
- **PTH 101 Access Management Plan** – This report describes the access management strategies and the access connections between PTH 101 and the adjacent lands for the recommended functional design. The plan seeks to improve the safety and efficiency of PTH 101 by reducing and controlling access points and provide acceptable ingress and egress from lands adjacent to PTH 101.

## 1.4 PUBLIC ENGAGEMENT

The stakeholder and public engagement strategy for this Study includes three phases of engagement:

- **Phase 1 – Preliminary Stakeholder Engagement:** The first phase introduced the study, communicated the project's scope and timing, and gathered initial feedback on the project.

- **Phase 2 – Present Roadway and Interchange Alternatives:** The second phase presented the conceptual design options for the roadway and interchanges.
- **Phase 3 – Present Study Recommendations to Stakeholders:** The third phase presented the study recommendations for PTH 101 and collected stakeholder feedback on the preferred options.

### PHASE 1 PUBLIC ENGAGEMENT SUMMARY

Phase 1 of public engagement was completed in February 2023 and included group stakeholder meetings with associated municipalities (six meetings in total), group stakeholder meetings with a variety of stakeholder groups (six meetings in total), virtual engagement on MTI's website and a project newsletter.

Overall, the feedback collected during Phase 1 from the stakeholders was positive. The prominent themes derived from the stakeholder events were as follows:

- That active transportation (AT) be considered in the design of PTH 101 at strategic locations.
- That coordination occurs between this study and other projects in the area such as the Headingley Bypass, Oakbank Corridor, Chief Peguis Extension, and the Capital Region Plan.
- That noise attenuation be incorporated to reduce the noise experienced by nearby residential developments.
- That consideration be made for maintaining access to existing businesses located directly on the highway.
- That an interchange at Pipeline and PTH 101 be prioritized due to safety concerns.
- That traffic impacts from CentrePort be incorporated into the design.

### PHASE 2 PUBLIC ENGAGEMENT SUMMARY

Phase 2 of public engagement was completed in January 2024 and included group stakeholder meetings with associated municipalities (five meetings in total), group stakeholder meetings with a variety of stakeholder groups (four meetings in total), group meetings with potentially impacted landowners (four meetings in total), Indigenous rights holder meetings as requested, two public open houses, and virtual engagement on the EngageMB website.

Overall, feedback collected from stakeholders during Phase 2 was mixed. There was general support for improved safety at intersections and improved traffic flow throughout the Perimeter.

There was also concern associated with negative impact to landowners in terms of direct property access and acquisition, the closing of access from Sperring Avenue to the loop at PTH 101 and Henderson Highway in the northeast quadrant, the large footprint of proposed design alternatives and the fragmentation of farmland.

Overall, the project received positive feedback through the Phase 2 EngageMB survey with respondents rating the project as having a very positive or positive impact to trade and goods movement (70 per cent), traffic movement (74 per cent), access (68 per cent) and safety (74 per cent), while recognizing potential

impacts to personal property or business. This was a significantly positive response to the project overall from the EngageMB survey.

### PHASE 3 PUBLIC ENGAGEMENT SUMMARY

Phase 3 of public engagement was completed in February 2025 and included meetings with associated municipalities (five meetings in total), group stakeholder meetings with a variety of stakeholder groups (five meetings in total), group meetings with directly impacted landowners (four meetings in total), Indigenous Rights Holder meetings as requested, two public open houses, virtual engagement on the EngageMB website, and individual directly impacted landowner meetings as requested.

Overall, feedback collected during Phase 3 was generally positive. Some impacted landowners expressed concern about property requirements and timing for expropriation. There was interest in priorities and timing of construction projects to execute the overall plan. There was general support for improved safety at intersections and improved traffic flow throughout the Perimeter. There was also concern associated with negative impact to landowners in terms of noise, direct property access and acquisition, the closing of accesses to PTH 101 and associated increased traffic on municipal roads in residential areas, and frequency and clarity of service road accesses for agricultural and emergency vehicles.

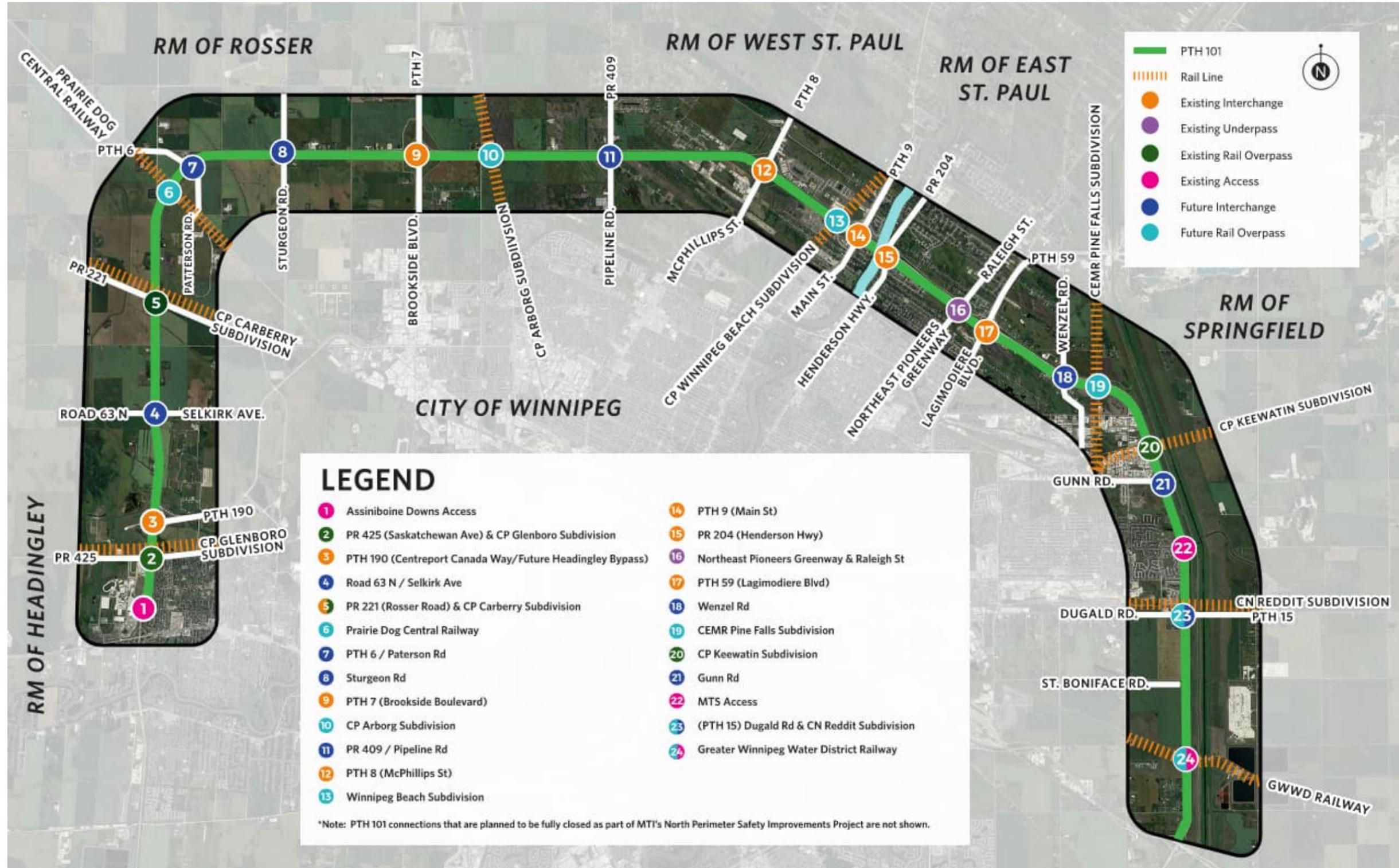


Figure 1-1: PTH 101 Study Area

## 2 EXISTING CONDITIONS

The existing conditions review was conducted to gain an understanding of the study area. The following sections summarize the reviews, investigations and analyses that were conducted. More details for these sections are provided in the *North Perimeter Highway Design Study: PTH 100 Functional Design Report*.

### PROPERTY BOUNDARIES & OWNERS

Property boundaries and landowners within the study area were identified. Parcel data for Winnipeg and the rural municipalities is publicly available. The City of Winnipeg and local municipalities were contacted to obtain land ownership information. The parcel and land ownership information was used throughout the study to consult with landowners whose properties were within the study area and identify directly impacted properties and landowners.

### LAND USE & DEVELOPMENT PLANS

The PTH 101 study area encompasses land through six municipalities: the City of Winnipeg, the Rural Municipality (RM) of Headingley, the RM of Rosser, the RM of West St. Paul, the RM of East St. Paul and the RM of Springfield. The study included a review and analysis of relevant Development Plan designations and policies, and any Secondary Plans from the City of Winnipeg and the RMs, including the Inland Port Special Planning Area Regulation.

### TRANSPORTATION PLANS

The study included a review and analysis of relevant Transportation Plans within the Winnipeg Capital Region that could influence or impact the functional plan for PTH 101, including the City of Winnipeg Transportation Master Plan, Capital Region Transportation Master Plan, Transportation Driving Growth: A Strategy for Manitoba's Capital Region, and Inland Port Special Planning Area Regulation.

### ROADWAY NETWORK

PTH 101 is the northern portion of the Perimeter Highway that surrounds the City of Winnipeg. It extends from PTH 1W (Portage Avenue) to PTH 1E (Fermor Avenue) and is currently a four-lane divided highway with a speed limit of 100 km/h or 80 km/h (in the vicinity of existing traffic signal-controlled intersections). Connections to PTH 101 are accommodated at either signalized intersections, unsignalized intersections or interchanges. MTI closed median openings at the majority of unsignalized locations along PTH 101 as part of *North Perimeter Highway Safety Plan*.

### TRAFFIC OPERATIONS & SAFETY

A traffic operations and safety review was conducted to identify and review any existing operational and safety issues and provide recommendations for the functional design. The review included a pavement condition assessment, roadway geometric review, traffic counts, existing and forecast traffic volumes, traffic operational analysis, historical collision review, in-service road safety review, and existing guide signs

review. The results of the traffic operations and safety review are summarized in the *Traffic Operations and Safety Review Report*.

Annual average daily traffic volumes vary along PTH 101, with the highest forecast volumes occurring between PTH 7 (Brookside Boulevard) and PTH 59 (Lagimodiere Boulevard) and peaking between PTH 9 (Main Street) and PR 204 (Henderson Highway). The lowest volumes are between Wenzel Street and PTH 15 (Dugald Road). An operational analysis of the PTH 101 mainline was conducted to determine the number of lanes that are required for the existing and future horizon years. The analysis found that six-lanes will be required on certain segments of PTH 101 in the next 30 years to accommodate forecast traffic volumes. A traffic analysis for the existing conditions was conducted to establish a baseline level of service for each of the existing intersections and interchanges. Several of the existing at-grade intersections have operational deficiencies that will be exacerbated in future years as traffic volumes increase.

A total of 1,266 collisions were recorded along the PTH 101 mainline in both directions during the seven-year analysis period with 949 property damage only (PDO) collisions, 312 injury collisions and five fatal collisions. The mainline collisions include collisions that occurred on PTH 101 near the at-grade intersections. The locations with the highest collision frequencies correlate well with the locations with highest traffic volumes.

A total of 423 collisions were recorded at at-grade intersections along PTH 101 during the analysis period with 298 PDO collisions, 123 injury collisions and two fatal collisions. Rear end collisions were the most common configuration for collisions at the signalized intersections and following too closely was identified as the most common primary contributing factor. Leaving stop sign before safe to do so was commonly identified as a contributing factor for collisions at the two-way stop-controlled intersections.

### RAIL CROSSINGS

There are nine rail crossings along PTH 101 that were investigated as part of this study. All at-grade rail crossings in the study area are currently equipped with active warning systems. In all cases, if changes to a crossing are made, the warning system will be required to interconnect with advance Prepare to Stop at Railway Crossing signs. All at-grade crossings meet the criteria for advance warning systems due to the approach being considered an expressway, and due to the likelihood of weather conditions repeatedly obscuring the visibility of warning systems at the track crossing.

- **Canadian Pacific Kansas City (CPKC) Glenboro Subdivision** – The Glenboro Subdivision is a CPKC secondary mainline servicing Starbuck, Fannystelle, Elm Creek and Rathwell in Manitoba. This crossing is currently grade separated and includes space for additional track. CPKC currently operates two trains per day across this section of the Glenboro Subdivision. Any modifications to the existing structure should provide room for one additional track. This location was not included in the study as the grade separation was constructed within the last 15 years.
- **CPKC Carberry Subdivision** – The Carberry Subdivision is a part of the CPKC mainline from Winnipeg to Brandon. This crossing is currently grade separated as part of the PR 221 interchange and includes space for additional track. CPKC operates approximately 24 trains per day across

this section of the Carberry Subdivision. Any modifications to the existing structure should provide room for one additional track.

- **Prairie Dog Central Railway** – The Prairie Dog passenger train travels to Gross Island and a car storage area in Warren, Manitoba. Prairie Dog Central operates approximately five trains per week (0.7 trains per day) at this at-grade crossing and traffic volumes on PTH 101 were over 20,000 vehicles per day in 2022. Additional track requirements are not anticipated. Based on Transport Canada's *Grade Crossing Standards*, a new crossing would require the same warning system as the existing crossing; however, grade separation or relocation is required to meet the desired freeway standard on PTH 101.
- **CPKC Arborg Subdivision** – The Arborg Subdivision provides service to Richardson Pioneer south Lakes Elevator north of PTH 101 from May to June and August to November. CPKC operates approximately 0.3 trains per day across this at-grade crossing and traffic volumes on PTH 101 were approximately 36,600 vehicles per day in 2022. CPKC requires room for one additional track and a service road. Based on Transport Canada's *Grade Crossing Standards*, a new crossing would require the same warning system as the existing crossing; however, grade separation or relocation is required to meet the desired freeway standard on PTH 101.
- **CPKC Winnipeg Beach Subdivision** – The Winnipeg Beach Subdivision provides services to Selkirk (Gerdau and Ash Grove Cement) and an interchange to Lake Line Railroad to Gimli north of PTH 101. CPKC operates approximately 0.6 trains per day across this at-grade crossing and traffic volumes on PTH 101 were approximately 41,600 vehicles per day in 2022. CPKC requires room for one additional track and a service road. Based on Transport Canada's *Grade Crossing Standards*, a new crossing would require the same warning system as the existing crossing; however, grade separation or relocation is required to meet the desired freeway standard on PTH 101.
- **Central Manitoba Railway (CEMR) Pine Falls Subdivision** – The Pine Falls Subdivision provides service to Imperial Oil and train car storage to East Selkirk. CEMR operates two trains per day at this at-grade crossing and traffic volumes on PTH 101 were just under 15,000 vehicles per day in 2022. Additional track requirements are not anticipated. Based on Transport Canada's *Grade Crossing Standards*, a new crossing would require the same warning system as the existing crossing; however, grade separation or relocation is required to meet the desired freeway standard on PTH 101.
- **CPKC Keewatin Subdivision** – The Keewatin Subdivision is part of the CPKC Mainline from Winnipeg to Kenora, Ontario. This crossing is currently grade separated and includes space for additional track. CPKC operates 11 trains per day across this section of the Keewatin Subdivision. Additional track requirements are not anticipated.
- **Canadian National (CN) Reddit Subdivision** - The Reddit Subdivision is part of the CN Mainline from Winnipeg to Sioux Lookout, Ontario. CN operates 18 trains per day across this at-grade crossing and traffic volumes on PTH 101 were just over 14,000 vehicles per day in 2022. CN

requires room for a second track on the north side. Based on Transport Canada's *Grade Crossing Standards*, a new crossing would require the same warning system as the existing crossing. However, grade separation or relocation is required to meet the desired freeway standard on PTH 101.

- **Greater Winnipeg Water District (GWWD) Railway** – The GWWD line provides service to the Shoal Lake aqueduct. GWWD operates one train per week at this at-grade crossing and traffic volumes on PTH 101 were just over 17,000 vehicles per day in 2022. No additional tracks are required. Based on Transport Canada's *Grade Crossing Standards*, a new crossing would require the same warning system as the existing crossing. However, grade separation or relocation is required to meet the desired freeway standard on PTH 101.

## ACTIVE TRANSPORTATION

Existing pedestrian and cycling facilities within the study area include:

- 1 Trail under PTH 101 on the west side of the North Perimeter Bridge over the Red River in West St. Paul near the PTH 9 interchange;
- 2 Sidewalk on the south side of the North Perimeter Bridge over the Red River (currently no connecting sidewalks or pathways on either side of the bridge).
- 3 PR 204 / Henderson Highway Multi-Use Pathway (underpasses PTH 101 and ends at Wallace Avenue);
- 4 Northeast Pioneers Greenway / Trans Canada Trail (underpasses PTH 101 at Raleigh Street);
- 5 Duff Roblin Parkway Trail along the Red River Floodway (access to pathway located on east side of PTH 101 at Gunn Road); and
- 6 Transcona Trail located south of Gunn Road (ends on west side of PTH 101).

There are also several proposed pedestrian and cycling facilities that have been included in the City of Winnipeg's *Pedestrian and Cycling Strategies* and the *Inland Port Special Planning Area Regulation 48/2016*. For this study, active transportation accommodation within the highway right-of-way was considered for the cases of logical route connectivity; however, no additional right-of-way will be obtained for pedestrian and cycling facilities. MTI will accommodate active transportation infrastructure that is planned, designed and constructed by local governments. Crossings of PTH 101, including at potential grade separations, will be planned for as appropriate.

## EMERGENCY SERVICES

There are no specific design requirements for emergency vehicles on Provincial Highways beyond the standard requirements related to selecting appropriate design vehicles. At least two access points are required for each community. It is recommended that when PTH 101 becomes a freeway, access points should be located periodically to allow for emergency, highway support, and maintenance vehicles and equipment to cross from the lanes in one direction to the other direction. If this cannot be accomplished at

an interchange, then at-grade median openings suitable for use only by emergency, highway support and maintenance vehicles should be installed. Further discussion with MTI will be required to identify the ideal locations for these median access points. The access points to each community should be confirmed at the detailed design phase.

### ILLUMINATION

The existing illumination within the study area was reviewed to confirm conformance with current MTI standards and warrants. All existing interchanges were found to be illuminated in accordance with MTI's Policy / Standard No. 300-A-1 Interchange Illumination as all decision points, merge / weave areas, interchange loops, underpass areas, and pedestrian crossings and sidewalks are illuminated, except for missing under structure lighting at the PR 221 interchange. All signalized and unsignalized intersections are illuminated.

None of the existing non-illuminated road segments in the study area were found to warrant continuous illumination based on the 2006 TAC warrant or the minimum 500m spacing requirement.

### UTILITIES

The study area contains various major and minor utilities systems above and below ground. The below ground utilities consist of shallow and deep utilities, while those above ground are Manitoba Hydro power lines. In general, the at-grade intersections and existing interchanges along PTH 101 have more densely populated utilities compared to the connecting sections.

### LAND DRAINAGE

The City of Winnipeg and Province of Manitoba were contacted to obtain relevant drainage studies and drainage reports. Field inspections were conducted to verify and assess the location and invert elevations of critical culverts. LiDAR information and water routes from Natural Resources Canada were obtained to assist in delineating the catchments within the study area. This information was supplemented with topographic survey data where required to confirm ditch drainage patterns.

The catchments affected by the proposed roadworks in the PTH 101 Functional Design Study discharge to the major drainage features, notably Sturgeon Creek, Omands Creek, East Colony Creek, the City Protection Drain, Grassmere Creek Drain, the Red River, the Navin Drain, and various other unnamed first-order drains.

Much of the area within the project extents is agricultural, with the exceptions of Assiniboia Downs and the developments in West St. Paul and East St. Paul. However, several of these developments contain internal drainage systems utilizing retention ponds to restrict runoff.

A review of the existing PTH 101 longitudinal ditch grades finds that they are often already at the minimal acceptable grade. This adds a constraint to the design as the ditches cannot often be raised to introduce more grade without negatively impacting adjacent land and municipal road ditches that rely on the current PTH 101 ditch bottom elevations.

### HYDROLOGICAL / HYDRAULICS

There are four crossings of PTH 101 that were evaluated with respect to hydraulic design:

- **West Colony Creek** – West Colony Creek is a tributary of Omands Creek. It drains agricultural fields on the west side of PTH 101. It is one of many numerous streams that flow from northwest to southeast into the City of Winnipeg. The Omands Creek eventually empties into the Assiniboine River.
- **East Colony Creek** – East Colony Creek is a tributary of Omands Creek. It forms the easterly most portion of the Sturgeon Creek Watershed. Overland flow in this region typically travels from northwest to southeast. The upper reaches of East Colony Creek, north of PTH 101, collects agricultural runoff from adjacent farmland. The area is predominantly covered with crops; however, there are small, limited portions of forested areas. There is no significant or notable areas of storage in the drainage basin upstream of the crossing. The East Colony Creek begins near the Grassmere Creek and by the time it reaches PTH 101 it is classified as a third order drain.
- **City Protection Drain** – The City Protection Drain collects overland runoff from an area between PTH 101 and PR 221. This area drains primarily agricultural fields although there are some portions of commercial business and residential units. Contrary to the other adjacent drains in the area, the City Protection Drain carries water from the southwest to northeast and eventually comes to a confluence with the Grassmere Creek Drain. At the crossing of PTH 101, PR 409 and the confluence with the Grassmere Creek Drain, the City Protection Drain is classified as a third order stream.
- **Red River Bridge** – Flows in the Red River originate as far south as Fargo, North Dakota, to the west at the Rocky Mountains and from the east near Atikokan, Ontario. With the potential for such large flows, hydraulic conditions at the Red River Bridge on PTH 101 are governed by the operation of the Red River Floodway. The operation of the floodway gates and the locks at the St. Andrews Dam is defined by a design flood level. The existing bridge was constructed with consideration for this flood level and any new structure will, at a minimum, be constructed at or above this level.

### GEOTECHNICAL

General existing geotechnical conditions were reviewed along PTH 101. The soil conditions along PTH 101 are highly variable. While the stratigraphy will be fairly consistent, that is, overburden clay and glacial till overlying limestone bedrock, the thickness of each layer varies along the PTH 101 route.

The glacial till that can be expected to be encountered at any of the grade separation structures can contain sporadic zones of cobbles, boulders and/or granular layers. These zones should be expected to be water bearing, prone to sloughing, and/or difficult to advance through. Difficulties and water inflows should be anticipated with all foundations extending to or through the glacial till layers and methods of controlling water inflows and/or sloughing should be determined by the foundation installation contractor at each site.

Upper portions of the bedrock should be expected to be highly fractured and water bearing, with typical RQD values ranging from very poor to poor. Any foundations that require to be socketed into the bedrock to obtain bearing will have to extend through this upper highly fractured zone down into the underlying more competent bedrock.

## STRUCTURES

A review of the existing structures was completed based on information provided by MTI. Structures currently exist at the following locations along PTH 101:

- **PR 221 / CPKC Carberry Subdivision** – Constructed in 1961, the existing bridge structure is 103.72m long between abutment bearings (25.8m-26.06m-26.06m-25.8m) and is simply supported. The bridge spans over two CPKC tracks and four lanes of undivided PR 221. Close proximity to live rail traffic may cause difficulties with scheduling construction activities to not impact CPKC. At 64 years old, the structure is nearing its end of service life and is recommended to be replaced rather than modified for future PTH 101 widening.
- **PTH 7 (Brookside Boulevard)** – Constructed in 1990, the existing twin bridge structures are 103.72m long between abutment backwalls (21.565m-24.445-24.435m-19.525m-19.550m-m) and are simply supported. The bridges span over two divided lanes of PTH 101 in each direction and three westbound lanes of CD road. At 35 years old, the structure is in generally good condition, with potential to add a third PTH 101 lane in each direction between the existing piers.
- **PTH 8 (McPhillips Street)** – Constructed in 1971, the bridge was modified with new barriers and concrete deck overlay in 2015. Twin 5-span bridge structures are 91.438m long between abutment bearings (20.116m-20.117m-15.240m-17.983m-17.983m) and are continuous structures. The bridges span over two divided lanes of PTH 101 in each direction and three westbound lanes including a CD road. At 54 years old, the structure appears to be in generally good condition.
- **PTH 9 (Main Street)** – Constructed in 1963, the existing single 4-span bridge structure is 56.21m long between abutment backwalls (14.059m-14.046m-14.046m-14.059m) and is simply supported. The bridge spans over three divided lanes of PTH 101 (one lane on-ramp/off-ramp) in each direction. At 62 years old, the structure is nearing its end of service life and is recommended to be replaced rather than modified for future PTH 101 widening.
- **PR 204 / Red River Bridge** – Constructed in 1963, the existing 10-span bridge structure is 347.332m long between abutment backwalls (25.502m-32.918m-25.057m-24.689m-34.442m-49.073m-46.939m-49.073m--34.442m-25.197m) and is a continuous bridge with simple spans only at spans 4 and 10. The bridge spans over the Red River and two lanes of PR 204 eastbound and three lanes westbound (one lane on-ramp/off-ramp) divided in each direction. At 62 years old, the structure is nearing its end of service life and is recommended to be replaced rather than modified for future PTH 101 widening.
- **CPKC Keewatin Subdivision** – Constructed in 1996 (southbound) and 2006 (northbound), the twin 3-span bridge structures are 98.2m long between abutment backwalls (32.75m-32.7m-

32.75m) and are simply supported. The bridges span over two CP tracks with allowance for a third track to the north. At 19 and 29 years old, the structures are in generally good condition.

- **GWWD Aqueduct** – The existing Branch I 1650mm aqueduct constructed in 1964 currently crosses beneath PTH 101 at an approximate 21 degree skew. The pipe is approximately 3m below the top of roadway surface. The PTH 101 road slabs are supported on caissons and pile caps on either side of the aqueduct. It is assumed that the piles and pier cap will be in good condition when widening of PTH 101 occurs and the aqueduct will remain in place. Reconstruction will involve wider road slabs, dowelled pier caps extensions and additional piles as required.

## ENVIRONMENT & HERITAGE RESOURCES

Determination of potential environment concerns (ecological, heritage resources and potential contaminated sites) was completed through completion of an overview environmental desktop review and roadside reconnaissance assessment of the study area. Field reconnaissance site visits via roadside visual assessments were conducted in August 2022 for biophysical features and to confirm areas of potential contamination.

Information collected from the environmental desktop review and roadside reconnaissance assessments was utilized to develop and inform the Environmental Assessment (EA) Plan completed in support of the project. The EA Plan will provide support for future project planning and design purposes and to provide MTI with a summary of future environmental permitting/approval applications that may be required in support of the project.

## FRICTION ANALYSIS

As part of the existing roadway conditions assessment, WDM USA conducted continuous friction testing and analysis on sections throughout the study area. The purpose of the continuous friction testing was for MTI to establish a baseline for friction performance and investigate the areas that could be a safety concern. The testing was completed along sections of the travel lane in both directions of PTH 101 including a sample of ramps and loops. As well, friction testing was undertaken on sections of various pavement types and ranges of traffic volumes for comparison to the typical sections of PTH 101. PTH 101 exhibits lower average friction and texture values compared to the broader MTI network, particularly at mid-to-high cumulative traffic levels.

## 3 PTH 101 DESIGN ALTERNATIVES

Conceptual design alternatives for the PTH 101 mainline, interchanges, rail grade separations and river crossings were developed. The conceptual design alternatives were based on approved design criteria and included an analysis of traffic operations, geometric considerations and structural considerations.

### 3.1 PTH 101 MAINLINE ALTERNATIVES

Three typical cross-sections will be applied to this project:

- Four-lane divided cross-section with a 30m depressed median and service roads where required. This cross-section will allow expansion to a six-lane cross-section in the future by adding lanes to the median side of each carriageway.
- Four-lane divided cross-section with a 21.34m to 25.0m depressed median and service roads where required. This cross-section will be applied between PTH 59N and PTH 1E as it allows the re-use of the existing carriageways on their current alignment. Future expansion to a six-lane cross-section in this area will involve adding a lane to the outside of each existing carriageway.
- Four-lane divided cross-section with a center concrete median barrier at a 3.7m shy line offset. This cross-section will be used in cases where existing structures are to be re-used and where existing development precludes the use of a wide depressed median. Future expansion to a six-lane cross-section will involve adding a lane to the outside of each carriageway.

### 3.2 ALIGNMENT ALTERNATIVES

The selection of the PTH 101 mainline alignment (i.e., widen to inside vs. widen to outside) was based on an analysis of utility impacts, land/development impacts, and environmental considerations.

- **Segment 1 – PTH 1W to PTH 190:** The alignment of PTH 101 between PTH 1W and PTH 190 has been established in two previous studies, the South Perimeter Highway Design Study and the CCW Design Study. PTH 101 will remain on the existing alignment and use a median barrier cross-section, and the additional lanes will be added to the outside.
- **Segment 2 – PTH 190 to PTH 6:** This section will have a four-lane divided cross-section with a depressed median, expandable to a six-lane cross-section. The option of widening to either the inside or outside of PTH 101 was evaluated and it is recommended that this segment be widened to the inside to be consistent with the remainder of the PTH 101 alignment.
- **Segment 3 – PTH 6 to PTH 8:** This section will have a four-lane divided cross-section with a depressed median, expandable to a six-lane cross-section. The option of widening to either the inside or outside of PTH 101 was evaluated and it is recommended that this segment be widened to the inside to reduce property and utility impacts.

- **Segment 4 – PTH 8 to PTH 59N:** Widening options are limited in this section due to the inability to increase ROW without significant developed property impacts (existing adjacent development), and the desire to utilize the existing structures at PTH 8, PR 204 and PTH 59. As a result, the recommendation is to remain on existing alignment and use a median barrier cross-section.
- **Segment 5 – PTH 59N to PTH 1E:** This section will use a four-lane divided cross-section with a depressed median and service roads where required. This cross-section allows the re-use of the existing carriageways on their current alignment.

### 3.3 PTH 101 INTERCHANGE AND RAIL OVERPASS ALTERNATIVES

The various options that were investigated for the interchange locations and outline considerations related to traffic operations, geometrics, utilities, land drainage, structural, construction / staging, rail, safety, and land development / property, access management, active transportation, and environment.

- **PTH 101 at Assiniboia Downs:** The MTI *Perimeter Highway Safety Plan* identified the Assiniboia Downs access for closure once the required consultations have occurred. The ultimate plan for PTH 101 maintains the closure of this access, and a new upgraded access is planned to be provided from Saskatchewan Avenue, so a total of three access points will remain.
- **PTH 101 at Road 63N / Selkirk Avenue:** Two interchange alternatives were investigated for Road 63N: (1) Diamond interchange and (2) Parclo B2 interchange. For both options, the interchange is proposed to be located north of the existing intersection of PTH 101 and Road 63N. Based on assumed CentrePort build-out and traffic forecasts, an interchange is not expected to be required by the 30-year horizon and a single interchange at PR 221 will be sufficient to service this portion of CentrePort.
- **PTH 101 at PR 221 (Rosser Road) & CPKC Carberry Subdivision:** Two interchange alternatives were investigated for PR 221 (Rosser Road): (1) Parclo AB interchange (no interchange at Road 63N) and (2) flyover (interchange at Road 63N). The preferred alternative is a partial cloverleaf at PR 221 and closing of the Road 63N intersection on PTH 101. Road 63N will be connected to PR 221 via service roads. This option requires the least amount of property, has the best forecast traffic operations, and eliminates a structure on PTH 101.
- **PTH 101 at PTH 6 & Prairie Dog Central Railway:** Four interchange alternatives were investigated for PTH 6: (1) Parclo AB interchange on existing PTH 101 alignment; (2) Parclo AB interchange off existing PTH 101 alignment; (3) combined Diamond interchange with Sturgeon Road; and (4) combined Parclo interchange with Sturgeon Road. The first two options integrate a grade-separated crossing of the Prairie Dog Central Railway, while the third and fourth options have a separate rail crossing and eliminate the need for a separate Sturgeon Road interchange. The preferred alternative is a partial cloverleaf at the existing PTH 6 intersection location and a rail overpass of the Prairie Dog Central rail line. This option is the most cost-effective option and has the fewest land related impacts, as well as lower utility impacts.

- **PTH 101 at Sturgeon Road:** Two interchange alternatives were investigated for Sturgeon Road: (1) Diamond interchange and (2) Parclo A2 interchange. A combined interchange with PTH 6 was selected as the preferred alternative for PTH 6 so an interchange is not recommended at Sturgeon Road.
- **PTH 101 at PTH 7 (Brookside Boulevard):** Only one interchange alternative was investigated for PTH 7. A Semi Direct Interchange is recommended for PTH 7 that includes a two-lane westbound to southbound semi-direct ramp and a two-lane northbound to eastbound direct ramp. The interchange is proposed to be located at the existing interchange location.
- **PTH 101 at CPKC Arborg Subdivision:** Only one alternative was investigated for this location. A rail overpass is recommended for the CPKC Arborg Subdivision crossing of PTH 101.
- **PTH 101 at PR 409 (Pipeline Road):** Only one interchange alternative was investigated for PR 409. A Diamond interchange is recommended for PR 409 to minimize impacts to adjacent properties. The interchange is proposed to be located at the existing intersection.
- **PTH 101 at PTH 8 (McPhillips Street):** Three interchange alternatives were investigated for PTH 8 (McPhillips Street): (1) Diamond interchange; (2) Parclo A4 interchange; and (3) Diverging Diamond interchange. All three options are proposed to be located at the existing interchange location. The preferred alternative at PTH 8 is a partial cloverleaf. This option provides improvement in traffic operations and active transportation with a moderate construction cost and good constructability.
- **PTH 101 at CPKC Winnipeg Beach Subdivision, PTH 9 (Main Street), Red River Bridge & PR 204 (Henderson Highway):** The CPKC Winnipeg Beach Subdivision, PTH 9 (Main Street) interchange, Red River bridge, and PR 204 (Henderson Highway) interchange were reviewed together due to their proximity. Two options were investigated for the area between the Winnipeg Beach Subdivision and PR 204 (Henderson Highway): (1) rail overpass, Cloverleaf interchange at PTH 9 and Elongated Parclo AB Interchange at PR 204 and (2) rail overpass, Parclo A4 interchange at PTH 9 and Parclo AB interchange at PR 204. Both options are proposed to be located at the existing interchange locations. PTH 9 is proposed to be converted from an overpass to an underpass with PTH 101 passing overhead. Due to the proximity of the Winnipeg Beach Subdivision, PTH 9 and PR 204, both options include collector-distributor roads (C-D roads) to safely accommodate vehicles entering and exiting PTH 101. The preferred alternative is a partial cloverleaf at both locations. The partial cloverleaf at PTH 9 edged higher in traffic operations, safety, and pedestrian and cyclist accommodation, and the partial cloverleaf at PR 204 scored slightly higher and is most desirable from an environmental perspective and utility impacts.
- **PTH 101 at PTH 59N:** The interchange was recently constructed as part of the PTH 59N and PTH 101 interchange project that opened in 2018. No work is expected to be required at this location in the near future; however, a future northbound to westbound semi-direct ramp was identified as a long-term plan during the PTH 59N and PTH 101 interchange project. The timing of the ramp addition would depend on traffic operations and safety concerns at the existing interchange.
- **Wenzel Street:** Two interchange alternatives were investigated for Wenzel Street that integrate a grade-separated crossing of the CEMR: (1) Diamond Interchange and (2) Parclo B2 interchange. Both options are proposed to be located at the existing intersection location. The overpass of the CEMR Pine Falls Subdivision would also be located at the existing rail crossing. The preferred alternative at Wenzel Street is a diamond interchange. This option is cost-effective and is easier to construct, has fewer land impacts and accommodates over-dimensional vehicles.
- **PTH 101 at CPKC Keewatin Subdivision:** Only one alternative was investigated for this location. A rail overpass is recommended for the CPKC Keewatin Subdivision crossing of PTH 101.
- **PTH 101 at Gunn Road:** Three interchange alternatives were investigated for Gunn Road: (1) Diamond interchange connected to Oakbank Corridor; (2) Parclo B2 interchange connected to Oakbank Corridor; and (3) Trumpet interchange with no connection to Oakbank Corridor. All options are proposed to be located at the existing intersection location. The preferred alternative at Gunn Road is a diamond interchange. This option has lower construction costs and accommodates over-dimension vehicles, and allows for the future connection of the Oakbank Corridor (if it is implemented).
- **PTH 101 at PTH 15 (Dugald Road) & CN Redditt Subdivision:** Three interchange alternatives were investigated for PTH 15 (Dugald Road) that integrate a grade-separated crossing of the CN Redditt Subdivision: (1) Parclo AB interchange with rail underpass; (2) Parclo AB interchange with rail overpass; and (3) Diamond interchange with rail overpass. The first two options are located at the existing intersection, while the third option is located south of the existing intersection. For all options, the rail crossings are located at the existing rail crossing location. The preferred alternative at PTH 15 is a Parclo interchange. This option has the least land and business impacts and provides the most cost-effective solution.
- **PTH 101 at GWWD Subdivision:** Only one alternative was investigated for this location. A rail overpass is recommended for the GWWD crossing of PTH 101.

## 4 RECOMMENDED NETWORK

The PTH 101 alignment and interchange options were evaluated based on engineering and transportation criteria, community and socioeconomic impacts, environmental impacts, and cost. The recommended network options for PTH 101 are summarized in **Table 4.1** and **Table 4.2** below and in **Figure 4-1** and **Figure 4-2**.

**Table 4.1: PTH 101 Future Capacity Upgrades (Additional Lanes)**

LOCATION	NETWORK WIDENING RECOMMENDATIONS
PTH 1W and PTH 190	Add lanes on the outside, PTH 101 on existing alignment
PTH 190 to PR 221	Add lanes on the inside, realignment inside PTH 101
PR 221 to PTH 6	Add lanes on the inside, realignment inside PTH 101
PTH 6 to PTH 8	Add lanes on the inside, realignment inside PTH 101
PTH 8 to PTH 59	Add lanes on the outside, PTH 101 on existing alignment
PTH 59 to PTH 1E	Add lanes on the inside, PTH 101 on existing alignment

**Table 4.2: PTH 101 Intersection Upgrades**

LOCATION	INTERCHANGE RECOMMENDATIONS
Assiniboia Downs	Access Closure
PR 425 (Saskatchewan Avenue)	Existing Rail Overpass - No change
PTH 190 (Centreport Canada Way)	Existing Interchange - No change
Road 63N / Selkirk Avenue	Closed - Traffic to use PR 221 Interchange
PR 221 (Rosser Road) and Carberry Subdivision	Partial Cloverleaf Interchange - Reconfiguration
Prairie Dog Central Railway	Rail Overpass
PTH 6 / Paterson Road	Partial Cloverleaf Interchange
Sturgeon Road	Closed - Traffic to use PTH 6 Interchange
PTH 7 (Brookside Boulevard)	Semi-Direct Interchange
CP Arborg Subdivision	Rail Overpass
PR 409 / Pipeline Road	Diamond Interchange
PTH 8 (McPhillips Street)	Partial Cloverleaf Interchange - Reconfiguration
Winnipeg Beach Subdivision	Rail Overpass
PTH 9 (Main Street)	Partial Cloverleaf Interchange - Reconfiguration
PR 204 (Henderson Highway)	Partial Cloverleaf Interchange - Reconfiguration
Northeast Pioneers Greenway & Raleigh Street	Existing Underpass - No change
PTH 59 (Lagimodiere Boulevard)	Existing Interchange - No change
Wenzel Road	Diamond Interchange
CEMR Pine Falls Subdivision	Rail Overpass
CP Keewatin Subdivision	Existing Rail Overpass – No change
Gunn Road	Diamond Interchange (Winnipeg-Oakbank Corridor) Trumpet Interchange (No Winnipeg-Oakbank Corridor)
MTI / City of Winnipeg Access	No Change
PTH 15 (Dugald & CN Reddit Subdivision)	Partial Cloverleaf Interchange and Rail Overpass
Greater Winnipeg Water District Railway	Rail Overpass



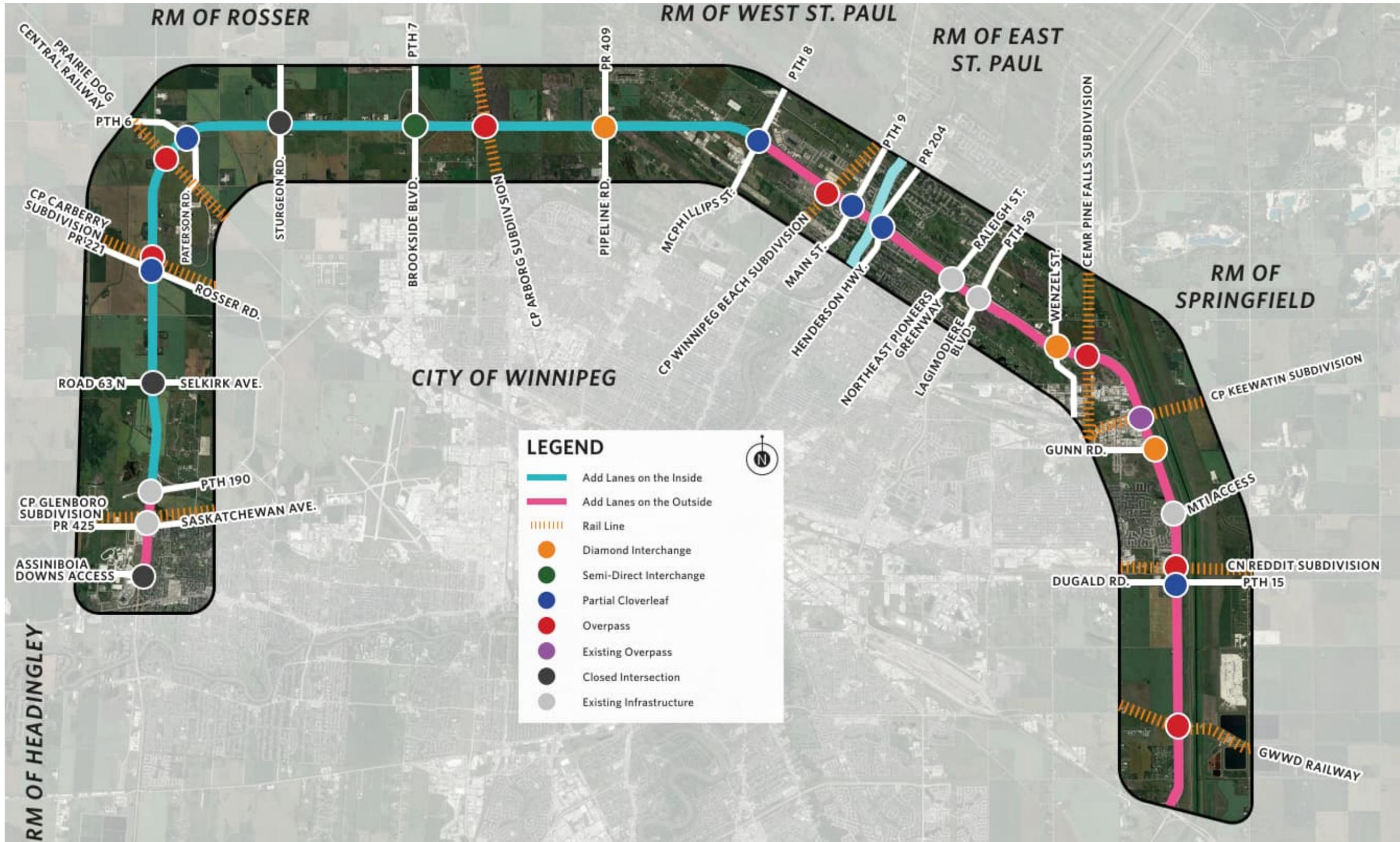


Figure 4-2: Interchange and Future Lane Upgrade Recommendations

## 5 FUNCTIONAL DESIGN

A functional design was developed for the recommended PTH 101 alternatives, which includes a combination of access closures, interchanges, and rail overpasses. The recommended functional design is illustrated in **Figure 5.1** through **Figure 5.10**. Prior to commencing the functional design, MTI approved the geometric design criteria to be applied to PTH 101, connecting roads and associated interchanges. These design criteria were used to the degree practical in preparing the functional design. However, at some locations it was not practical or reasonable to apply the design criteria directly and the design criteria was modified with the approval of MTI. In cases where MTI's approval was received, the design exception was implemented into the design. Design exceptions are cases where one or more design elements fall outside the boundaries established in the geometric design criteria. Design exceptions are used in situations where the design has been tailored to its context through sound professional judgement, and if necessary, appropriate mitigations implemented.

In addition to developing roadway and structures functional design drawings, the functional design included completing other necessary studies and plans to confirm the functional design for PTH 101. The following sections outline the analyses that were conducted. More details for these sections are provided in the *North Perimeter Highway Design Study: PTH 100 Functional Design Report*.

### TRAFFIC OPERATIONS

A traffic operational analysis was conducted using 30-year (2054) forecast traffic volumes to evaluate the operational performance of the proposed design and ensure that the mainline, interchanges and intersections are designed to accommodate forecast volumes. The analysis identified that all intersections are forecast to operate with an acceptable overall LOS. All ramp merge, diverge and weaving analyses, in addition to the mainline basic segment analyses, operate at an acceptable LOS D or better. Additional details on the traffic operational analysis are provided in the *PTH 101 Traffic Operations and Safety Report*. It is recommended that the traffic operational analysis be updated at the time of detailed design to confirm the proposed designs for the mainline, interchanges and intersections.

### ROAD SAFETY AUDIT

A Road Safety Audit of the preferred functional design of PTH 101 was undertaken by an independent third-party engineering consultant, Fireseeds North Infrastructure. The Road Safety Audit report (*Road Safety Audit – PTH 101 Functional Design*) included specific comments related to the plan view drawings, cross section drawings, and the *Traffic Operations and Safety Report*. The results of the Road Safety Audit were incorporated into the functional design of PTH 101 as deemed appropriate.

### ACCESS MANAGEMENT STRATEGY

The PTH 101 Access Management Plan summarizes access management strategies and service / local road concepts intended to improve the safety and efficiency of PTH 101 while providing acceptable ingress and egress from lands adjacent to PTH 101. These strategies and concepts were developed based on

road safety principles and highway design standards and informed by a public engagement program that sought to identify and address issues and concerns of various stakeholder groups in the study area.

The access management strategies for PTH 101 include land use strategies for Rural Agricultural, Industrial and Commercial, and Residential land uses and special vehicles strategies for Emergency and Service Vehicle Access, Agricultural Equipment Crossings, and Over-height Vehicles. The service / local road concepts support a fully access controlled Freeway classification on PTH 101 from PTH 1W / Portage Avenue to PTH 1E / Fermor Avenue with access to PTH 101 provided at interchanges.

### NOISE ASSESSMENT & MITIGATION PLAN

An assessment of highway traffic related noise within the study area was conducted and, where appropriate, mitigations are proposed to bring noise levels to more acceptable levels. WSP retained the Industrial Technology Centre to undertake the noise analysis and provide recommendations on where mitigation measures may be considered, based on the transportation noise guidelines and criteria provided by MTI. Highway noise was evaluated along PTH 101 where there are residential developments in close proximity to the highway. Highway noise attenuation is being recommended on the south side of PTH 101, immediately west of the CPKC Winnipeg Beach Subdivision rail grade separation, at the PTH 101 and PTH 9 interchange in the northeast and southeast quadrants, at the PTH 101 and PR 204 interchange in the northeast quadrant, and along the west side of PTH 101 from Gunn Road to PTH 15.

### HIGHWAY GUIDE SIGNAGE PLAN

A highway guide signage plan was developed for the new interchanges along PTH 101 and where changes to highway guide signage at existing interchanges are required. The signage plan includes signage drawings that identify the location, messaging and structural type for each of the guide signs along PTH 101 and connecting roadways. The signage plan is in conformance with the Manual of Uniform Traffic Control Devices for Canada (MUTCDC) and includes three main types of highway guide signage for PTH 101 (advance guide signs, exit direction signs and gore signs). The highway guide signage plan also includes recommendations for the guide signage for the connecting roadways and highways along PTH 101. The signage recommendations are consistent with MTI's current practices and consider the characteristics of the connecting roadways / highways and surrounding land uses.

### IMPLEMENTATION PLAN

An implementation plan for construction on PTH 101 was developed based on several priorities including existing traffic operations and safety concerns, forecast adjacent development and impact on future traffic operations and safety, the age and condition of existing structures, existing and anticipated rail traffic volumes at at-grade crossings, the age and condition of existing pavement, and any priority locations designated by MTI. The sequence of construction priorities for the segments identified are shown in **Figure 5-11**; however, it should be noted that the actual order and priority of projects will be determined by MTI as part of the capital planning process. The top three priorities are the Assiniboia Downs access closure, the PR 409 (Pipeline Road) interchange, and the PTH 15 (Dugald Road) Interchange and CN Reddit Rail Overpass.



**Figure 5-1: Access Closure at Assiniboia Downs**





Figure 5-3: Partial Cloverleaf Interchange at PTH 6 and Rail Overpass

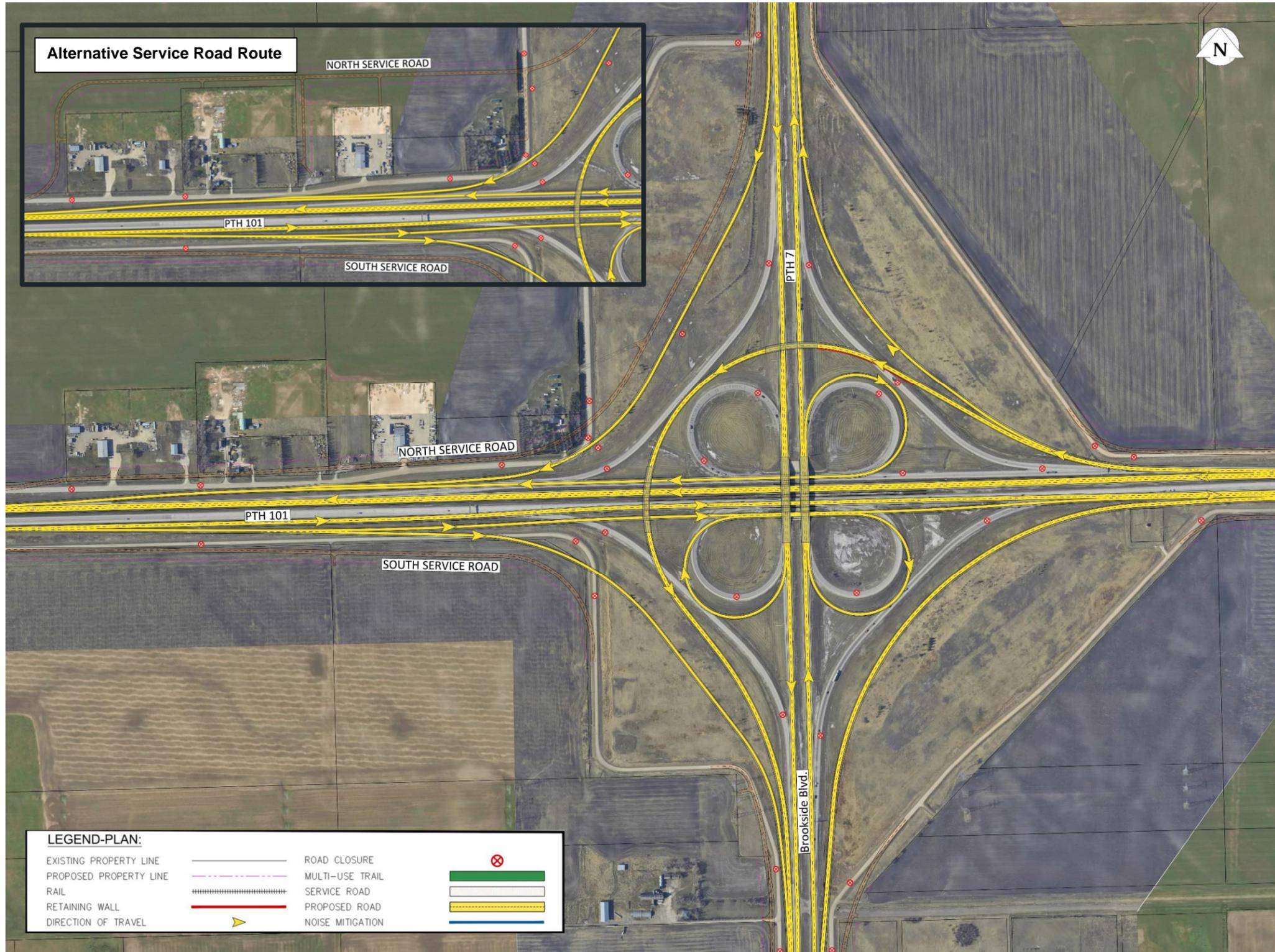


Figure 5-4: Semi Direct Interchange at PTH 7



Figure 5-5: Diamond Interchange at PR 409

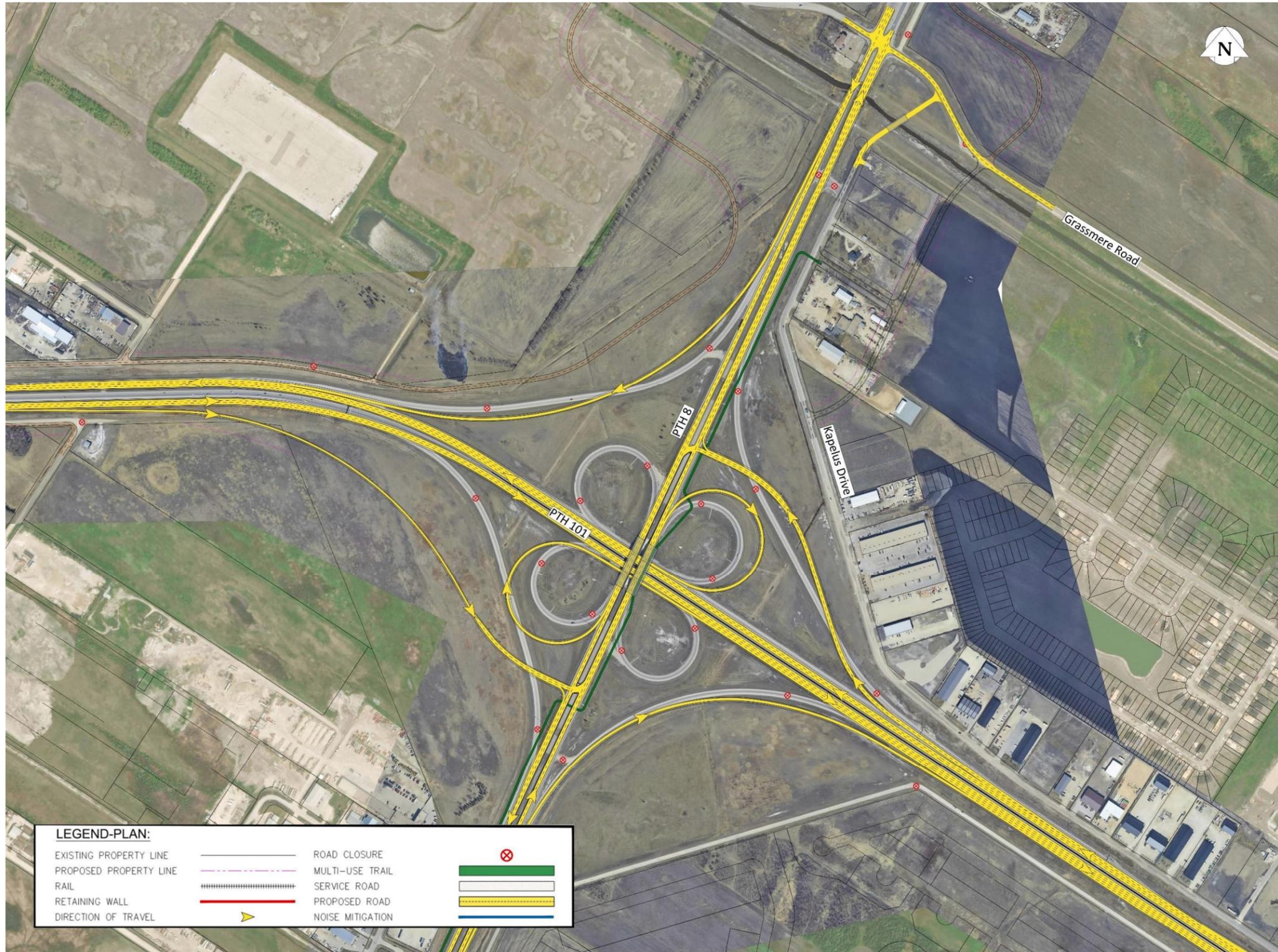


Figure 5-6: Partial Cloverleaf Interchange at PTH 8

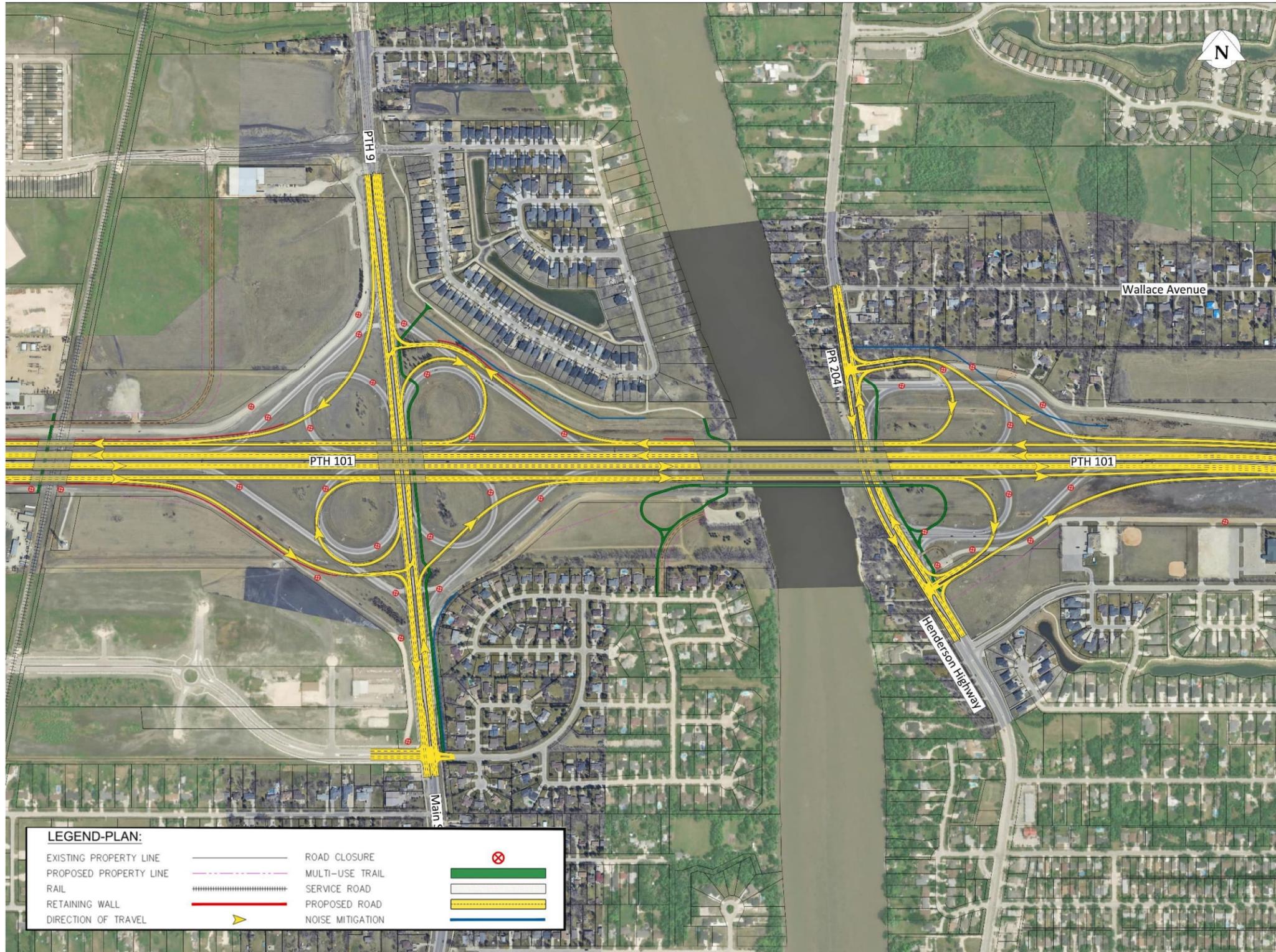
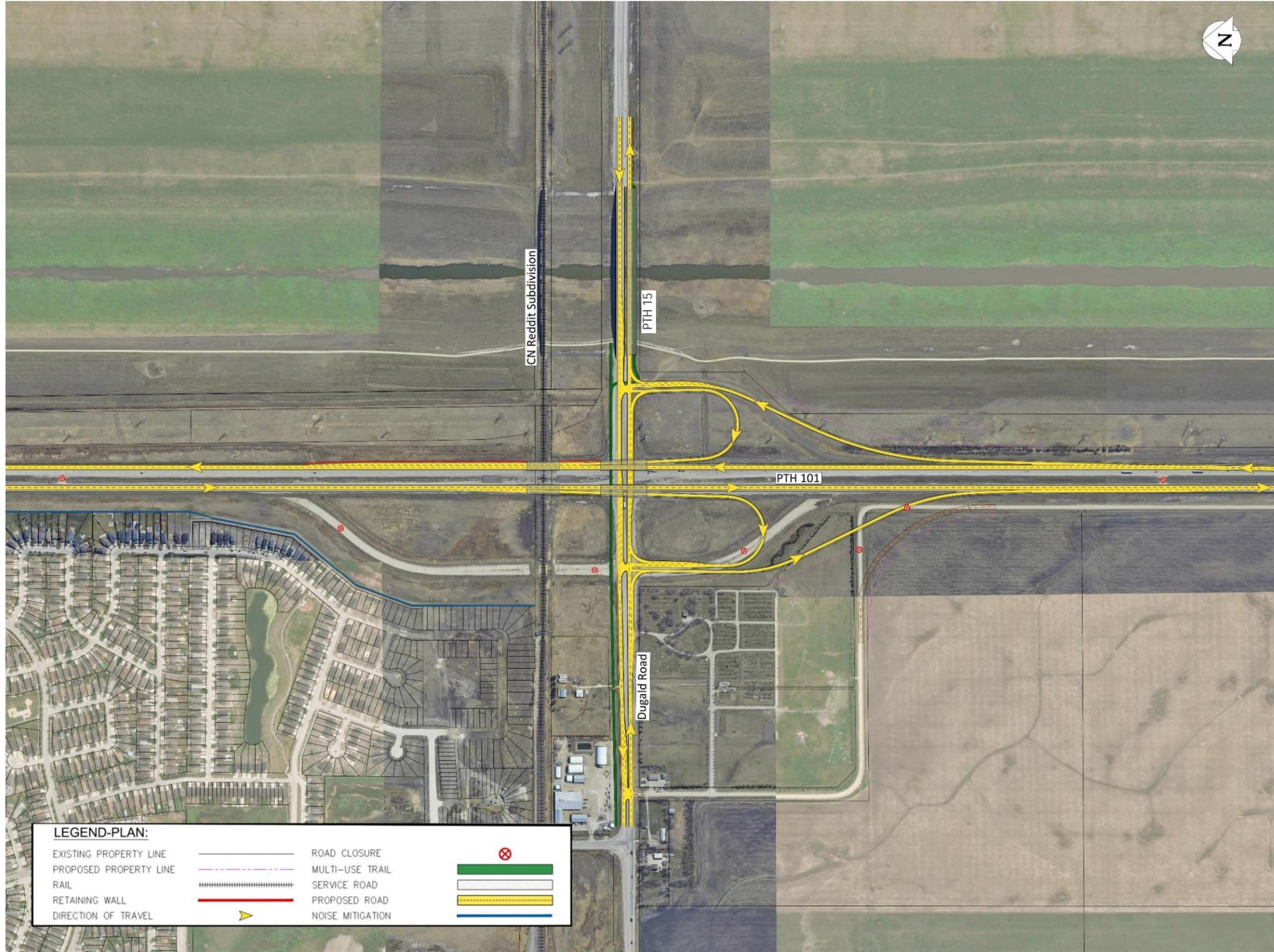


Figure 5-7: Partial Cloverleaf Interchange at PTH 9 and Partial Cloverleaf Interchange at PR 204



Figure 5-8: Diamond Interchange at Wenzel Road





**Figure 5-10: Partial Cloverleaf Interchange at PTH 15**



Figure 5-11: Proposed Sequence of Construction Priority

## ILLUMINATION PLAN

An illumination plan was developed for the proposed PTH 101 functional design. All interchanges will be fully illuminated and will include gore areas, exits, merge / weave areas, interchange ramps, underpass areas, signalized intersections, roundabouts and pathway / sidewalk areas. Ramp, mainline and cross-road segments between interchange merges, diverges and intersections are illuminated for consistency. For unsignalized intersections within interchanges, MTI's Policy / Standard No. 300-C-1 was referenced which outlines when illumination should be considered for rural isolated intersections on the provincial highway network based on a province-wide priority points rating system. This rating system was applied to all unsignalized ramp intersections at the PR 221, PTH 6 and Wenzel Street interchanges and found that illumination is warranted. A continuous lighting warrant assessment was completed for PTH 101 to determine where continuous lighting is warranted between interchanges. None of the road segments scored enough points to warrant continuous illumination.

## CONSTRUCTION STAGING & MAINTENANCE OF TRAFFIC PLANS

The construction staging philosophy for this project is based on the RFP requirement to maintain two lanes of traffic per direction on PTH 101 wherever possible. The proposed construction staging plans achieve this objective except at locations where there is a need to tie into existing structures. At these locations, there will be a need to reduce traffic to one lane per direction for short periods of time to complete the tie-ins to the existing structures. Construction staging techniques were presented for mainline depressed median cross-sections, mainline concrete median barrier cross-sections, mainline rail overpasses and interchanges.

## ACTIVE TRANSPORTATION PLAN

Municipal active transportation plans for the study area were reviewed and desire lines within and adjacent to the PTH 101 study area were identified by the public and stakeholders. These plans and desire lines were used to determine locations where active transportation should be accommodated in the recommended plan. Active transportation accommodation within the highway right-of-way will be considered for cases of logical route connectivity; however, no additional right-of-way will be obtained for pedestrian and cycling facilities. MTI will not plan or design pathways within the right-of-way, but will allow adjacent municipalities to do so, in consultation with MTI. Crossings of PTH 101, including at potential grade separations, will be planned for as appropriate. Active transportation crossings of PTH 101 are included in the recommended plan at the PR 409 (Pipeline Road) interchange, PTH 8 (McPhillips Street) interchange, CPKC Winnipeg Beach Subdivision / PTH 9 (Main Street) / Red River Bridge / PR 204 (Henderson Highway), Gunn Road, and PTH 15 (Dugald Road). AT recommendations will be reviewed with the local municipalities prior to construction.

## RAIL CROSSING PROTECTION REQUIREMENTS

At-grade rail crossing protection requirements were examined at four rail crossings of local roads / service roads. At three of the locations (CPKC Arborg Subdivision at Holmes Road, CPKC Arborg Subdivision at

Garden View Drive, and GWWD Railway at James Farm Road), it was determined that a standard railway crossing sign and road stop sign should be sufficient provided the sightlines are not obscured by the new grade separated crossing. At CPKC Winnipeg Beach Subdivision at Kapelus Drive, it is recommended that the crossing have a warning system with lights and bells to maintain the current level of safety. The detailed design will ensure the safety of the grade crossing as economically as feasible.

## RIGHT-OF-WAY & LAND ACQUISITION REQUIREMENTS

Plans outlining the right-of-way requirements have been developed based on the preferred functional design and MTI's standards for right-of-way protection. There are 136 impacted properties, totaling approximately 388 acres. Of these 136 impacted properties, 14 are already owned by the Province of Manitoba and four are owned by the City of Winnipeg. Two properties are owned by the RM of West St. Paul and there is a single impacted property owned by the RM of East St. Paul. The remaining 115 impacted properties are privately owned (including those owned by utility companies), totalling approximately 327 acres. Almost all land acquisition requirements are a result of right-of-way requirements related to proposed interchange locations. Note that these requirements are approximate only and should be confirmed through survey and detailed design.

## UTILITY RELOCATIONS

The proposed roadway alignment for PTH 101 was selected to avoid conflicts with major utility infrastructure, including existing transmission line towers, and the gas facility located southeast of the Red River Crossing. The plan does require some hydro pole and street light relocations and will impact some of the telecommunication infrastructure and municipal land drainage, sewer mains, and water mains. The affected owners include Manitoba Hydro, City of Winnipeg, MTI (traffic signals), RM of East St Paul, RM of West St Paul, RM of Rosser, Bell, Rogers, Telus, Valley Fiber, and the Seven Oaks School Division. The detailed design phase should include onsite utility locates with hydrovac and elevation surveys to confirm depths as required.

## LAND DRAINAGE

A functional drainage design was developed for the recommended design for PTH 101. Based on the proposed roadwork alignments, new drainage catchments, ditches, and culvert crossings have been defined. The runoff flow rates for the proposed catchments and sizing of the culverts have been designed in accordance with MTI's standard practices and design criteria. The calculated design flows and the flow conditions for the culverts while conveying these flows, including flow, headwater depth, head loss, and velocity, are provided for every culvert affected by, or required for, the proposed roadworks.

The functional drainage design generally follows the existing drainage patterns to ensure that adjacent properties relying on discharging into the existing PTH 101 roadside ditches are not negatively affected. Within the constraints imposed by adjacent upstream drainage features, the design still seeks to maximize the longitudinal grade of PTH 101's ditches. Where possible, railway crossings are established as high points to minimize the number of through-grade rail crossings. The catchments within the project area are

shown to discharge to Sturgeon Creek, Omands Creek, East Colony Creek, the City Protection Drain, Grassmere Creek Drain, the Red River, the Navin Drain, and various other unnamed first-order drains.

## STRUCTURES

Conceptual structural alternatives were developed for the PTH 101 interchanges and rail grade-separations. The structures were designed to AASHTO LRFD latest edition following guidelines in the MTI Structures Design Manual and using typical MTI standards where possible. Vertical clearances for overpasses over roadways and railways meet requirements in TAC and rail standards. Span lengths and number of spans were considered to balance the depth of superstructures to minimize embankment heights.

## HYDRAULIC ANALYSIS

A hydraulic analysis was performed for East Colony Creek, West Colony Creek, City Protection Drain, and the Red River Bridge. Eight concrete pipe culvert options were developed for East Colony Creek and four concrete pipe culvert options were developed for West Colony Creek. Two options were developed for the City Protection Drain, including a concrete pipe culvert option and a combination option that included concrete box culverts and concrete pipe culverts. KGS also modelled the proposed structure design of the Red River Bridge and evaluated its performance against the flow rate associated with the flood protection level. The proposed structure was found to not impose a significant change to the existing hydraulics in the river; however, due to the extended pier length there is a slightly larger headloss (considered negligible) through the crossing, while streamflow velocities were maintained.

## GEOTECHNICAL INVESTIGATIONS

Geotechnical assessments were completed at seven sites within the study area - Selkirk Avenue, PTH 6, Sturgeon Road, PR 409, Wenzel Road, Gunn Road, and PTH 15. The geotechnical investigation program included a drilling and sampling program to determine the stratigraphy of the sites, installation of nested vibrating wire (VW) piezometers to monitor groundwater levels, and laboratory testing on representative soil samples to determine relevant engineering properties of the subsurface soils.

## ENVIRONMENTAL ASSESSMENT

An Environmental Assessment (EA) Plan was completed based on the preferred functional designs for PTH 101. The EA Plan included a desktop review of existing literature / information and ecological fields surveys to supplement existing information where practical. The objectives of the EA Plan were to identify potential environmental concerns/sensitivities associated with the Project Study Area (PSA), including areas of ecological and heritage concern, as well as identify any sites that may require additional investigations to support future land aquations/project construction (e.g., Phase I or II Environmental Site Assessments) and aid in project planning and design and provide a summary of future environmental permitting/approval applications that may be required in support of the Project.

## 6 FUTURE CONSIDERATIONS

The following considerations should be addressed at future design phases:

- It is recommended that the traffic operational analysis be updated at the time of detailed design with current traffic volumes to confirm the proposed designs for the mainline, interchanges and intersections.
- Ramp terminal intersection geometry should be reviewed and designed based on updated traffic forecasts at the detailed design phase.
- Surface treatment of service roads should be reviewed and designed at the detailed design phase. General concern about the state of service roads and inquiries if service roads would be paved.
- Concerns about increased noise levels caused by additional traffic, interchange construction and travel lanes was consistently raised as a concern throughout the design study area. Updated noise analysis should occur for any future design phases. This analysis should include the development of recommended noise mitigation at each location.
- There were a high number of animal related collisions along the PTH 101 mainline, especially between PTH 6 and Sturgeon Road and between PR 409 and PTH 9. Animal fencing should be investigated further at the detailed design phase to determine the benefit of wildlife fencing versus the disruption to the mobility of wildlife.
- Emergency access and truck movement, especially to CentrePort, is a critical concern for the PR 221 and PTH 6 interchange locations. Design needs to consider emergency access time delays caused by changes in access and service road provision.
- The RM of East St. Paul has an opportunity to develop longer term options for improving traffic movement in the area of Sperring Avenue to address concerns related to additional traffic on local roads as a result of the proposed closure of Sperring Avenue.
- The RM of West St. Paul should be consulted regarding the ultimate connection between Kapelus Drive and Grassmere Road during the detailed design of the PTH 8 interchange.
- The final location of the proposed City Protection Drain south of PTH 101 should be reviewed with the City of Winnipeg and impacted landowners during the detailed design stage.
- MTI is planning to complete upgrades to the City Protection Drain subsequent to this study. Future phases will need to incorporate the latest conditions.
- MTI Water Operations needs to be included during future planning and design of the Grassmere Drain.
- Utility relocation work that crosses Provincial Waterways will be required to meet the applicable crossing requirements and submit for the appropriate permits to complete the work.
- Additional design requirements are applicable for culverts and ditches discharging into Provincial Waterways that will need to be considered during future phases of design. All Provincial Waterways will require additional review and design for crossing inverts.
- The proposed cross-sections for crossing roadways under municipal jurisdiction should be reviewed and confirmed with the local jurisdiction during the detailed design stage.
- Preliminary designs for future Floodway bridge structures at Gunn Road and PTH 15 were beyond the scope of this study. This work should be undertaken prior to the commencement of interchange detailed design at these locations.
- Drainage into the Floodway should be avoided if possible as it would require an outfall structure and depending on elevations may require a flood pump station.
- Any land not required for the functional design along the Floodway should be transferred to the Floodway.
- The interchanges at Gunn Road and PTH 15 will require additional geotechnical analysis during future design phases to recommend appropriate measures to ensure stability. Coordination with Water Infrastructure will also be required in future design phases to ensure the overall flood protection level is achieved.
- It may be necessary to provide an additional public parking lot and/or MTI-only access to the Floodway for maintenance crews when the existing access and parking lot on PTH 101 at Gunn Road is closed. This issue will need to be discussed with various MTI departments to confirm an appropriate location for the parking lot and access on PTH 101.
- The construction of the interchange at Wenzel Road will need to include the remediation of the existing floodway access road and should be investigated during future design phases.
- The hydraulic analyses for this study were completed using a design flood frequency of 2% for PTH 101; however, the design flood was changed to 1% near the completion of this study. Any future analysis for PTH 101 should use a design flood frequency of 1%.
- Impacts to individual accesses was considered in the development of the functional design, however; it is recommended that impacted landowners be re-engaged during the detailed design stage to ensure the proposed alternative access solutions remain valid.
- The Safety Audit identified engineered slopes as a possible alternative to vertical retaining walls at some locations. It is recommended that these alternatives be investigated during the detailed design stage.
- The functional design includes active transportation facilities aligned with existing desire lines. It is recommended that these facilities be reviewed during the detailed design phase to ensure the final design meets active transportation needs as the project progresses. This may require further engagement with key stakeholders.
- Key environmental and heritage concerns should be addressed at future phases:

- The project will require several Environment Act Licenses (as Class 3 Developments) based on build-out timeframes e.g., 5-to-10-year, 10-to-15-year, and 20-to-25-year timeframes (three separate licenses may be required).
- Heritage Resource Impact Assessments will also be required for the project and will need to be completed in support of future design phases based on build-out timeframes.
- Detailed assessments for wetlands impacted by the project including determining area of impact and corresponding compensation for wetland loss (as applicable) will be required per environmental regulations.
- Ensuring environmental mitigation measures are incorporated into future design phases and regulatory requirements (current and future) are met including permitting, review and approvals/authorizations are satisfied.
- In the Structural preliminary design stage, for shorter span bridges, 1200mm deep girders may be considered instead of 1300mm deep girders which were proposed to match other sites for simplification of girder fabrication and to present a uniform depth for all structures.
- MTI-style concrete I girders may be considered in place of 1600mm deep NU girders proposed.
- Consideration may be given to add an additional girder for proposed precast box girder cross-sections to reduce deck overhangs where feasible.
- Closed abutment bridges utilizing MSE walls may be modified to open abutments with longer spans and inclusions of headslopes to minimize future maintenance costs associated with MSE walls.
- The findings of the friction analysis completed for this study should be considered as part of future design studies along the PTH 101 corridor and additional friction testing be completed as appropriate.
- Right of way requirements will need to be confirmed during the detailed design phase of each component.