Manitoba

South Perimeter Design Study

FINAL REPORT

JUNE 2020

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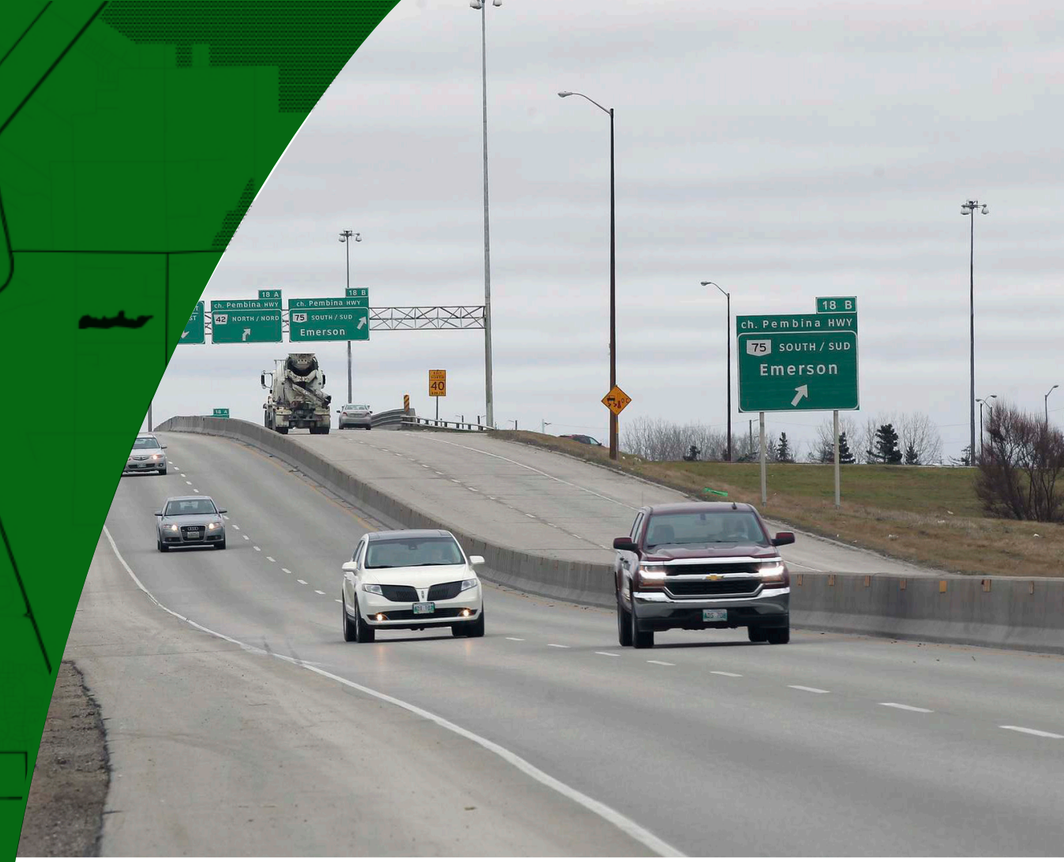

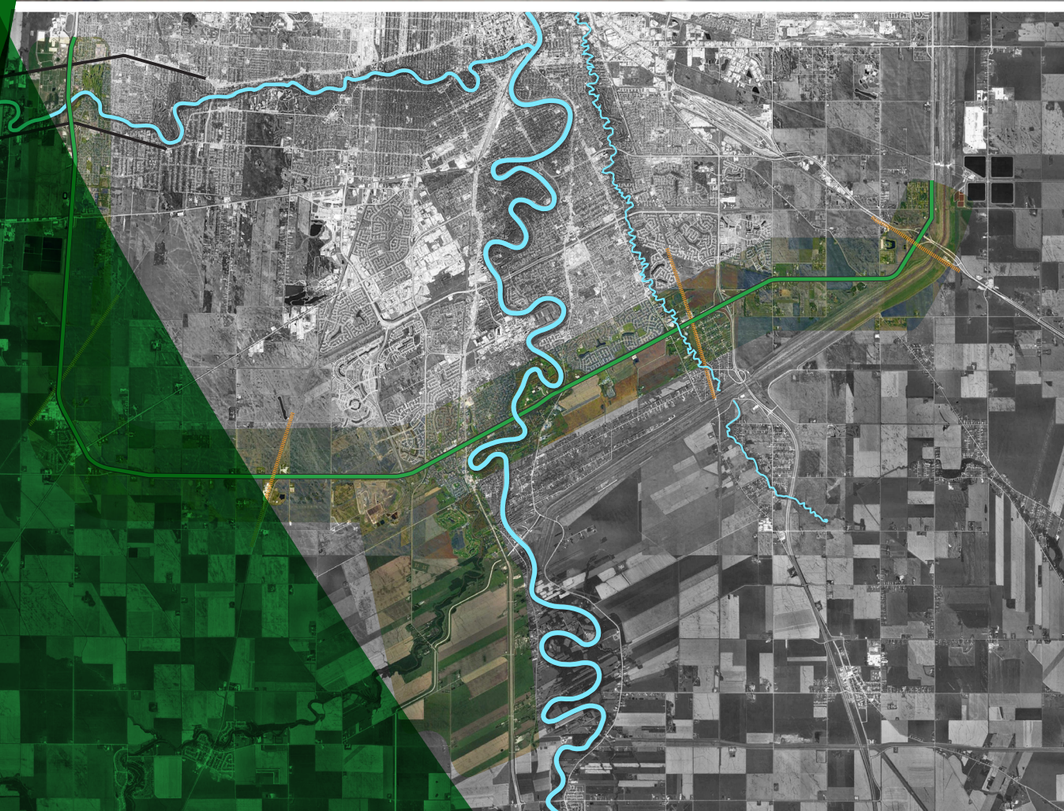

SOUTH PERIMETER DESIGN STUDY

MANITOBA INFRASTRUCTURE

CONFIDENTIAL

PROJECT NO.: 17M-02424-00
DATE: JUNE 2020

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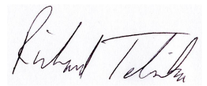

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1 INTRODUCTION

1.1 STUDY BACKGROUND

Provincial Trunk Highway (PTH) 100 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 101, is known as the Perimeter Highway. The Perimeter Highway was constructed to allow through traffic to bypass the City street system. PTH 100 extends from PTH 1W (Portage Avenue) easterly to PTH 1E (Fermor Avenue), skirting the south side of the City, and is currently accessed via stop controlled and signalized at-grade intersections and interchanges.

Since the original construction of PTH 100, residential growth in Winnipeg and other adjacent rural municipalities has expanded and is now directly adjacent to PTH 100 in many areas. This growth has resulted in an increase in urban traffic demand on PTH 100, resulting in a corresponding decline in the percentage of interurban traffic that is using PTH 100 as a bypass. This residential growth, combined with commercial development on either side of PTH 100, has led to a significant increase in cross-street movements and growing safety / operational issues.

A Preliminary Design Study of the South Perimeter Highway from PTH 3 (McGillivray Boulevard) to PTH 59 (Lagimodiere Boulevard) was undertaken in 1988, and recommended that PTH 100 become a freeway with access limited to interchanges only. This Study has been used since that time as a decision-making guide when reviewing development proposals to protect future right-of-way requirements. However, since the 1988 Study, traffic volumes on PTH 100 have increased by 100 percent. As a result, safety, operational, and capacity deficiencies have also significantly increased and the general physical condition of the roadway on PTH 100 has decreased. Therefore, prior to programming improvements to PTH 100, Manitoba Infrastructure (MI) has determined that the 1988 Study should be updated and the limits revised to encompass all of PTH 100 from the north functional limit of the PTH 1W (Portage Avenue) / PTH 100 interchange to the north functional limit of the PTH 1E (Fermor Avenue) / PTH 100 interchange.

The two main objectives for the PTH 100 Study are to:

- Develop a functional design for PTH 100 to a freeway standard; and
- Develop either conceptual or preliminary designs for the associated structures along PTH 100.

The intent is that PTH 100 will act as a fully access-controlled freeway. Therefore, it will be necessary to confirm which existing connections along PTH 100 are to be closed. MI has identified 22 connections / crossings that they assume will remain with the reconstruction of PTH 100; however, an analysis of these locations will be required as part of this Study. **Figure 1.1** identifies the 22 locations, which include:

- Roadway and structure design modifications for nine existing crossings / connections; and
- New roadway designs for 13 connection / crossing locations and structure designs for 11 crossings.

Modifications are also required to accommodate the interim (four-lane) and ultimate (six-lane) cross-sections for the future reconstruction of PTH 100 to new design standards, as well as to address operational and safety issues at the existing crossing locations. New roadway designs are required for locations where new structures are necessary and to accommodate the proposed interim and ultimate cross-sections.

As part of the South Perimeter Design Study, a functional design study was undertaken for the future proposed St. Norbert Bypass, which will connect to the south side of PTH 100 at Kenaston Boulevard (study area shown in **Figure 1.2**). The Bypass design was required in order to be able to finalize the future plans for the PTH 100 at Kenaston interchange. The future Bypass has been contemplated by MI for many years to provide a faster and safer connection between PTH 100 and PTH 75 to address the significant and growing truck traffic, which travels between western Canada and the United States.

1.2 ALIGNMENT OF FUTURE CONSTRUCTION PROJECTS WITH REPORT RECOMMENDATIONS

As components of the recommended infrastructure are considered for construction, constraints such as schedule, budget or needs analysis may influence the scope of the project under consideration. These constraints may limit project scope to partial implementation of the recommended Initial Stage or Ultimate Stage configurations. The scope of any future construction projects should align, to the degree possible, with the recommended alternatives contained in this report if the full scope of the Initial Stage or Ultimate Stage configuration cannot be pursued due to a constraint.

1.3 STUDY TEAM & OVERSIGHT

The South Perimeter Design Study Team included individuals from the following firms:

- WSP Canada Group Limited – project management; transportation planning and analysis; land development and property services; roadway and bridge surveying; roadway, land drainage, utility and structural design; railway crossings; construction staging and scheduling; cost estimating; environmental site assessments; and public engagement.
- KGS Group – geotechnical and hydrologic / hydraulics.
- ITC – noise analysis and mitigation.
- Flood Murray International – road safety audit.

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

- Don McRitchie, MI Project Manager (to March 2020), Manager, Capital Projects
- Dustin Booy, MI Project Manager (March 2020 to July 2020, Director, Contract Services
- Ruth Eden, Acting Assistant Deputy Minister, Technical Services & Operations Division
- Walter Burdz, Executive Director, Roadside Safety
- Doug Struthers, Director of Regional Operations, Region 1
- Brett Wareham, Director, Highway Design
- Glenn Cuthbertson, Director, Traffic Engineering
- Russ Andrushuk, Executive Director, Engineering Services
- John Logan, Consultant Services Engineer, Structures
- Derek Durant, Acting Manager of Geometric Design and Standards Section, Highway Design
- Kris Maranchuk, Project Engineer, Capital Projects
- Mel Spencer, Acting Railway Crossing Safety Technologist, Traffic Engineering
- Warren Borgford, Acting Traffic Services Engineer, Traffic Engineering
- Archie Miller, Technical Services Engineer, Region 1

LEGEND

- PTH 100
- Major Connecting Roads
- Railway Subdivision
- River

1	PTH 1W (Portage Avenue)	5	Four Mile Road / Wyper Road	10	PR 330	15	PR 200 (St. Mary's Road)
2	Assiniboine River Crossing	6	CEMR Carman Subdivision	11	Kenaston Boulevard	16	St. Anne's Rd
3	PR 241 (Roblin Boulevard)	7	PTH 3 (McGillivray Boulevard)	12	CN Letellier Subdivision	17	Seine River Crossing
4	PR 427 (Wilkes Avenue) / CN Rivers Subdivision	8	Road 8E	13	PTH 75 (Pembina Highway)	18	CPR Emerson Subdivision
		9	CPR La Riviere Subdivision	14	Red River Crossing		

19	PTH 595 (Lagimodiere Boulevard)	21	CN Sprague Subdivision
20	Symington Road	22	PTH 1E (Fermor Ave)

Figure 1.1: South Perimeter Study Area

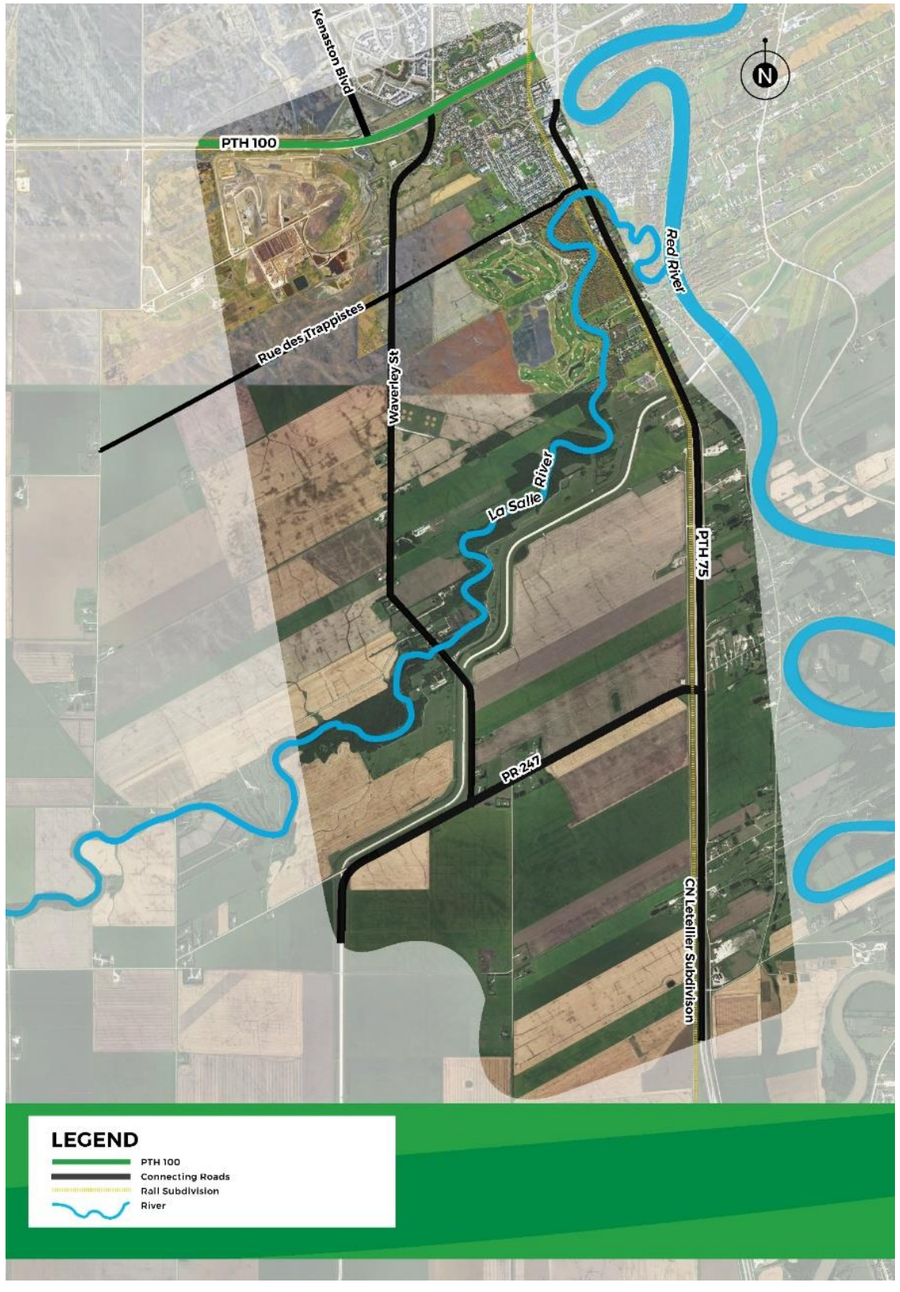

Figure 1.2: Proposed Future St. Nobert Bypass Study Area

1.4 PUBLIC ENGAGEMENT

The Study included public and stakeholder engagement for three phases:

- Phase 1 – introduced the study and identified potential study impacts;
- Phase 2 – presented the conceptual design options for the roadways and interchanges; and
- Phase 3 – presented the functional design for PTH 100 and the proposed future St. Norbert Bypass.

PHASE 1 PUBLIC ENGAGEMENT SUMMARY

Phase 1 engagement began in June 2018 and was completed by September 2018. The purpose of Phase 1 was to:

- Inform stakeholders and the public on the purpose and scope of the study;
- Review highway crossing locations and future access closures;
- Discuss any other potential study impacts;
- Develop an understanding of future development plans that should be considered in the study; and
- Offer an opportunity for stakeholders and the public to provide input and ask questions.

Phase 1 engagement included stakeholder groups, affected municipalities and the public. The activities facilitated during Phase 1 included:

- Group stakeholder meetings with associated municipalities (five meetings in total);
- Group stakeholder meetings with a variety of stakeholder groups (four meetings in total);
- Three pop-up information booths in a variety of locations near / within the study area;
- Three open house events in a variety of locations near / within the study area; and
- Online engagement.

Overall, the feedback collected from stakeholders and the public during Phase 1 of public engagement was positive. Many participants expressed the need for the study, and noted they hope that construction of improvements to the South Perimeter would commence in a timely fashion. Many participants were also very pleased that a proposed future St. Norbert Bypass was being considered by MI.

PHASE 2 PUBLIC ENGAGEMENT SUMMARY

Phase 2 engagement began in November of 2018, and was completed in early February 2019. The purpose of Phase 2 was to present conceptual design options for PTH 100, the 22 grade separated crossings, and for the proposed future St. Norbert Bypass alignment.

Phase 2 engaged stakeholder groups, affected municipalities and the public. The activities facilitated during Phase 2 of public engagement included:

- Group stakeholder meetings with associated municipalities (five meetings in total);
- Group stakeholder meetings with a variety of stakeholder groups (five meetings in total);
- Three pop-up information booths in a variety of locations near / within the study area;
- Three open house events in a variety of locations near / within the study area; and
- Online engagement.

Overall, most feedback received was positive, similar to the feedback received during Phase 1. Generally, respondents were very supportive of the widening of PTH 100 to an ultimate six-lane cross-section, and its transition to a freeway standard. The proposed future St. Norbert Bypass also garnered support from

stakeholders and the public. However, there were a number of stakeholders who expressed that they are opposed to the proposed future St. Norbert Bypass if it negatively impacts Camp Amisk, La Barriere Park, or other important greenspaces within the study area.

PHASE 3 PUBLIC ENGAGEMENT SUMMARY

Phase 3 engagement was completed in early January of 2020. The purpose of Phase 3 of engagement was to present the recommended functional design of the PTH 100 alignment, its associated structures and the proposed future St. Norbert Bypass.

Phase 3 engagement included:

- Group stakeholder meetings with affected municipalities (five meetings in total);
- Group stakeholder meetings with a variety of stakeholder groups (five meetings in total);
- Group meetings held with directly impacted landowners (four meetings in total);
- Three open house events in a variety of locations near / within the study area; and
- Online engagement.

In general, many of the public and stakeholders who participated in the engagement process were supportive of the study, and expressed satisfaction that the Government of Manitoba is planning to implement major improvements to the South Perimeter Highway. Resolutions of support from the Councils of affected municipalities within the study area were requested and will be forwarded to MI under separate cover if and when received. Many respondents were pleased that the intent of the South Perimeter Design Study is to transition PTH 100 to a freeway standard, and that traffic lights and at-grade intersections will eventually be eliminated within the study area. Similar positive feedback was received during the study's Phase 1 and Phase 2 engagement processes.

The concerns raised during Phase 3 of engagement primarily related to noise, the land acquisition process, access to property, the impact the recommended designs will have on the operation of existing businesses / organizations in the area, impacted property values, and how the proposed (future) designs will limit / constrain the use / investments of property over an uncertain future time period.

1.5 STUDY REPORTS

The study included the following project deliverables:

- South Perimeter Design Study: PTH 100 Functional Design Report – This report outlines the functional design study completed for PTH 100 from PTH 1W / Portage Avenue to PTH 1E / Fermor Avenue to provide a fully access controlled facility. The recommended network for PTH 100 includes two stages – Initial and Ultimate. Both stages feature a fully access controlled PTH 100 with access limited to highway interchanges. The Initial Stage includes four lanes (two per direction) on PTH 100, except the segment between Kenaston Boulevard and the Red River, which requires additional lanes. There will be 12 interchanges in the Initial Stage and 14 interchanges in the Ultimate Stage.
- South Perimeter Design Study: Proposed Future St. Norbert Bypass Functional Design Report – This report outlines the functional design study completed for the proposed future St. Norbert Bypass. The proposed bypass is located west of St. Norbert and would provide a faster connection between PTH 100 and PTH 75 by avoiding the many intersections, streets and private approaches along PTH 75, south of PTH 100. One of the driving forces for the bypass is the significant truck traffic moving between western Canada and the United States, which could take full advantage of the proposed bypass, including traffic generated to / from the CentrePort Canada inland port.
- South Perimeter Design Study: PTH 100 Access Management Plan Report – This report summarizes the existing roadway connections, which will be closed as part of the recommended network for PTH 100. The report also outlines the required local road and service road improvements to provide alternate access where there are closures.
- South Perimeter Design Study: Environmental Impact Assessment Report – This report outlines the Environmental Impact Assessment (EIA) completed for the study. The EIA includes a desktop review and ecological field surveys to supplement existing information where practical.
- South Perimeter Design Study: PR 200 Preliminary Design Report – This report outlines the preliminary design for the PTH 100 and PR 200 (St. Mary's Road) interchange structures.
- South Perimeter Design Study: PTH 3 Preliminary Design Report – This report outlines the preliminary design for the PTH 100 and PTH 3 (McGillivray Boulevard) interchange structures.

2 PTH 100 FUNCTIONAL DESIGN REPORT – SOUTH PERIMETER DESIGN STUDY SUMMARY

2.1 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 *South Perimeter Design Study: PTH 100 Functional Design Report*.

PROPERTY BOUNDARIES & LANDOWNERS

Other than the actual road right-of-way for the existing PTH 100, the vast majority of the land within the study area identified in proximity of PTH 100 is owned by private landowners. There were over 15,000 land parcels initially identified within the study area. The parcel information was provided to the individual municipalities in order to obtain landowner information. The parcel and land ownership information was used throughout the project to consult with landowners whose properties were within the study area identified and identify directly impacted properties and landowners.

LAND USE & DEVELOPMENT PLANS

The South Perimeter Design Study area encompasses land through four municipalities: Rural Municipality (RM) of Headingley, RM of Macdonald, City of Winnipeg and 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 of Headingley, Macdonald and Springfield.

TRANSPORTATION PLANS FROM LOCAL JURISDICTIONS

Each of the local governments (City of Winnipeg and RMs of Macdonald, Springfield, and Headingley) within the study area, as well as the Partnership of the Manitoba Capital Region (now known as the Winnipeg Metropolitan Region), were contacted to obtain available information regarding their transportation plans. The following plans were reviewed as part of this study:

- City of Winnipeg Transportation Master Plan;
- Capital Region Transportation Master Plan; and
- Transportation Driving Growth: A Strategy for Manitoba's Capital Region.

ROADWAY NETWORK

PTH 100 is the southern portion of the Perimeter Highway that surrounds the City of Winnipeg. PTH 100 extends from PTH 1W (Portage Avenue) to PTH 1E (Fermor Avenue) and is currently a four-lane divided highway with a speed limit of 80 km/h or 100 km/h, depending on location. Connections to PTH 100 are accommodated at either signalized intersections, unsignalized intersections or interchanges. In 2019, MI closed most service road median openings and several service road accesses to PTH 100 as part of *South Perimeter Highway Safety Plan*. Additional safety improvements and service road access closures to PTH 100 are planned for future years.

ROADWAY CONDITION

A roadway condition assessment was completed to create an inventory of the existing service / local roads in the study area (less than 1.6 kilometers from PTH 100). The inventory included the identification of physical properties (road length, width, right-of-way, material and surface condition) and the types of upgrades that would be needed if a service / local road needed to be rerouted to the future interchanges on PTH 100. In total, of the 101 paved, gravel, and undeveloped road segments evaluated 14% were found to be in good condition, 43% in fair condition, 9% in poor condition, and 34% were mud / undeveloped roadways. This inventory, along with other considerations, such as travel patterns, distance to nearest crossing, property requirements, construction length, cost, etc., were used to assist in determining the most suitable option for rerouting traffic to the future interchanges on PTH 100.

TRAFFIC VOLUMES AND ANALYSIS

Traffic volumes for the PTH 100 mainline and intersections were forecasted for the existing (2018), 10-year (2028), 20-year (2038) and 30-year (2048) design horizons. Traffic volumes include:

- Peak hour traffic (a.m. and p.m.) for intersections and interchanges;
- Annual average daily traffic volumes for roadway segments;
- Average summer daily traffic volumes for roadway segments; and
- Annual average daily truck traffic volumes for roadway segments.

Annual average daily traffic volumes vary along PTH 100, with the highest forecast volumes occurring between PTH 1W (Portage Avenue) and PR 427 (Wilkes Avenue), and between PTH 75 (Pembina Highway) and PTH 59S (Lagimodiere Boulevard). The lowest volumes are between PR 330 and Kenaston Boulevard, and between PTH 59S (Lagimodiere Boulevard) and PTH 1E (Fermor Avenue).

An operational analysis of the PTH 100 mainline was conducted to determine the number of lanes that are required for the existing and future horizon years. The analysis found that four-lanes on PTH 100 would typically be acceptable for the horizon years, except in specific areas where weaving or merge / diverge operations may result in the need for six lanes.

A traffic analysis for the existing conditions was conducted to establish a baseline level of service for each of the existing intersections and interchanges. A number of the existing at-grade intersections have operational deficiencies that will be exacerbated in future years as traffic volumes increase. Interim intersection improvement recommendations were made for several locations and could be implemented prior to the conversion to an interchange. Traffic analyses were also conducted for the interchange alternatives and preferred alternatives developed for the connections to PTH 100.

COLLISION HISTORY

A collision analysis was conducted for PTH 100, between PTH 1W (Portage Avenue) and PTH 1E (Fermor Avenue), using the historical data provided by the MI Traffic Engineering Branch. The analysis period was completed over a nine-year study period, between 2007 and 2015. The collision data included a summary of the frequency, time, severity, configuration, location, and other related statistics of the reported collision records. Collision information provided included intersection collisions and segment collisions. There was a total of 1,336 collisions recorded within the study area, 391 intersection collisions and 945 non-intersection collisions. A single collision involving a pedestrian was reported during the analysis period, and no collisions involving cyclists were reported.

ACTIVE TRANSPORTATION

Existing pedestrian and cycling facilities identified within the study area include:

- Grand Trunk Trail / Harte Trail Off-Street Pathway;
- PTH 75 (Pembina Highway) Buffered Bicycle Lanes / Off-Street Pathway; and
- Cloutier Drive Off-Street Pathway.

There are also several proposed pedestrian and cycling facilities that have been included in the City of Winnipeg's Pedestrian and Cycling Strategies. 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. MI will accommodate active transportation infrastructure that is planned designed and constructed by local governments. Crossings of PTH 100, including at potential grade separations, will be planned for as appropriate.

TRANSIT SERVICE

Transit service within the PTH 100 Study Area is provided by Winnipeg Transit and is limited to a section of PTH 100 between PR 241 (Roblin Boulevard) and PTH 1W (Portage Avenue) for routes 66 and 98. Transit service also crosses PTH 100 along PTH 75 (Pembina Highway) for routes (91, 137, 162 and 170) serving St. Norbert. Winnipeg Transit is exploring the possibility of extending a route across PTH 100 along PTH 1W (Portage Avenue) into Headingley.

RAIL CROSSINGS & FUTURE TRACK REQUIREMENTS

The are six railway crossings along PTH 100 that were examined as part of this study:

- CN 10.46 Rivers Subdivision – There is a grade separated crossing over two main tracks of the CN River Subdivision near PR 427 (Wilkes Avenue). CN operates an average of 34 trains per day across this section of the Rivers Subdivision, which is part of CN's transcontinental corridor connecting the port of Vancouver and Ridley to the US Mid-West and Eastern Canada. Preliminary discussions with CN indicate that there are no future designs for infrastructure expansion.
- CEMR 4.05 Carman Subdivision – Central Manitoba Railway (CEMR) operates four trains per week at this crossing. The Carman subdivision provides access to Agrico (fertilizer), Besco Grain (seed supplier), Richardson Pioneer (Grain Elevator) and Linear Grain (Grain Elevator), as well as storage capacity for CEMR. The track is owned and Operated by CEMR. Access to the subdivision is via the CN Rivers Subdivision, over which CEMR has running rights. The annual average daily traffic volume on this portion of PTH 100 is 10,870 and the average number of daily total trains is one. 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 and to facilitate the movement of local agricultural traffic across PTH 100.
- CP 11.04 La Riviere Subdivision – CP operates six trains per week at this crossing. The train services Bunge in Altona, interchanges to the Boundary Trails Railway at Rosenfeld and services a few additional customers in Morris. In addition, there are two high throughput elevators on the La Riviere Subdivision (Morris and Winkler), which are served as required that will increase the train count during grain season (April to June and September to December). The average annual daily traffic volume on this portion of PTH 100 is 13,420 and the average number of daily total trains is two, which gives a cross product of 26,840. Based on Transport Canada's *Grade Crossing Standards*, a new crossing would require the same warning system as the existing crossing. However, grade separation is required to meet the desired freeway standard and to facilitate the movement of local agricultural traffic across PTH 100.
- CN 5.45 Letellier Subdivision – CN operates 12 trains per week at this grade separated crossing. BNSF has haulage rights across the Letellier Subdivision and interchanges with CN in the Fort Rouge yard and rail traffic is moved by CN into Fort Rouge in regular train service. There are two high throughput elevators on the Letellier Subdivision (Morris and Letellier), which are served as required. This will increase the train count during grain season (April to June and September to December).
- CP 6.71 Emerson Subdivision – The crossing of the Emerson Subdivision is CP's secondary connection to the US Mid-West (primary connection is at North Portal, Saskatchewan). Regular train service accounts for two trains per day with bulk commodities (grain, potash and oil) making up the additional five trains per day for a total of seven trains per day. The average annual daily traffic volume on this portion of PTH 100 is 16,340 for a cross product of 114,380. Based on Transport Canada's *Grade Crossing Standards*, a new crossing would require the same warning system as the existing crossing. However, grade separation is required to meet the desired freeway standard and to facilitate the movement of local agricultural traffic across PTH 100.
- CN 144.95 Sprague Subdivision – CN operates 16 trains per day at this grade separated crossing. The line runs from Winnipeg to Rainy River, Ontario. The crossing is currently grade separated in two locations (PTH 100, as well as an off ramp to PTH 1). Grade separation will be maintained at this crossing.

EMERGENCY SERVICES

The City of Winnipeg Fire and Paramedic Service and the City of Winnipeg Police Service were consulted during the initial Stakeholder meetings for this project. It was noted that there are no specific design requirements for emergency vehicles on Provincial Highways beyond the standard requirements related to selecting appropriate design vehicles. Emergency services did note that a minimum of two access points is required for each community, and that emergency median crossovers were required in some locations. It is recommended that when PTH 100 becomes a freeway, accesses should be spaced approximately 8 km apart 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 by emergency, highway support and maintenance vehicles should be installed at approximately halfway between two interchanges. Access points for each community should be identified during the detailed design phase.

UTILITIES

The study area contains various minor and major utility systems, both above and below ground. The below ground utilities consist of shallow and deep utilities, while all above ground utilities are Manitoba Hydro power lines. In general, the at-grade intersections and existing interchanges along PTH 100 have more densely populated utilities compared to the sections of PTH 100 between them.

LAND DRAINAGE

Most of the drainage infrastructure was original to the construction of PTH 100 and is generally due for replacement.

Overall, conveyance of runoff flow in the highway ditches is hampered by the lack of slope in the land, in particular, the sections in the study area that are distant from rivers and major drains.

Three rivers, the Assiniboine River, the Red River, and the Seine River, cross the PTH 100 right-of-way. There are also several major drains, the Lot 16 Drain, the Atchison Drain, the Westendorf Coulee, the Beaujolais Coulee, and two unnamed drains, which either cross the PTH 100 right-of -way or connect with the highway ditches. The rivers, major drains, and highway side ditches are the main systems that provide conveyance for runoff generated from the PTH 100 right-of-way, adjacent farmlands, and other lands that drain into the highway ditches through all the study area.

STRUCTURES

A review of all existing structures was completed based on information provided by MI. Structures currently exist at the following locations:

- PTH 1W (Portage Avenue) – Constructed in 1994, a 4-span 29.5 m wide x 71.52 m long (16.50 m / 18.90 m / 18.90 m / 16.50 m) precast prestressed box girder (PPCBG) structure at 14° left hand skew (LHS) spanning over Portage Avenue.
- Assiniboine River – Constructed in 1959, a 5-span 16.86 m wide x 138.70 m long (20.90 m / 27.90 m / 36.80 m / 27.90 m / 25.20 m) tapered steel girder crossing with reinforced concrete deck and asphalt overlay with four river piers.
- PR 241 (Roblin Boulevard) – Replacement structures were constructed in 2016. Two 2-span 80 m long (40 m / 40 m) PPCBG structures with reinforced concrete deck and asphalt overlay.
- PR 427 (Wilkes Avenue) / CN Rivers Subdivision – Constructed in 1959, a 4-span 18.75 m wide x 95.22 m long (23.56 m / 23.80 m / 23.80 m / 23.56 m) PPCBG overhead structure and multi-column bents supported on spread footing over CN and Wilkes Avenue.
- CN Letellier Subdivision – Originally constructed in 1958, a 22.33 m reinforced concrete rigid frame at 31° right hand skew over CN track and approach spans.
- PTH 75 (Pembina Highway) – Constructed in 1959, a 4-span 26.62 m wide x 67.89 m long (16.36 m / 18.66 m / 18.66 m / 14.21 m) simply supported rolled steel girder structure with multi-column bents supported on spread footing spanning over PTH 75.
- Red River – Constructed in 1960, a 7-span 22.83 m wide x 258.41 m long (28.80 m / 28.80 m / 36.58 m / 48.77 m / 48.77 m / 36.58 m / 28.80 m) tapered steel girder crossing with reinforced concrete deck and asphalt overlay with three river piers.
- Seine River – Constructed in 1974, a 3.66 m x 2.44 m single cell reinforced concrete box culvert.
- PTH 59S (Lagimodiere Boulevard) – Constructed in 1972, a 4-span 22.86 m wide x 82.85 m long (19.04 m / 25.74 m / 19.04 m / 19.04 m) PPCBG overpass structure with multi-column bents supported on spread footing over PTH 100.
- CN Sprague Subdivision Exit Ramp – Constructed in 2006, a 10.44 m wide x 86.07 m long 3-span PCCBG structure at 28° LHS with center span over CN track.
- CN Sprague Subdivision – Constructed in 1959, a 10.97 m clear span x 26.75 m long reinforced concrete rigid frame with base slab, over the CN track.
- PTH 1E (Fermor Avenue) – Constructed in 1959, a 4-span 26.0 m wide x 56.72 m long (12.62 m / 16.31 m / 16.31 m / 11.48 m) simply supported steel girder structure with multi-column bents supported on spread footing spanning over PTH 1E.

GEOTECHNICAL CONDITIONS

The soil conditions that can be expected to be encountered along PTH 100 are highly variable. While the stratigraphy will be fairly consistent, that is, overburden clay and glacial till overlying limestone bedrock, it will be the thickness of each layer that will vary along the route.

HYDROLOGICAL / HYDRAULIC CONDITIONS

The existing hydraulic conditions for the major waterway crossings of PTH 100, including the Seine River, Red River and Assiniboine River, were reviewed.

- Seine River – The existing crossing through the Seine River at PTH 100 consists of a single cell 3.6 m wide by 2.4 m high concrete box culvert. The culvert is approximately 50 m long and has vertical headwalls on both the upstream and downstream ends of the culvert. The HEC-RAS model was used to simulate the hydraulic conditions at the existing crossing using the updated design flows. It was found that this structure would produce a headloss of approximately 0.30 m for the design flow, which is equal to MI's design standard. Furthermore, it does not provide any clearance between the water level and culvert soffit at the 50-year flow, which is less than the design criterion of 0.3 m. At the two-year flow, there is only 0.32 m of vertical clearance, which does not meet navigation standards (1.5 m minimum) and at the 3Q10 flow, the velocity through the structure is 1.4 m/s, which does not meet the maximum allowable velocity for fish passage (0.6 m/s). In addition, when water levels on the Red River are nearing or at the flood protection level (230.0 m or 27 ft. JAPSD), backwater effects can extend all the way up the Seine River to the crossing location. In this case, the culvert would become submerged and flow through the culvert would become restricted for all design flows. In turn, the headwater of the culvert would rise, backwatering the reach upstream of the culvert. Under this scenario, river levels upstream of the culvert are expected to be approximately 0.5 m higher than if the Red River was at the normal level, for the 50-year design flow.
- Red River – PTH 100 crosses the Red River in southern Winnipeg between PTH 75 (Pembina Highway) and PR 200 (St. Mary's Road). The existing crossing at this location consists of a seven-span bridge, with a total span of approximately 256 m. The bridge is approximately 23 m wide and accommodates four lanes of traffic, two eastbound lanes and two westbound lanes. The existing crossing over the Red River was not hydraulically assessed at this stage of design because this crossing will remain unchanged for the Initial Stage of the project. The underside of the girder is well above the flood protection level at the site. It is therefore anticipated that the existing structure would meet all hydraulic design criteria, but these details should be confirmed at the next stage of design.
- Assiniboine River – PTH 100 crosses the Assiniboine River in western Winnipeg between PTH 1W (Portage Avenue) and PR 241 (Roblin Boulevard). The existing crossing at this location consists of a five-span bridge, with a total span of approximately 139 m. The bridge is approximately 21 m wide and accommodates four lanes of traffic, two northbound lanes and two southbound lanes. The crossing is located immediately upstream of a bend in the river. As such, all piers are skewed to approximately match the direction of flow. The existing crossing over the Assiniboine River was not hydraulically assessed at this stage of design because this crossing will remain unchanged for the Initial Stage of the project. The underside of the girder is well above the flood protection level at the site. It is therefore anticipated that the existing structure would meet all hydraulic design criteria, but these details should be confirmed at the next stage of design.

ENVIRONMENTAL CONSIDERATIONS

A desktop review of available biophysical and socio-economic information for the study area was completed in May to June of 2018. The desktop review entailed an examination of: applicable federal and provincial government databases; publicly accessible websites; mapping resources; environmental reports; and information requests from provincial and federal database managers / specialists. The review summarized potential project impacts related to: environmental legislation; existing land use; parks and open spaces; heritage, historic and archaeological resources; natural areas; wildlife; surface waterbodies; fish and fish habitat; species of conservation concern; and wildlife collision concerns.

Information collected from the desktop review formed the basis of the screening level report for the proposed PTH 100 reconstruction functional design study and was utilized to:

- Identify data gaps relating to ecological information for the study area;
- Guide additional field studies to supplement existing information; and
- Develop future considerations / recommendations for the Project to be presented in a final environmental assessment report.

2.2 ALTERNATIVES

Conceptual design alternatives for the PTH 100 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.

The conceptual design alternatives were evaluated considering the input from the public / stakeholders. The criteria included considerations for traffic operations, geometry, utilities, construction and staging, safety, oversize loads, land acquisition / severance, impact on businesses, impact on access, pedestrian and cycling accommodation, noise impacts, natural environment impacts, heritage resource impacts, and construction costs. The evaluation was approved by the MI Steering Committee.

2.2.1 CROSS-SECTION AND ALIGNMENT ALTERNATIVES

CROSS-SECTION ALTERNATIVES

Two cross-section alternatives were proposed – depressed median cross-section or concrete median barrier cross-section. The depressed median cross-section is preferred; however, there are several sections of PTH 100 with an existing concrete median barrier that would need to be retained or extended because of right-of-way limitations or because the section is in the vicinity of an existing interchange or river crossing. The widening of PTH 100 for the various segments was proposed to be either to the inside of the existing PTH 100 alignment (towards Winnipeg) or to the outside of PTH 100 (away from Winnipeg).

ALIGNMENT ALTERNATIVES

Alignment alternatives were proposed for various segments of PTH 100. The alignment alternatives were based on one of the two cross-section alternatives identified above. The conceptual design alternatives and preferred alternative for each location include:

- Segment 1 – PTH 1W (Portage Avenue) to PR 427 (Wilkes Avenue): Only one alignment alternative was considered for this segment. The preferred alignment for this section widens PTH 100 to the inside and is identified in the *PTH 100 Alignment & PTH 100 / PR 241 Intersections Modification Study, Dillon Consulting, April 2019*.
- Segment 2 – PR 427 (Wilkes Avenue) to CEMR Carman Subdivision: Only one alignment alternative was considered for this segment as both the City of Winnipeg West End Pollution Control Centre and the community of Oak Bluff present significant constraints to the widening of PTH 100 to the outside. The preferred alignment for this section widens PTH 100 to the inside with a depressed median cross-section.
- Segment 3 – CEMR Carman Subdivision to West of Road 8E: Two alignment alternatives were considered for this segment: (1) utilize the existing alignment; and (2) construct a new alignment inside of the existing alignment (towards Winnipeg). The preferred alignment for this segment was dependent on the interchange alternative selected for PTH 3 and PTH 100. The preferred alignment for this section reconstructs all lanes of PTH 100 on a new alignment to the inside of the existing location with a depressed median cross-section.
- Segment 4 – West of Road 8E to CP La Riviere Subdivision: Two alignment alternatives were proposed for this segment: (1) widen to the outside of PTH 100 with a depressed median cross-section; and (2) widen to the inside of PTH 100 with a depressed median cross-section. The preferred alignment for this segment widens PTH 100 to the outside with a depressed median cross-section, as the section east of CP La Riviere Subdivision requires widening to the outside in the vicinity of the Waverley West development. This option also eliminates the need for the alignment to transition from the inside to the outside east of the CP La Riviere Subdivision. More residential / commercial properties (two residential and two commercial properties) will be impacted with this alternative; however, existing buildings would not be affected.
- Segment 5 – CP La Riviere Subdivision to Waverley Street: Only one alignment alternative was considered for this segment, as there are development related constraints that make widening to the inside undesirable. The preferred alignment for this section widens PTH 100 to the outside with a depressed median cross-section.
- Segment 6 – Waverley Street to Red River Crossing: Only one alignment alternative was considered for this segment, as this segment is constrained by significant residential land development on both the inside and outside of PTH 100. The preferred alignment for this segment is the median barrier cross-section on the existing alignment.
- Segment 7 – Red River Crossing to West of PR 200 (St. Mary's Road): Initially, two alignment alternatives were proposed for this segment: (1) widen to the outside along the entire length of the segment; and (2) widen to the outside at the Red River to be compatible with the future six-lane bridge and then transition to widen to the inside at St. Mary's Road. However, to transition to the alignment alternative recommended for Segment 8, the recommended alternative widens to the outside along the entire length of the segment. The preferred cross-section segment varies depending on the construction stage. For the Initial Stage, PTH 100 is recommended to have a concrete median barrier cross-section until east of the Red River Bridge and then widen to a depressed median cross-section prior to the St. Mary's Road interchange. For the Ultimate Stage, the entire segment is recommended to have a depressed median cross-section.
- Segment 8 – West of PR 200 (St. Mary's Road) to East of St. Anne's Road: Two alignment alternatives were proposed for this segment: (1) widen to the outside of PTH 100 with a depressed median cross-section; and (2) widen to the inside of PTH 100 with a depressed median cross-section. The preferred alignment for this segment widens PTH 100 to the outside with a depressed median cross-section, as it has less impacts to the residential properties with respect to noise and allows for pedestrian and cyclists to be accommodated north of PTH 100.
- Segment 9 – East of St. Anne's Road to East of PTH 59S (Lagimodiere Boulevard): Only one alignment alternative was considered for this segment, as it is constrained by significant residential and commercial land on both the inside and outside of PTH 100. The preferred alignment for this segment remains on the existing alignment and includes a median barrier cross-section.
- Segment 10 – East of PTH 59S (Lagimodiere Boulevard) to West of PTH 1E (Fermor Avenue): Two alignment alternatives were proposed for this segment: (1) widen to the outside of PTH 100 with a depressed median cross-section; and (2) widen to the inside of PTH 100 with a depressed median cross-section. The preferred alignment for this segment widens PTH 100 to the inside, as it has less severe impacts to residential properties with respect to land acquisition and noise since houses are set farther back.
- Segment 11 – West of PTH 1E (Fermor Avenue) to East of PTH 1E (Fermor Avenue): Only one alignment alternative was considered for this segment, as it is constrained by the existing PTH 1E interchange structure that was recently rehabilitated and has a concrete median barrier cross-section. The preferred alignment for this segment remains on the existing alignment and includes the median barrier cross-section for the Initial Stage. A depressed median cross-section could be considered for the Ultimate Stage if the interchange is reconfigured.

2.2.2 INTERCHANGES, RAIL GRADE SEPARATIONS & RIVER CROSSINGS ALTERNATIVES

Alternatives were proposed for the various interchange, rail-grade separation and river crossing locations along PTH 100. The conceptual design alternatives and preferred alternative for each location include:

- PTH 1W (Portage Avenue) Interchange: Three alternatives were investigated for this location: (1) Diamond interchange; (2) Parclo B4 interchange; and (3) Diverging Diamond interchange. The Diverging Diamond interchange was selected as the preferred alternative for the PTH 1W interchange as it offers more flexibility and has additional safety benefits and operational capacity than the other options. It should be noted that the traffic operational analysis indicates that the existing cloverleaf interchange, although substandard from a geometric perspective, can operate adequately from a traffic perspective until the study horizon year of 2048.
- Assiniboine River Crossing: Only one alternative was investigated for this location for each construction stage. For the Initial Stage, the bridge is proposed to be used as-is. For the Ultimate Stage, a new bridge for southbound / eastbound traffic could be constructed to the outside of the existing bridge and the existing bridge could be used for northbound / westbound traffic.
- PR 241 (Roblin Boulevard) Interchange: Only one alternative was investigated for this location. The interchange remains a Parclo AB interchange at the Initial Stage and Ultimate Stage; however, the ramp length and loop radii are increased to meet current geometric standards and roundabouts are added at the east and west intersections.
- PR 427 (Wilkes Avenue) Interchange / CN Rivers Subdivision Rail Grade Separation: Only one alternative was investigated for this location. For the Initial Stage, no changes are recommended. For the Ultimate Stage, it is recommended that the proposed interchange remains a Parclo AB interchange; however, the ramp length and loop radii are increased to meet current geometric standards, and Wilkes Avenue would be “straightened” to improve sight lines. The intersection configurations would remain the same as existing.
- Four Mile Road / Wyper Road Interchange: Only one alternative was investigated for this location. For the Initial Stage, the existing right-in / right-out access to PTH 100 will be closed and a service road will be constructed to provide access to PTH 100 at the PR 427 (Wilkes Avenue) interchange. For the Ultimate Stage, it is recommended that a new Diamond interchange be constructed with the intersections on Four Mile Road / Wyper Road being stop controlled.
- CEMR Carman Subdivision Rail Grade Separation: Three alternatives were investigated for this location: (1) grade-separation on existing alignment; (2) realignment to CN Rivers Subdivision (west of PTH 100); (3) and realignment to Four Mile Road / Wyper Road Interchange (west of PTH 100). The grade-separation on the existing alignment was selected as the preferred alternative, as the relocation alternatives were deemed not feasible in terms of the ease of being able to purchase and obtain additional right-of-way for rail relocation. For the Initial Stage, twin two-lane east-west structures are proposed. For the Ultimate Stage, the twin east-west structures are proposed to be widened to three lanes.
- PTH 3 (McGillivray Boulevard) Interchange: Four alternatives were investigated for this location: (1) Diamond interchange on existing PTH 100 alignment; (2) Parclo A4 interchange on existing PTH 100 alignment; (3) Diamond interchange with a new PTH 100 alignment; and (4) Parclo A4 interchange with a new PTH 100 alignment. The Diamond interchange with a new PTH 100 alignment (inside of the existing alignment) was selected as the preferred alternative for the PTH 3 interchange as it provides the best access to existing businesses, has development potential, reduces noise impacts to Oak Bluff and accommodates oversize loads better than the Parclo A4 interchange.
- Road 8E Interchange: Only one alternative was investigated for this location. For the Initial Stage, the existing right-in / right-out access to PTH 100 from the north service road will be closed. For the Ultimate Stage, it is recommended that a new Diamond interchange be constructed with the intersections on Road 8E being stop controlled.
- CP La Riviere Subdivision Rail Grade Separation: Only one alternative was investigated for this location. A grade separation structure is the preferred alternative at this location to meet the desired freeway standard and to facilitate the movement of local agricultural traffic such as grains and seed oil across PTH 100. For the Initial Stage, twin two-lane east-west structures are proposed. For the Ultimate Stage, the twin east-west structures are proposed to be widened to three lanes.
- PR 330 Interchange: Only one alternative was investigated for this location for each construction stage. For the Initial Stage, the preferred alternative is a Diamond interchange with roundabout intersection control on PR 330. For the Ultimate Stage, the preferred alternative is a Diamond interchange with signalized intersection control on PR 330.
- Kenaston Boulevard / Proposed Future St. Norbert Bypass Interchange: Two alternatives were investigated for this location: (1) Cloverleaf interchange with semi-direct southbound to eastbound ramp and (2) Parclo A4 interchange. For the Initial Stage, the preferred alternative is a Parclo A4 interchange, as it is expected to have lower cost and the ability to accommodate traffic within the 2048 horizon year. The Parclo A4 interchange will connect to Waverley Street in the interim until the proposed future St. Norbert Bypass is constructed. For the Ultimate Stage, the interchange could be upgraded to a Cloverleaf interchange with a semi-direct southbound to eastbound ramp to provide a system interchange at this location. The Cloverleaf interchange is recommended once the proposed future St. Norbert Bypass is in place, as it is anticipated to be key economic corridor for the Province and the City of Winnipeg.
- CN Letellier Subdivision Rail Grade Separation: Only one alternative was investigated for this location for each construction stage. For the Initial Stage, it is recommended that the existing grade separated structure be replaced at its current alignment. For the Ultimate Stage, the grade separated structure will need to be widened to accommodate a six-lane cross-section of PTH 100. Separate railway grade separation structures will be required to accommodate the PTH 75 (Pembina Highway) interchange southbound to westbound ramp and eastbound to southbound ramp.
- PTH 75 (Pembina Highway) Interchange: Two alternatives were investigated for this location: (1) Diamond interchange and (2) Parclo B4 interchange. The Parclo Interchange is the preferred alternative as it can accommodate traffic beyond the 2048 horizon year and removes the undesirable weaving that currently exists with the existing cloverleaf interchange. The Diamond interchange alternative requires double left-turns on PTH 75 to operate at an acceptable level of service; however, there is a lack of space to accommodate these lanes with the existing bridge abutments.
- Red River Crossing: Only one alternative was investigated at this location for each construction stage. For the Initial Stage, it is recommended that the existing bridge continue to be used as is with a barrier shy distance design exception. For the Ultimate Stage, it is recommended that the existing structure be used to carry the three westbound lanes (assuming there is sufficient structural life remaining at that point) and a new structure be constructed on the outside where the right-of-way is wider to carry the three eastbound lanes.
- PR 200 (St. Mary’s Road) Interchange: Three alternatives were investigated for this location: (1) Diamond interchange; (2) Parclo B4 interchange; and (3) Diverging Diamond interchange. The Diverging Diamond interchange was selected as the preferred alternative as it has additional safety benefits and operational capacity compared to the other options. St. Mary’s Road is realigned to the east to improve the crossing angle at PTH 100 an increase the separation from the Red River.
- St. Anne’s Road Interchange: Only one alternative was investigated for this location for each construction stage. For the Initial Stage, the preferred alternative is a Diamond interchange with signalized intersection control on St. Anne’s Road. St. Anne’s Road is proposed to have four-lanes north of PTH 100 and two-lanes south of PTH 100. For the Ultimate Stage, the preferred alternative remains the same; however, St. Anne’s Road south of PTH 100 is widened to four-lanes.
- Seine River Crossing: It is anticipated that construction for the proposed Seine River crossing structure will be done in conjunction with construction of the proposed interchange at St. Anne’s road. For the Initial Stage, the existing four-lane east-west structure over the Seine River will require modifications to accommodate the ramp terminals from the St. Anne’s Road interchange. For the Ultimate Stage, the

existing north-south culvert structure along the Seine River is proposed to be replaced with a structure that can accommodate river flows, canoeists, cyclists, and pedestrians. Crossing alternatives considered included: (1) separate box culverts for the river and an AT path; (2) extension of the existing culvert; (3) a channel girder bridge; (4) a precast concrete arch culvert; and (5) a cast-in-place concrete rigid frame. The concrete rigid frame was the preferred option beneath the north access road and beneath PTH 100 in the Ultimate Stage. New crossings will also be required on the service roads north of PTH 100 as part of the new interchange construction works.

- CP Emerson Subdivision Rail Grade Separation: Only one alternative was investigated for this location. A grade separation structure is the preferred alternative at this location to meet the desired freeway standard. For the Initial Stage, twin two-lane east-west structures are proposed. For the Ultimate Stage, the twin east-west structures are proposed to be widened to three-lanes.
- PTH 59S (Lagimodiere Boulevard) Interchange: Only one alternative was investigated for this location for each construction stage. For the Initial Stage, the preferred alternative is the existing Parclo AB interchange, as it currently operates in free flow with the current ramp configurations. For the Ultimate Stage, the preferred alternative is a Cloverleaf interchange with CD roads, as the current interchange structure span is not long enough to allow for three lanes in each direction on PTH 100 plus ramp exits and entrances and will need to be replaced.
- Symington Road Interchange: Only one alternative was investigated for this location. For the Initial and Ultimate Stages, the preferred alternative is a Diamond interchange with stop sign intersection control on Symington Road.
- CN Sprague Subdivision Rail Grade Separation: Only one alternative was investigated for this location for each construction stage. For the Initial Stage, the grade-separated structure over the rail line will remain unchanged. For the Ultimate Stage, the existing structures should be replaced to accommodate 3-lanes in each direction on PTH 100. It is anticipated that construction for the proposed CN Sprague Rail overpass structures will be done in conjunction with construction of the proposed interchange at PTH 1E (Fermor Avenue) for the Ultimate Stage.
- PTH 1E (Fermor Avenue) Interchange: Only one alternative was investigated for this location for each construction stage. For the Initial Stage, the preferred alternative is the existing Cloverleaf interchange, as it currently operates in free flow with the current ramp configurations. For the Ultimate Stage, the preferred alternative is a Cloverleaf interchange with CD roads to remove the short weaving sections between the loop ramps and to improve traffic flow. In addition, the current interchange structure span is not long enough to allow for three lanes in each direction on PTH 100.

2.3 RECOMMENDED NETWORK

The recommended network for PTH 100 includes two phases – Initial and Ultimate.

- Initial Stage: The Initial Stage will include four lanes (two per direction) on PTH 100 with the exception of the segment of PTH 100 between Kenaston Boulevard and the Red River Crossing, which requires additional lanes to accommodate forecast traffic volumes. The Initial Stage does not include the proposed future St. Norbert Bypass.
- Ultimate Stage: The Ultimate Stage will include six lanes (three per direction) on PTH 100 from PTH 1W (Portage Avenue) to PTH 1E (Fermor Avenue). The Ultimate Stage will also include the proposed future St. Norbert Bypass.

The recommended network for PTH 100 is summarized in **Table 2.1** and is shown in **Figure 2.1**.

Table 2.1: Recommended Network for PTH 100

LOCATION	RECOMMENDED NETWORK	
	INITIAL STAGE	ULTIMATE STAGE
PTH 1W	**Cloverleaf Interchange** AT paths added to Existing Interchange	**Diverging Diamond Interchange** New Interchange
PTH 1W to PR 241	**4-lanes on PTH 100** Widening to Both Sides	**6-lanes on PTH 100** Add Lanes
PR 241	**Parclo AB Interchange** Upgrade Existing Interchange Intersections and Loop Ramps	**Parclo AB Interchange** Upgrade Interchange
PR 241 to PR 427	**4-lanes on PTH 100** Widening to Inside	**6-lanes on PTH 100** Add Lanes
PR 427	**Parclo AB Interchange** AT paths added to Existing Interchange	**Parclo AB Interchange** Upgrade Interchange
PR 427 to Four Mile Road / Wyper Road	**4-lanes on PTH 100** Widening to Inside	**6-lanes on PTH 100** Add Lanes
Four Mile Road / Wyper Road	**No Interchange** Close Existing Intersection	**Diamond Interchange** New Interchange
Four Mile Road / Wyper Road to PTH 3	**4-lanes on PTH 100** New Alignment Inside of Existing Alignment	**6-lanes on PTH 100** Add Lanes
PTH 3	**Diamond Interchange** New Interchange	**Diamond Interchange** Upgrade Interchange
PTH 3 to Road 8E	**4-lanes on PTH 100** New Alignment Inside of Existing Alignment	**6-lanes on PTH 100** Add Lanes
Road 8E	**No Interchange** Close Existing Intersection	**Diamond Interchange** New Interchange
Road 8E to PR 330	**4-lanes on PTH 100** Widening to Outside	**6-lanes on PTH 100** Add Lanes
PR 330	**Diamond Interchange** New Interchange	**Diamond Interchange** Upgrade Interchange
PR 330 to Kenaston Boulevard	**4-lanes on PTH 100** Widening to Outside	**6-lanes on PTH 100** Add Lanes
Kenaston Boulevard	**Parclo A4 Interchange** New Interchange	**Cloverleaf Interchange with Semi-Direct SB-EB Ramp** New Interchange Implement with proposed future St. Norbert Bypass
Kenaston Boulevard to PTH 75	**4+ Lanes on PTH 100** Widening to Both Sides	**6-lanes on PTH 100** Add Lanes
PTH 75	**Parclo A4 Interchange** Replace Existing Interchange	**Parclo A4 Interchange** Upgrade Interchange
PTH 75 to Red River Bridge	**Transition from 4+ to 4-lanes on PTH 100** Widening to Both Sides	**6-lanes on PTH 100** Add Lanes
Red River Bridge to PR 200	**4-lanes on PTH 100** Widening to Outside	**6-lanes on PTH 100** Add Lanes
PR 200	**Diverging Diamond Interchange** New Interchange	**Diverging Diamond Interchange** Upgrade Interchange

LOCATION	RECOMMENDED NETWORK	
	INITIAL STAGE	ULTIMATE STAGE
PR 200 to St. Anne's Road	**4-lanes on PTH 100** Widening to Outside	**6-lanes on PTH 100** Add Lanes
St. Anne's Road	**Diamond Interchange** New Interchange	**Diamond Interchange** Upgrade Interchange
St. Anne's Road to PTH 59S	**4-lanes on PTH 100** Widening to Both Sides	**6-lanes on PTH 100** Add Lanes
PTH 59S	**Parclo AB Interchange** Upgrade Existing Interchange Intersections	**Cloverleaf Interchange** New Interchange
PTH 59S to Symington Road	**4-lanes on PTH 100** Widening to Inside	**6-lanes on PTH 100** Add Lanes
Symington Road	**Diamond Interchange** New Interchange	**Diamond Interchange** Upgrade Interchange
Symington Road to PTH 1E	**4-lanes on PTH 100** Widening to Inside	**6-lanes on PTH 100** Add Lanes
PTH 1E	**Cloverleaf Interchange** Existing Interchange	**Cloverleaf Interchange** Upgrade Interchange

SOUTH PERIMETER DESIGN STUDY

Recommended Network

Legend

- PTH 100
- Major Connecting Roads
- Railway Subdivision
- River

Recommended Interchange

- Diverging Diamond Interchange
- Diamond Interchange
- Parclo AB Interchange
- Parclo A4 Interchange
- Cloverleaf Interchange
- No Interchange, Existing Intersection Closed

Recommended Alignment

- Widen to both sides
- Widen to inside
- Widen to outside
- New alignment

Note:

The recommended network for PTH 100 includes two phases - Initial and Ultimate.

The **Initial Phase** includes four lanes (two per direction) on PTH 100, except the segment between Kenaston Boulevard and the Red River Crossing which requires additional lanes.

The **Ultimate Phase** includes six lanes (three per direction) on PTH 100 between PTH 1W and PTH 1E.

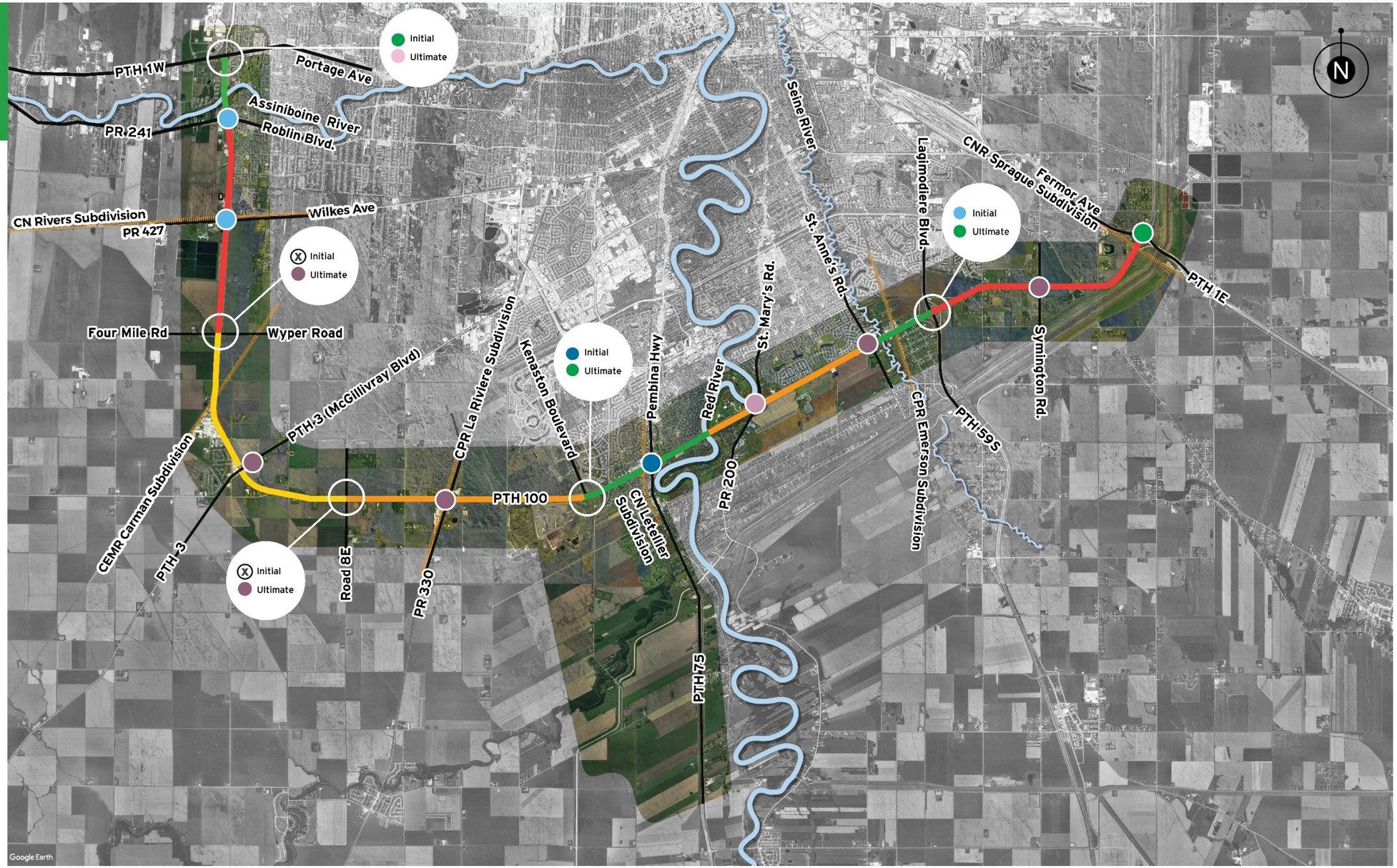

Figure 2.1: Recommended Network for PTH 100

2.4 FUNCTIONAL DESIGN

A functional design was completed for the recommended network for the PTH 100 mainline, interchanges, rail grade separations and river crossings. The roadway design is compliant with the following reference material, along with design criteria WSP has used in recent similar MI projects. In general, WSP used the reference material noted below in the order of precedence as listed below. In situations where either an approved design criterion does not apply, or cannot reasonably be applied, WSP consulted with MI to arrive at a mutually agreed to solution.

- MI – Geometric Design Guide Supplement Sheets (Blue Sheets).
- Transportation Association of Canada, Geometric Design Guide for Canadian Roads, 1999 edition.
- Transportation Association of Canada, Geometric Design Guide for Canadian Roads, 2017 edition.
- American Association of State Highway and Transportation Officials, A Policy on Geometric Design of Highways and Streets, current edition.
- Design guides from other Provincial Transportation Departments.
- Transportation Association of Canada, Canadian Roundabout Design Guide.
- Transportation Association of Canada, Manual of Uniform Traffic Control Devices for Canada.
- MI, Roadside Safety Manual.
- American Association of State Highway and Transportation Officials, Roadside Design Guide.
- American Association of State Highway and Transportation Officials, Highway Safety Manual.
- Transportation Association of Canada, Canadian Road Safety Audit Guide.

In addition to developing roadway and structures functional design drawings (which have been included in Appendix F of the *South Perimeter Design Study: PTH 100 Functional Design Report*), the functional design involved completing all other necessary studies and plans for the functional design of PTH 100. **Figures 2.2** to **2.5** illustrate the recommended functional designs for the initial and ultimate stages for each interchange. The following sections outline the studies and plans that were conducted in the development of the functional design for PTH 100.

TRAFFIC OPERATIONS

The traffic analysis was undertaken using Synchro 10 traffic analysis software (for intersections) and Highway Capacity Software (for the PTH 100 mainline and interchange diverging, merging and weaving segments). Micro-simulation analysis using SimTraffic software was carried out at locations where additional insight into operational performance was required. All interchange recommendations for the Initial Stage were shown to achieve acceptable level of service (level of service D or better) in the 2048 horizon year, with the exception of a few areas where weaving or merge / diverge operations result in the need for six lanes (i.e., between Kenaston Boulevard and PTH 75). The PTH 100 mainline also achieved acceptable level of service (level of service D or better) in the 2048 horizon year.

ROAD SAFETY AUDIT

A Road Safety Audit of the preferred functional design of PTH 100 was undertaken by an independent third-party engineering consultant, Flood Murray International. The Road Safety Audit procedures were consistent with the Transportation Association of Canada – Canadian Road Safety Audit Guide. The Road Safety Audit report included general comments, a summary of design exceptions proposed by WSP and approved by MI, and specific comments related to the proposed design. The results of the RSA were incorporated into the functional design of PTH 100 as deemed appropriate.

ACCESS MANAGEMENT STRATEGY

An access management strategy was created taking into account the unique strategies required for the three basic categories of land uses that currently exist along PTH 100. The strategy is further detailed in the *PTH 100 Access Management Plan Report* (under separate cover). The report details existing roadway connections which will be closed as part of the recommended network for PTH 100 and the need for local road and service road improvements to provide alternate access where there are closures.

NOISE ASSESSMENT & MITIGATION PLAN

An assessment of highway traffic related noise within the study area was conducted and where appropriate, proposed mitigations to bring noise levels to within guidelines (MI adopted the City of Winnipeg's noise guidelines). 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 MI. Locations where highway noise attenuation is being recommended for consideration in this study include:

- East side of PTH 100, Assiniboine River to PR 427 (Wilkes Avenue);
- North side of PTH 100, Kenaston Boulevard to PTH 75 (Pembina Highway);
- South side of PTH 100, Waverley Street to PTH 75 (Pembina Highway);
- North side of PTH 100, PR 200 (St. Mary's Road) to St. Anne's Road; and
- South side of PTH 100, CPR Emerson Subdivision to 300 m east.

HIGHWAY GUIDE SIGNAGE PLAN

A highway guide signage plan was developed for the new interchanges along PTH 100 and where changes to highway guide signage at existing interchanges are required for the Initial Stage. The signage plan is in conformance with the *Manual of Uniform Traffic Control Devices for Canada (MUTCDC)*, is consistent with MI's current practices, and considers the characteristics of the connecting roadways / highways and surrounding land uses. The plan includes four main types of highway guide signage for PTH 100 (Advance Guide Signs, Interchange Sequence Signs, Exit Direction Signs and Gore Signs) and identifies the location, messaging and structural type for each of the guide signs along PTH 100 and connecting roadways.

IMPLEMENTATION PLAN

The overall implementation of the PTH 100 improvements are based on two stages. The first stage is termed the "Initial Stage" and it involves:

- Upgrading PTH 100 to a four-lane divided freeway with a wide rural depressed median (where possible) by reconstructing the mainline;
- Existing interchanges and river bridges will continue to be used as-is where traffic capacity, traffic operations and the life of structures are considered acceptable; and
- New interchanges will be constructed to replace existing at-grade intersections.

The implementation plan for the Initial Stage construction was developed in consultation with MI. Various segments of PTH 100 were identified as potential combinations of interchanges and roadways that could be delivered based on traditional Design, Bid, Build delivery models. These segments could be combined to optimize the project size should other delivery models be used (i.e., Design-Build, Public Private Partnership, etc.).

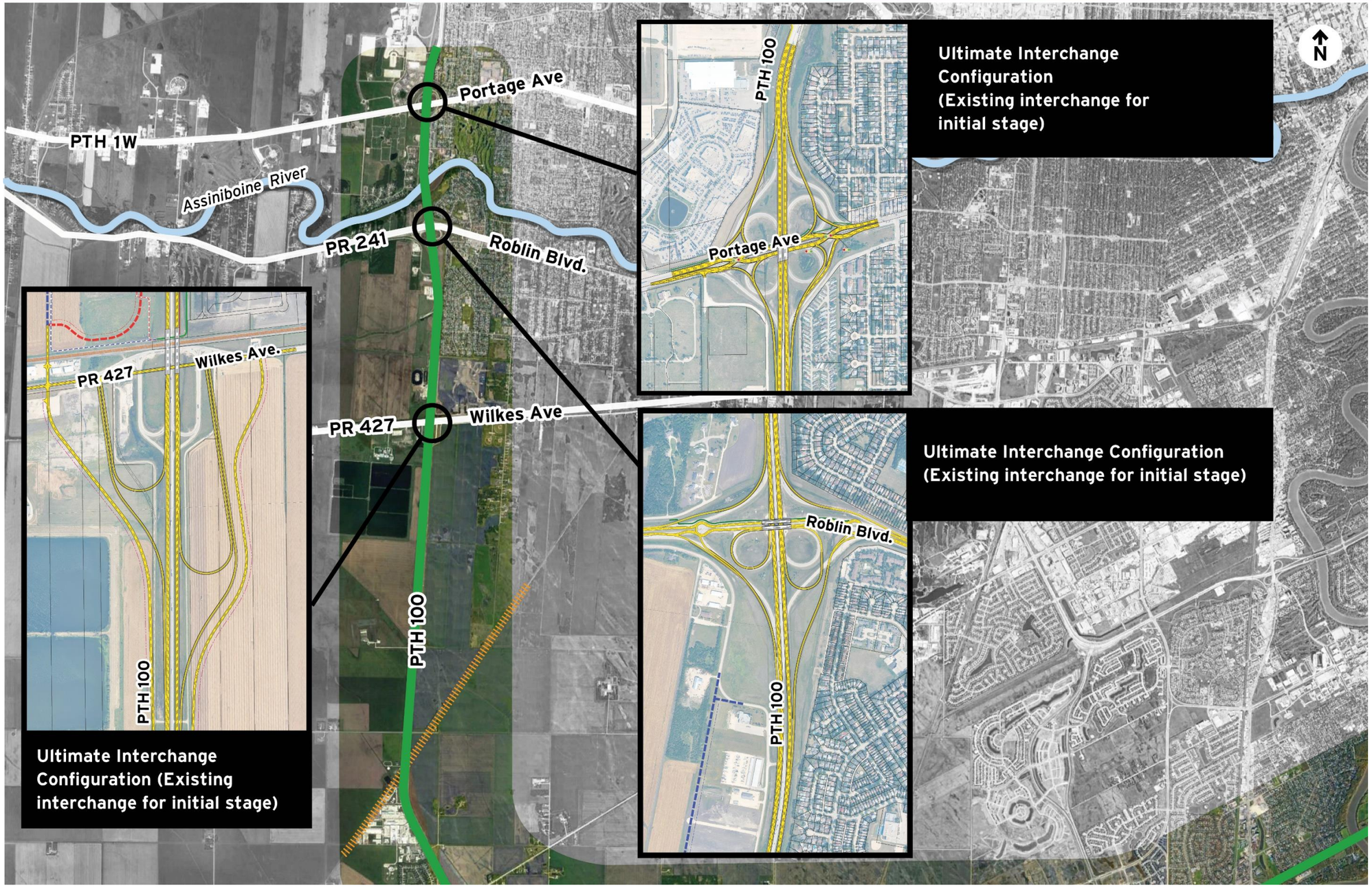

Figure 2.2: Recommended Interchange Functional Design for PTH 100 (PTH 1W to PR 427)

Figure 2.3: Recommended Interchange Functional Design for PTH 100 (Four Mile Road to PR 330)

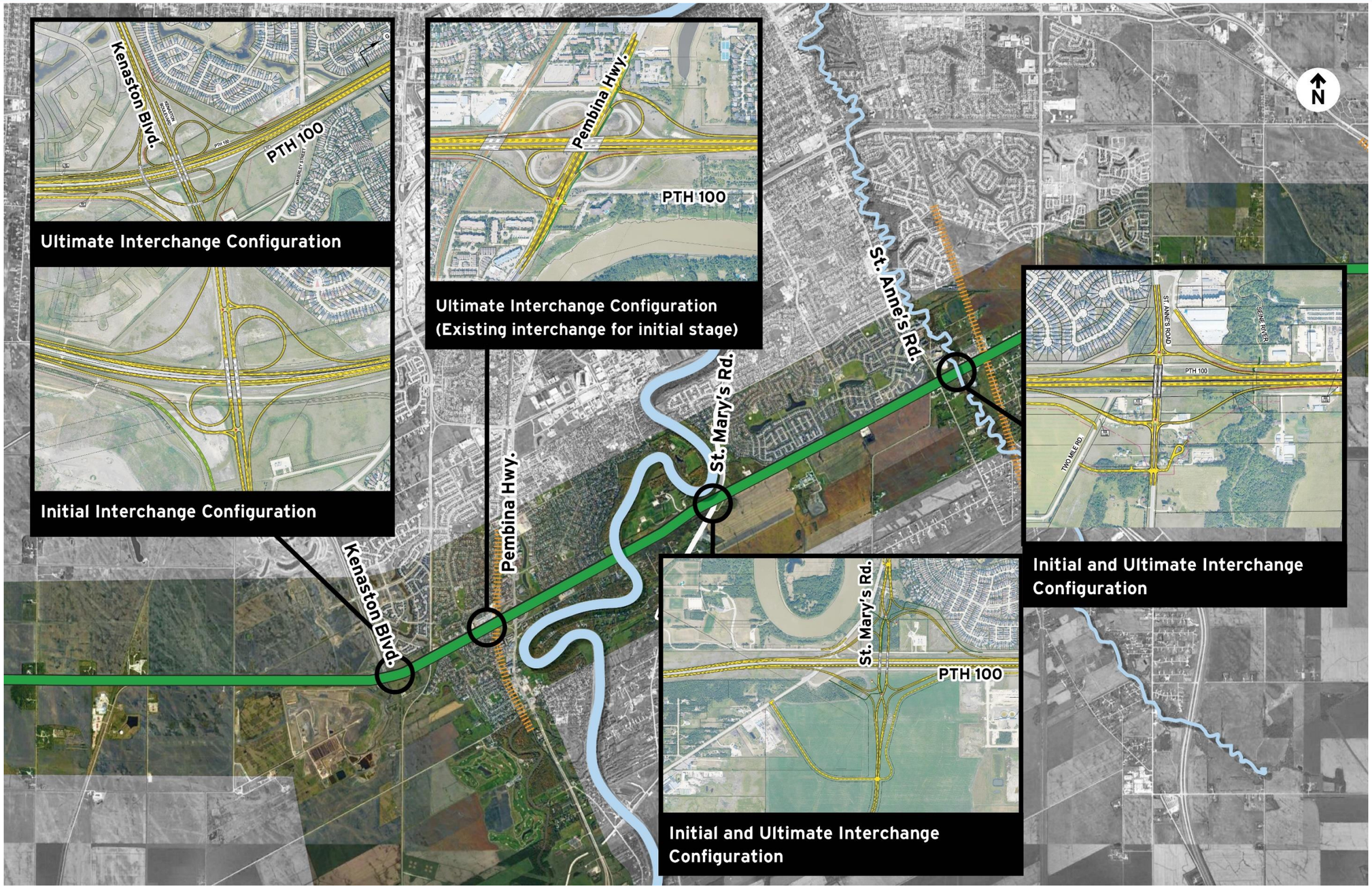

Figure 2.4: Recommended Interchange Functional Design for PTH 100 (Kenaston to St. Anne's)

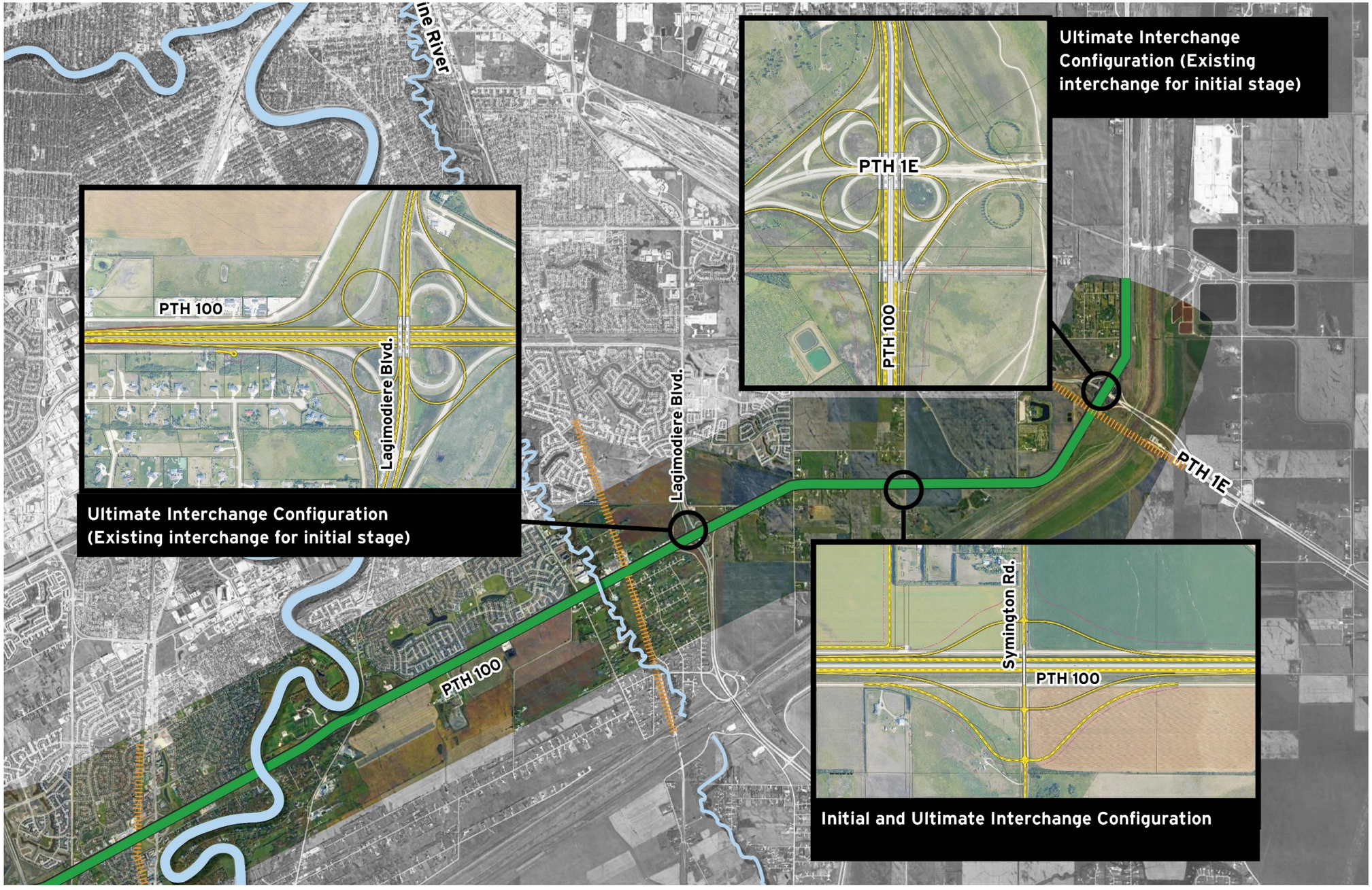

Figure 2.5: Recommended Interchange Functional Design for PTH 100 (PTH 59S to PTH 1E)

The second stage is termed the “Ultimate Stage” and it involves:

- Upgrading PTH 100 to a six-lane divided freeway;
- Reconstructing existing interchanges where required; and
- Constructing new interchanges and river bridges that may be needed because of traffic growth or condition.

The Ultimate Stage will likely happen well in the future (the Initial Stage was designed to accommodate forecast 2048 traffic levels) in a gradual fashion. Due to the uncertainty in when the Ultimate Stage will occur, an implementation plan has not been developed for it as part of this study.

CONSTRUCTION STAGING AND MAINTENANCE OF TRAFFIC PLANS

The construction staging philosophy for this study is based on the RFP requirement to maintain two lanes of traffic per direction on PTH 100 wherever possible. The proposed construction staging plans achieve this objective except at locations where there is a need to tie into existing structures (i.e., PTH 1W (Portage Avenue), Assiniboine River Bridge, PR 427 (Wilkes Avenue), Red River Bridge, and PTH 1E (Fermor Avenue). 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 tie-in at existing structures, mainline rail overpasses and interchanges.

ACTIVE TRANSPORTATION PLAN

Active transportation desire lines within and adjacent to the PTH 100 study area were identified by the public and stakeholders. These 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. MI will accommodate active transportation infrastructure that is planned designed and constructed by local governments. Crossings of PTH 100, including at potential grade separations, will be planned for as appropriate. Active transportation infrastructure that has been accommodated in the recommended plan is located at the PTH 1W (Portage Avenue) interchange, PR 241 (Roblin Boulevard) interchange, Harte Trail / Grand Trunk Trail / PR 427 (Wilkes Avenue), between Kenaston Boulevard and PTH 75 (Pembina Highway), PR 200 (St. Mary’s Road) interchange, and Seine River crossing.

TRANSIT PLAN

Winnipeg Transit is considering: park-and-ride sites at PTH 1W (Portage Avenue, north side on Red River Exhibition lands), PR 200 (St. Mary’s Road), Dakota Street, and St. Anne’s Road; possible median rail rapid transit system in the long term along Portage Avenue; and a rail maintenance yard outside the Perimeter Highway. If these plans go forward, joint planning would be needed to determine if that can be accommodated, and if so, what reconstruction would be needed.

RAIL CROSSING PROTECTION REQUIREMENTS

At-grade rail crossing protection requirements were examined for rail crossings of local roads / service roads in the vicinity of PTH 100. New or upgraded at-grade rail crossings will be required for the: new service road from La Fleche Road to PR 427 (Wilkes Avenue) that crosses the CN Rivers Subdivision; new service road that crosses the CEMR Carman Subdivision from Oak Bluff to PR 427 (Wilkes Avenue); existing at-grade crossing of CP La Riviere Subdivision at Road 51E and PR 330; and new service road from Melnick Road and Aimes Road that crosses the CP Emerson Subdivision.

RIGHT-OF-WAY & LAND ACQUISITION REQUIREMENTS

Plans outlining the right-of-way requirements have been developed based on the preferred functional design and MI’s standards for right-of-way protection. There are 107 impacted properties, totaling approximately 801 acres. Of these 107 impacted properties, 13 are already owned by the Province of Manitoba, totalling approximately 25 acres, and six are owned by the City of Winnipeg, totalling approximately 108 acres. The remaining 88 impacted properties are privately owned, totalling approximately 668 acres. Almost all land acquisition requirements are a result of right-of-way requirements related to proposed interchange locations.

UTILITY RELOCATIONS

There are several utilities within the study area that will be impacted by the future plans for PTH 100. These utilities include City of Winnipeg or RM owned infrastructure, Manitoba Hydro Power and Gas lines, privately owned pipelines, and major telecommunications. The exact realignment of non-City / non-RM utilities will be addressed at a future stage in the design process. WSP has requested that all non-City / non-RM utilities provide all relevant information that may affect the project. WSP has been in contact with all utilities in the area and requested a review of any infrastructure that requires upgrades and / or relocation. The detailed design phase should include a full-scale utility locate and survey to ensure all utility locations are confirmed, with hydrovac and elevation surveys to confirm depth as required.

LAND DRAINAGE

The general objective of the functional drainage study for this project was to design a system to collect stormwater runoff from the PTH 100 right of way and adjacent lands and convey it to the receiving drainage systems while minimizing upstream and downstream impacts, and improve the existing drainage conditions within the PTH 100 right of way where possible. The hydraulic analysis and runoff simulation for this study was conducted by using PCSWMM 2017 hydraulic modeling software. A City of Winnipeg 50-year design storm with a six-hour duration was used for modeling analysis. Culverts were sized according to the flows developed in PCSWMM through an iterative process that minimizes size, while complying with the applicable guidelines. Culverts were sized to limit backwater conditions and to effectively route flows downstream. In compliance with MI standards, through-grade culverts beneath multi-lane highways are recommended to have flared end treatments and rip-rap protection. As well, culvert end grates are recommended in areas with local residential development. Erosion and sediment control and fish passage have not been discussed in detail in this study as typically these control and design procedures are addressed during the detailed design phase. Further modeling analysis was conducted to verify the design capacity of the proposed land drainage systems based on the Ultimate Stage roadway design condition. Modeling results show that the proposed land drainage systems, including culverts and ditches should have sufficient capacity to accommodate the slightly increased runoff produced under the Ultimate Stage condition with no impact on the highway and adjacent lands.

ENVIRONMENTAL IMPACT ASSESSMENT

An Environmental Impact Assessment (EIA) was completed based on the preferred functional and preliminary engineering designs. The EIA included a desktop review of existing literatures / information and ecological field surveys to supplement existing information where practical. The objectives of the EIA were to: identify any existing environmental constraints or concerns; identify data gaps; aid in the selection of lane reconstruction / relocation and new structure alignments; collect baseline ecological data associated with the project study area; and provide a report summarizing this information for support to MI for any future environmental licensing or permitting requirements / applications. Full details of the EIA, including findings, conclusions and recommendations are provided in the *South Perimeter Design Study Environmental Impact Assessment Report*.

3 PROPOSED FUTURE ST. NORBERT BYPASS FUNCTIONAL DESIGN REPORT EXECUTIVE SUMMARY

3.1 EXISTING CONDITIONS

The existing conditions review was conducted to gain an understanding of the proposed future St. Norbert Bypass study area. The following sections summarize the reviews, investigations and analyses that were conducted. More details for these sections are provided in the *South Perimeter Design Study: Proposed Future St. Norbert Bypass Functional Design Report*.

PROPERTY BOUNDARIES & LANDOWNERS

As there is no current right-of-way for the proposed St. Norbert Bypass, the vast majority of the land within the study area identified is owned by private landowners. There were over 14,500 land parcels initially identified within the study area. The parcel information was provided to the individual municipalities in order to obtain landowner information. The parcel and land ownership information was used throughout the project to consult with landowners whose properties were within the study area identified and identify directly impacted properties and landowners.

LAND USE & DEVELOPMENT PLANS

The proposed future St. Norbert Bypass study area encompasses lands within the City of Winnipeg and the RM of Ritchot. Development and land use plans for these jurisdictions were reviewed to identify opportunities and issues related to land use and development within the study area and to be considered in the evaluation of roadway and structure alternatives.

TRANSPORTATION PLANS FROM LOCAL JURISDICTIONS

The local governments within the study area (City of Winnipeg and RM of Ritchot), as well as the Winnipeg Metropolitan Region, were contacted to obtain available information regarding their transportation plans. The following plans were reviewed as part of this study:

- City of Winnipeg Transportation Master Plan (2011);
- Capital Region Transportation Master Plan; and
- Transportation Driving Growth: A Strategy for Manitoba's Capital Region.

ROADWAY NETWORK

The existing roadway network in the study area includes the following roads and highways:

- Kenaston Boulevard – Kenaston Boulevard is a paved four-lane divided highway with a speed limit of 80 km/hr and is under the City of Winnipeg's jurisdiction. The existing intersection with PTH 100 is a signalized T-intersection. The Initial Stage of reconstructing PTH 100 to a fully access controlled freeway will include a three-legged interchange at Kenaston Boulevard. Ultimately, this interchange will be modified and upgraded to include a fourth leg that will connect to the proposed future St. Norbert Bypass south of PTH 100.
- PTH 75 (Pembina Highway) – PTH 75 is a paved four-lane divided highway with a speed limit of 60 km/hr and is under the City of Winnipeg's jurisdiction within the City boundary and MI's jurisdiction south thereof. South of the PTH 100 interchange, it is classified as an Expressway and the speed limit reduces to 50 km/h through St. Norbert. Further to the south the posted speed incrementally increases until it reached 100 km/hr. The current Cloverleaf Interchange at PTH 75 is experiencing increasing traffic operational issues due to high traffic volumes and short weaving distances between ramp entrances and exits, and ramps that do not meet current design standards.
- Waverley Street – Waverley Street is under the City of Winnipeg's jurisdiction and is a paved two-lane undivided roadway south of PTH 100 and north of Grandmont Boulevard. It has a gravel surface south of Grandmont Boulevard. The speed limit is 80 km/hr and it provides access to commercial, recreational and residential properties between PTH 100 and PR 247.
- Rue des Trappistes – Rue des Trappistes is under the City of Winnipeg's jurisdiction and is a gravel two-lane undivided roadway with a speed limit of 80 km/hr between Waverley Street and Rue des Ruines du Monastere, and a paved two-lane undivided roadway with a speed limit of 50 km/hr between Rue des Ruines du Monastere and PTH 75. Rue des Trappistes provides access to residential properties between Waverley Street and PTH 75.
- PR 247 – PR 247 is a two-lane undivided provincial highway with a 90-kilometre speed limit that provides access between La Salle and PTH 75, as well as serving adjacent agricultural properties. It has an asphalt surface between PTH 75 and just west of the CN Letellier Subdivision and a gravel surface west thereof.

ROADWAY CONDITIONS

A roadway conditions assessment was completed to create an inventory of the existing service / local roads in the study area. The inventory included the identification of physical properties (road length, width, right-of-way, material and surface condition) and the types of upgrades that would be required if a particular road needed to be rerouted due to the construction of the proposed future St. Norbert Bypass. In total, of the 29 paved, gravel, and undeveloped road segments evaluated 14% were found to be in good condition, 62% in fair condition, 4% in poor condition, and 20% were mud / undeveloped roadways.

TRAFFIC VOLUMES & ANALYSIS

The majority of traffic that will utilize the proposed future St. Norbert Bypass is currently accessing PTH 75 via PTH 100 at the Pembina Highway Interchange. The Bypass will provide alternative access for traffic from PTH 100 to PTH 75 south of St. Norbert. Forecast traffic volumes for the Bypass were developed using the City of Winnipeg's VISUM traffic model and data from MI's Permanent Count Station located on PTH 75 north of PR 247. The forecast traffic volumes include AADT, Average Summer Daily Traffic (ASDT) and Annual Average Daily Truck Traffic (AADTT) for links, and morning and afternoon weekday peak hour traffic volumes for intersections and interchanges.

An operational analysis of the proposed future St. Norbert Bypass mainline was conducted to determine the number of lanes required for the future horizon year (2048). Highway Capacity Software (HCS) Version 7 was used for the operational analysis. All segments performed at acceptable level of service (LOS) in the morning and afternoon weekday peak hours with two lanes per direction.

Traffic analysis was undertaken using Synchro 10 traffic analysis software for intersections and HCS for interchange diverging, merging and weaving segments. Micro-simulation analysis using SimTraffic software was used for additional insight into operational performance.

ACTIVE TRANSPORTATION

The City of Winnipeg's Pedestrian and Cycling Strategies Report identified existing and potential connections between Winnipeg and adjacent municipalities, and crossings of PTH 100 within the City

boundaries. In the Bypass study area, this includes AT routes that cross PTH 100 along Pembina Highway and Waverley Street, and an east-west route connecting Pembina Highway and Waverley Street north of PTH 100 in the Richmond Lakes neighbourhood. Pembina Highway and Waverley Street are identified as part of the planned long-term bicycle network. Potential destinations south of PTH 100 include the St. Norbert Market, Trappist Monastery Historical Park, Saint Norbert Provincial Heritage Park, Southwood Golf and Country Club, and La Barriere Park / Camp Amisk.

Existing active transportation facilities in and adjacent to the study area include:

- An off-street multi-use path on the east side of Pembina Highway from north of PTH 100 to south of Ducharme Avenue;
- An off-street multi-use path on the north side of Cloutier Drive;
- A buffered bike lane along Pembina Highway north of PTH 100;
- An off-street multi-use path on the west side of Kenaston Boulevard north of Waverley Street;
- An off-street multi-use path on the north side of Waverley Street east of Kenaston Boulevard; and
- A network of off-street multi-use paths through the residential neighbourhood north of PTH 100 and west of Waverley Street.

TRANSIT SERVICE

Transit service within the study area is provided by Winnipeg Transit, with four routes (91, 137, 162, and 170) operating on Pembina Highway south of PTH 100, as far south as Rue des Trappistes. One route continues south of this point along Pembina Highway during rush hour only (Route 162).

RAIL CROSSINGS & FUTURE TRACK REQUIREMENTS

PTH 75 is adjacent to the CN Letellier Subdivision near where the Bypass will connect to PTH 75. CN was consulted as part of the study and indicated they have future plans for a second track on the Letellier Subdivision.

There is one at-grade railway crossing that was examined as part of this study:

- CN 9.54 Letellier Subdivision and PR 247 – This crossing is controlled with an automatic crossing warning device consisting of flashing lights and bell. CN operates an average of two trains per day across this section of the Letellier Subdivision. In addition, two high throughput elevators on the Letellier Subdivision (at Morris and Letellier) are served as required and it is estimated these elevators may increase the train count by approximately two trains per week during grain season (April to June and September to December). When the Bypass is constructed, PR 247 will be realigned along the PTH 75 west service road from the Bypass to Mourant Road, 1.6 km north of its existing intersection with PTH 75.

EMERGENCY SERVICES

The City of Winnipeg Fire and Paramedic Service and the City of Winnipeg Police Service were consulted during the initial Stakeholder meetings for this project. It was noted that there are no specific design requirements for emergency vehicles on Provincial Highways beyond the standard requirements related to selecting appropriate design vehicles. Emergency services did note that a minimum of two access points is required for each community. A minimum of two access points for each community should be identified during the detailed design phase.

UTILITIES

Much of the study area is greenfield and there are generally no utilities that run along the proposed Bypass route. However, there are underground and above ground utilities within the study area at locations where the Bypass route crosses and connects to existing roadways. All utility, rail and pipeline companies, as well as the City of Winnipeg and RM of Ritchot, were contacted to obtain records for all existing utilities and plans for any proposed work within the study area. TransCanada Pipeline has several major pipelines within the study area that the Bypass will have to cross that will have to be considered as the project moves ahead. Manitoba Hydro is also planning for an east-west transmission line that will pass across the Bypass that will also have to be considered as the project moves ahead.

LAND DRAINAGE

Existing drainage systems for the study area consist generally of surface drainage via field drains and rural ditches local to the area and at connection points, whether internal or external to the study area. Drainage collection points include the Westendorf Coulee, the La Salle River, and the Red River. Outlets for runoff from the study area include a drain along Rue des Trappistes, the La Salle River, the ditch along the Z-Dike, a drain along PR 247 / Marchand Road, and a drain along Turski Road and Tencha Road.

GEOTECHNICAL CONDITIONS

Based upon drilling information in the vicinity of the proposed La Salle River crossing, the clay thickness varies from approximately 10± m to 15± m, with the glacial till ranging in thickness from approximately 9± m to 15± m thick, and the underlying bedrock encountered at approximately 20 m to 30 m below grade. As with other river crossings, thicknesses and depths to each layer will depend on the relative location of the structure to the river channel / bottom.

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.

HYDROLOGICAL / HYDRAULIC CONDITIONS

The La Salle River is a tributary to the Red River that drains in an easterly direction from its headwaters east of Portage la Prairie to its outlet at the Red River, south of Winnipeg. A low gradient stream that flows through predominantly agricultural land consisting of soils and fine sediments, the La Salle River is a turbid, slow moving, meandering river with erodible, undercut banks. Riparian areas typically consist of trees with an understory of grasses and shrubs.

Design flow calculations on the La Salle River at the proposed future St. Norbert Bypass crossing were updated for this project. Analyses with a hydraulic model of the La Salle River have indicated that the design flood water level at the project site is governed by the backwater from the Red River during flood events and a minimum soffit / girder elevation of approximately 233.1 m will be required. However, the 2% local La Salle River flood, combined with a normal Red River level will govern the criteria for headloss, velocities through the crossing, and the erosion protection / riprap design.

ENVIRONMENTAL CONSIDERATIONS

A desktop review of available biophysical and socio-economic information for the study area was completed, including an examination of: applicable federal and provincial government databases; publicly accessible websites; mapping resources; environmental reports; and information requests from provincial and federal database managers / specialists. The review summarized environmental considerations related

to: environmental legislation; ecological classification; climate; soils and terrain; vegetation; wildlife; species of conservation concern; heritage resources; aquatic systems; and parks and protected areas.

3.2 ALTERNATIVES

Conceptual design alternatives for the proposed future St. Norbert Bypass mainline, interchanges, rail grade separation and La Salle River crossing were developed. The conceptual design alternatives were based on approved project design criteria and included an analysis of traffic operations, geometric considerations and structural considerations.

The conceptual design alternatives were evaluated considering the input from the public / stakeholders. The criteria included considerations for traffic operations, geometry, utilities, construction and staging, safety, oversize loads, land acquisition / severance, impact on businesses, impact on access, pedestrian and cycling accommodation, noise impacts, natural environment impacts, heritage resource impacts, and construction costs. The evaluation was approved by the MI Steering Committee.

No cross-section alternatives were developed for the Bypass as direction was provided by MI for a cross-section consisting of a four-lane divided limited access Expressway with depressed median.

3.2.1 ALIGNMENT ALTERNATIVES

Three alternative alignments were generated for the proposed future St. Norbert Bypass alignment:

- Option 1 (Central Alignment) – Option 1 is a southerly extension of Kenaston Boulevard until it crosses the La Salle River before turning east to connect with PTH 75. This alignment provides the most direct connection between PTH 100 and PTH 75. However, it segregates the most land and impacts a small woodland.
- Option 2 (Western Alignment) – Option 2 utilizes the existing Waverley Street for the northmost portion of the Bypass alignment. It minimizes land costs and land severance, but will require a service road for developments that currently use Waverley Street for access. This option has the longest Bypass route and will likely have the greatest construction cost.
- Option 3 (Eastern Alignment) – Option 3 bends the Bypass alignment to the east closer to the Golf Course and east property lines of Rue des Trappistes. The proximity to the Golf Course will depend on the ultimate treatment of Rue des Trappistes. This option has the biggest impact on woodlands.

For all three options, the location of the potential Rue des Trappistes Interchange is 2 km south of the PTH 100 Interchange, which is the recommended minimum intersection spacing according to the Transportation Association of Canada (TAC). While TAC allows the spacing to be reduced to a minimum of 1.6 km, the tighter spacing often leads to weaving issues on high-speed facilities such as this. Additionally, even with the reduced 1.6 km spacing, the interchange would be located south of the existing Rue des Trappistes intersection and would not significantly improve the alignment for the crossroad.

3.2.2 INTERCHANGES, RAIL GRADE SEPARATIONS & RIVER CROSSING ALTERNATIVES

Alternatives were proposed for the PTH 100 Interchange, Rue des Trappistes Interchange, La Salle River crossing and the PTH 75 Interchange / CNR Letellier Subdivision rail grade separation.

- PTH 100 Interchange – In the Initial Stage, the future interchange at PTH 100 and Kenaston Boulevard will be a Parclo A4 interchange with a connection to Waverley Street. When the proposed future St. Norbert Bypass is constructed, the Initial Stage Parclo A4 interchange will be upgraded to a Cloverleaf Interchange with collector-distributor roads and a semi-direct ramp for the southbound to eastbound movement.
- Rue des Trappistes Interchange – For the Initial Stage, there will be an at-grade signalized intersection at the Rue des Trappistes and proposed future St. Norbert Bypass intersection. For the Ultimate Stage, when development in the area results in traffic volumes warranting an upgrade, it is recommended that a Diamond interchange be constructed with the intersections on Rue des Trappistes being stop controlled.
- La Salle River Crossing – The crossing of the La Salle River will extend across the City of Winnipeg Z-Dike south of the river and will feature underpasses to connect the Scout Manitoba Campsites (Camp Amisk) and an equestrian trail crossing that are cut off by the alignment of the Bypass. Three structures options were considered: clear span bridge, precast arch structure, and concrete box culvert.
- PTH 75 Interchange & CNR Letellier Subdivision Rail Grade Separation – A Trumpet Interchange with the Bypass connection passing over the existing PTH 75, the railway and the west service road is proposed for this location. Two options for the interchange were developed: for design speeds of 120 km/h and 130 km/h.

3.3 RECOMMENDED NETWORK

The recommended network for proposed future St. Norbert Bypass includes two phases, Initial and Ultimate.

- Initial Stage – The Initial Stage will include four lanes (two per direction) on the proposed future St. Norbert Bypass from PTH 100 to PTH 75 with the following connections / features:
  - PTH 100 Interchange – Cloverleaf Interchange with a semi-direct southbound to eastbound ramp.
  - Rue des Trappistes At-Grade Intersection – Traffic signal control.
  - La Salle River Crossing – Single span bridge structure crossing the La Salle River and Z-Dike with underpasses for the Scout Manitoba Campsite and equestrian trail crossing.
  - PTH 75 Interchange & CNR Letellier Subdivision Rail Grade Separation – Trumpet Interchange with design speed of 120 km/h.
- Ultimate Stage – The Ultimate Stage is the same as the Initial Stage with one exception:
  - Rue des Trappistes Interchange – Diamond Interchange

The recommended network for the proposed future St. Norbert Bypass is shown in **Figure 3.1**.

SOUTH PERIMETER DESIGN STUDY

St. Norbert Bypass Recommended Network

Legend

- St. Norbert Bypass
- Major Connecting Roads
- Railway Subdivision
- River
- Z-Dike
- Cloverleaf Interchange
- Trumpet Interchange
- Traffic Signal (Initial Stage)
- Diamond Interchange (Ultimate Stage)

Note:

The recommended cross-section of the St. Norbert bypass is a 4 lane divided roadway with depressed median.

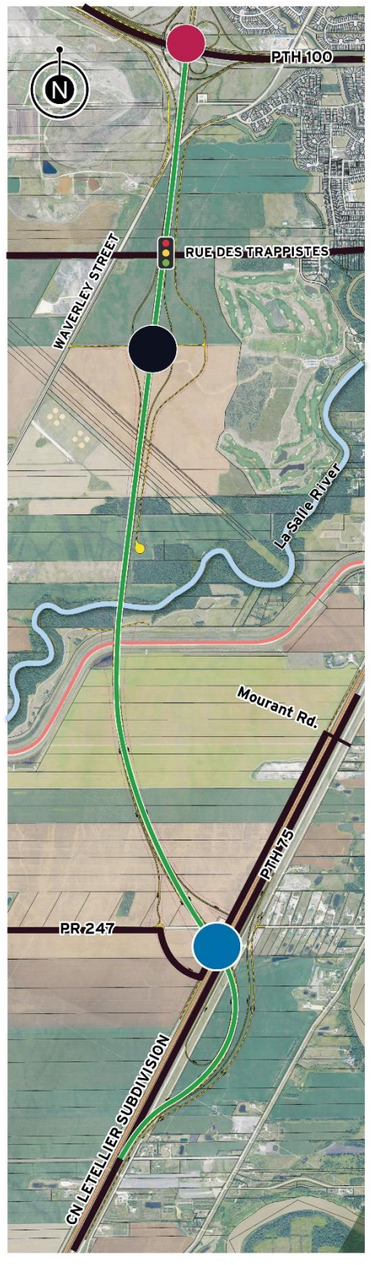

Figure 3.1: Recommended Network for the Proposed Future St. Norbert Bypass

3.4 FUNCTIONAL DESIGN

A functional design was completed for the recommended network for the proposed future St. Norbert Bypass mainline, interchanges, rail grade separation and La Salle River crossing. The roadway design is compliant with the following reference material, along with design criteria WSP has used in recent similar MI projects. In general, WSP used the reference material noted below in the order of precedence as listed below. In situations where either an approved design criterion does not apply, or cannot reasonably be applied, WSP consulted with MI to arrive at a mutually agreed to solution.

- MI – Geometric Design Guide Supplement Sheets (Blue Sheets).
- Transportation Association of Canada, Geometric Design Guide for Canadian Roads, 1999 edition.
- Transportation Association of Canada, Geometric Design Guide for Canadian Roads, 2017 edition.
- American Association of State Highway and Transportation Officials, A Policy on Geometric Design of Highways and Streets, current edition.
- Design guides from other Provincial Transportation Departments.
- Transportation Association of Canada, Canadian Roundabout Design Guide.
- Transportation Association of Canada, Manual of Uniform Traffic Control Devices for Canada.
- MI, Roadside Safety Manual.
- American Association of State Highway and Transportation Officials, Roadside Design Guide.
- American Association of State Highway and Transportation Officials, Highway Safety Manual.
- Transportation Association of Canada, Canadian Road Safety Audit Guide.

In addition to developing roadway and structures functional design drawings (which have been included in Appendix E of the *South Perimeter Design Study: Proposed Future St. Norbert Bypass Functional Design Report*), the functional design involved completing all other necessary studies and plans for the functional design. The following sections outline the studies and plans that were completed in the development of the functional design for the proposed future St. Norbert Bypass. More details of each section are provided in the *South Perimeter Design Study: Proposed Future St. Norbert Bypass Functional Design Report*.

TRAFFIC OPERATIONS

As described above, traffic volume forecasts were developed from the City of Winnipeg's VISUM traffic model and data from MI's Permanent Count Station on PTH 75 north of PR 247. The 2048 forecast AADT's for the proposed future St. Norbert Bypass are as follows:

- 23,000 vehicles per day between PTH 100 and Rue des Trappistes; and
- 20,400 vehicles per day between Rue des Trappistes and PTH 75.

Traffic analysis for the proposed future St. Norbert Bypass was undertaken using Synchro 10.0 traffic analysis software and SimTraffic 10 traffic modelling software. The relative performance of an intersection was measured in terms of LOS, ICU LOS, v/c ratio and critical movement LOS. Interchange diverging, merging and weaving analysis was completed using Highway Capacity Software analysis. SimTraffic software models were observed to confirm the findings of the Synchro and Highway Capacity Software analysis, including queuing and weaving performance. Intersection and interchange configurations for the Initial and Ultimate Stage Functional Designs were based on the traffic analysis findings. All intersection and interchange recommendations were shown to achieve acceptable levels of service (level of service D or better) in the 2048 horizon year.

ROAD SAFETY AUDIT

A Road Safety Audit of the preferred functional design of the proposed future St. Norbert Bypass was undertaken by an independent third-party engineering consultant, Flood Murray International. The Road Safety Audit procedures were consistent with the Transportation Association of Canada – Canadian Road Safety Audit Guide. The Road Safety Audit report included general comments, a summary of design exceptions proposed by WSP and approved by MI, and specific comments related to the proposed design. The results of the RSA were incorporated into the functional design of the proposed future St. Norbert Bypass as deemed appropriate.

ACCESS MANAGEMENT STRATEGY

An access management strategy was developed to identify the appropriate access types and locations, and the associated connecting roadway network. Direct access to the Bypass will be provided at PTH 100, Rue des Trappistes and PTH 75. Though the land adjacent to the Bypass is currently predominately rural agriculture, it is recommended that access management strategies be adopted based on the type of land uses that are expected to develop in this area in the future. As such, unique access management strategies were developed for three potential land uses along the proposed future St. Norbert Bypass: (1) Rural Agriculture, Residential and Business; (2) Agricultural / Industrial Business and Commercial Developments at Major Intersections; and (3) Urban Residential Land Development Adjacent to PTH 100.

NOISE ASSESSMENT & MITIGATION PLAN

A noise study was not conducted for the proposed future St. Norbert Bypass as the alignment does not pass near enough existing residentially developed areas to warrant a noise analysis. However, it is recommended that any future residential developments adjacent to the proposed future Bypass be required to show how they meet the maximum Daytime Nighttime noise level of 65 dBA Ldn as set out in the *City of Winnipeg Motor Vehicle Noise Policies and Guidelines*.

IMPLEMENTATION PLAN

Prior to construction of the proposed future St. Norbert Bypass, PTH 100 will be reconstructed to a freeway standard with an interchange at PTH 100 and Kenaston Boulevard. The PTH 100 Interchange will need to be modified from a Parclo A4 interchange to a Cloverleaf interchange at the time of construction of the Bypass. The Bypass will need to be implemented as one project because it will become PTH 75 and the new direct route to PTH 100. In the Initial Stage of the proposed future St. Norbert Bypass, there will be an at-grade signalized intersection at Rue des Trappistes. In the Ultimate Stage, when development in the area results in traffic volumes warranting an upgrade, a Diamond Interchange is recommended at Rue des Trappistes.

CONSTRUCTION STAGING AND MAINTENANCE OF TRAFFIC PLANS

Preliminary construction staging plans were developed for the proposed future St. Norbert Bypass functional design. The construction staging / maintenance of traffic plans include three phases: (1) Phase 1 Greenfield Construction; (2) Phase 2 PTH 75 Overpass and Kenaston Tie-ins; and (3) Phase 3 Kenaston Interchange Reconstruction. The majority of the Bypass and much of the PTH 75 overpass infrastructure will be constructed off alignment and can be built while traffic is maintained on existing routes.

ACTIVE TRANSPORTATION PLAN

Active transportation desire lines within and adjacent to the study area were identified by the public and stakeholders. In the study area, active transportation connections crossing PTH 100 at Pembina Highway / CN Letellier Subdivision and at Waverley Street were identified. Active transportation improvements in the study area recommended by the *Winnipeg Pedestrian and Cycling Strategies* were also presented.

TRANSIT PLAN

As part of Winnipeg Transit's new Transit Master Plan to be completed in 2020, a 25-year vision for Winnipeg's transit system, the City of Winnipeg has plans for additional bus service on Pembina Highway through St. Norbert, as well as a new route on Kenaston Boulevard, which would cross PTH 100 and continue south on the proposed future St. Norbert Bypass. These additional transit services feature transit buses traveling in mixed traffic.

RAIL CROSSING PROTECTION REQUIREMENTS

The existing PR 247 at-grade crossing of the CN Letellier Subdivision will be closed as part of the realignment of PR 247 along the PTH 75 west service road with traffic redirected to PTH 75 at Mourant Road. The realignment of PR 247 and the CN Letellier Subdivision crossing at Mourant Road will be designed to meet Transport Canada *Grade Crossing Standards*, and will require upgrading of the rail crossing control on Mourant Road, likely to an automatic warning device consisting of flashing lights and bell, subject to future discussions with CN and Transport Canada.

RIGHT-OF-WAY & LAND ACQUISITION REQUIREMENTS

Plans outlining the right-of-way requirements for the proposed future St. Norbert Bypass have been developed based on the preferred functional design and MI's standards for right-of-way protection. There are 61 impacted properties, totaling approximately 393 acres. Of these 61 impacted properties, two are already owned by the Province of Manitoba, totalling approximately 10 acres, and four are owned by the City of Winnipeg, totalling approximately 12 acres. The remaining 54 impacted properties are privately owned, totalling approximately 371 acres. Of the impacted properties, none are anticipated to be full takings, based on MI's standards for property acquisition.

UTILITY RELOCATIONS

There are underground and above ground utilities in the study area at locations where the Bypass route crosses and connects to existing roadways, including the TransCanada Pipeline southeast of the PTH 100 and Kenaston Boulevard / proposed future St. Norbert Bypass intersection, and two City of Winnipeg watermains along PTH 75 / Pembina Highway where the Bypass will tie into the existing highway. There are generally no utilities that run along the route as much of it is greenfield; however, there are existing Manitoba Hydro overhead power lines and a sub-station in the Waverley Street area. The detailed design phase should include a full-scale utility locate and survey to ensure all utility locations are confirmed, with hydrovac and elevation surveys to confirm depth as required, and to develop utility realignment and relocation plans as required.

LAND DRAINAGE

The general objective of the drainage study for this project was to design a system, at a functional level, for collecting stormwater runoff from the proposed future St. Norbert Bypass right-of-way area and adjacent lands where applicable, and conveying it to the downstream receiving drainage systems while minimizing upstream and downstream impacts, and improving the existing drainage conditions. Only major drainage components were examined within each sub-area. There will likely be additional culverts and miscellaneous drainage works that remain to be evaluated and determined at the detailed design stage, though those will typically be of a more minor nature.

The hydraulic analysis and runoff simulation for the study was conducted using PCSWMM 2017 hydraulic modeling software. The City of Winnipeg's 50-year summer design storm with a six-hour duration was used for modeling analysis. The design flows of major culverts within the study area were determined and the culverts sized according to the flows developed in PCSWMM through an iterative process that minimizes

size, while complying with the applicable guidelines and MI requirements. Culverts were sized to limit backwater conditions and to effectively route flows downstream.

ENVIRONMENTAL ASSESSMENT SCREENING LEVEL

A screening level environmental assessment (EA) was completed for the project study area to identify any existing environmental constraints or concerns to aid in the selection of the alignment for the proposed future St. Norbert Bypass. The screening level EA involved the completion of a desktop review of available biophysical and socio-economic information for the project study area, including an examination of aerial photographs, applicable federal and provincial government databases, websites, mapping resources, environmental reports, and information requests from provincial and federal database managers / specialists. A summary report of the screening level EA findings was developed as a separate stand alone report for the project and is under separate cover.