



SNC • LAVALIN

Garner Road/Rymal Road and Garth Street

Class Environmental Assessment

ENVIRONMENTAL STUDY REPORT



Hamilton

FEBRUARY 2014





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**Prepared for:
City of Hamilton
400 - 77 James Street North
Hamilton, ON L8R 2K3**

128039-4E-Rev 0

PREFACE AND OTHER CONSIDERATIONS

In consideration of recommendations contained in Staff Report PW14002, the Environmental Study Report (ESR) documenting the results and recommendations of the Garner Road/Rymal Road and Garth Street Improvements Municipal Class Environmental Assessment Study was endorsed for filing in the public record by the City of Hamilton Public Works Committee on January 13, 2014 and by Council on January 29, 2014.

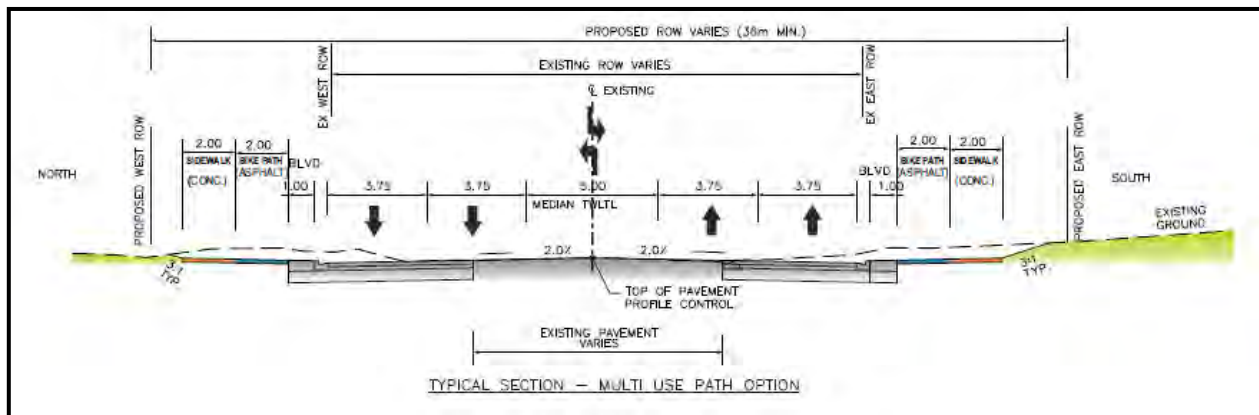
The City's Cycling Master Plan (Shifting Gears, 2009) shows proposals for the introduction of an on-street reserved bike lane on the segments of Garner Road, Rymal Road and Garth Street under consideration in this study. During its January 13 deliberations on the project, based on concerns expressed by the Ward 8 Councillor, the Public Works Committee also directed staff to investigate options for cycling lanes in the area. Councillor Whitehead's concerns are related to the potential exposure of cyclists to relatively high speed inter-regional and traffic in immediately adjacent travelled lanes, and the need to provide a safer cycling environment.

The resolution on this matter is as follows:

Public Works Committee (January 13, 2014)

"That staff be directed to investigate options for cycling lanes in the area during the 30 day consultation period and to include consultation with appropriate stakeholders and Ward Councillors."

Staff conducted a preliminary review of the feasibility of relocating the bike lanes beyond the roadside curb in the boulevard area (on an asphalt surface next to the proposed concrete sidewalk) and arrived at some positive conclusions. The revised cross-section is presented below.



Note: This cross-section represents a general concept. The location of the bike path and sidewalk will be determined during the Detail Design phase.

The revised cross-section and the results of the analysis were provided to the Ward Councillor. Additional consultation on this matter was initiated through a public meeting convened by Councillor Whitehead in his Ward on February 11, 2014. Based on

presentation of the revised cross-section, the public preferred the off-road alternative for bike lanes.

Consequently, City staff has committed to investigate modifications to the road cross-sections proposed in this ESR during the subsequent Detail Design phase in a continuing effort to maximize levels of safety for non-vehicular traffic in the road corridors under consideration.

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APPENDICES

Appendix A Consultation Record

- A.1 Notice of Commencement and Public Information Centre #1 (PIC #1)
- A.2 Public Information Centre #2 (PIC #2)
- A.3 First Nation Consultation
- A.4 Notice of Completion

Appendix B Correspondence and Minutes of Meetings

Appendix C Garner Road/Rymal Road and Garth Street Design Plates

Appendix D Technical Support Material

- D.1 Traffic Study Report (Abridged)
- D.2 Stormwater Management Report (Abridged)
- D.3 Natural Heritage Report
- D.4 Hydrogeology Report
- D.5 Noise Assessment
- D.6 Cultural Heritage Assessment Report
- D.7 Stage 1 Archaeological Assessment

Appendix E Cost Estimates

EXECUTIVE SUMMARY

The City of Hamilton has identified the need to complete a study using the Municipal Class Environmental Assessment (EA) process to address Schedule C projects, to concentrate on improvements needed for the Garner Road East/Rymal Road West corridor between Highway 6 South and the West 5th Street, as well as in the Garth Street corridor from Rymal Road to Stone Church Road. The purpose of this study is to recommend preferred alternatives to improve the road infrastructure to accommodate transportation demands.

Several previous studies related to development growth (Meadowlands - Neighbourhoods 3, 4 & 5 Class EA (February 2000); South Mountain Transportation Master Plan Study (2000); Airport Employment Growth District Study (2010); Hamilton Truck Route Master Plan Study (2010)) provide the rationale for implementing transportation improvements in the project area. Some of these studies identified the need to complete Class Environmental Assessments (EA) for the proposed improvement projects. The Meadowlands Class EA identified the need for a Schedule C EA for the widening of Garner Road.

The Garner Road East/Rymal Road West and Garth Street Municipal Class Environmental Assessment Study has followed the Municipal Engineers Association Municipal Class Environmental Assessment process for Schedule C projects. The Class EA process recognizes that there are many ways of solving a particular problem and requires various alternative solutions to be considered.

The aforementioned studies have established the necessity to widen Garner Road to 4 lanes, and include additional left-turn lanes between Southcote Road and Glancaster Road, as well as consider an additional connection to Garner Road and/or Southcote Road, or increased left-turn storage lanes on Garner Road. The need for Rymal Road to be widened to 4 or 5 lanes from the limit of the Garner Road 4-lane section recommended as part of the Meadowlands development to West 5th Street was also identified. In addition, widening of Garth Street to 3 lanes with a two-way centre turn lane south of Stone Church Road was recommended. The “do nothing” alternative would not adequately address the factors considered in the evaluation of alternatives, and there is no reason to reconsider the “do nothing” alternative in this study for the same reasons.

Alternative design concepts for implementing the recommended road improvements were developed and evaluated as part of this study and are illustrated in Chapter 4 of this report. Alternative transportation facilities, including transit, bike lanes and sidewalks, are accommodated in all of design options assessed. The recommended alternative is Alternative 1 (Widen to four (4) lanes with two-way left-turn lane), which has been identified as the technically preferred design concept for both the Garner Road/Rymal Road and Garth Street corridors.

Chapter 5 provides the description of the recommended alternative and the factor-specific environmental issues, potential impacts, proposed mitigation measures, and net effects of implementing the proposed Garner/Rymal Road and Garth Street

improvements, as well as proposed monitoring and future additional/contingency investigations.

The general commitments to environmental compliance and effects monitoring are described in Chapter 6. The Project Team's understanding of approvals, permits, authorizations and clearances that must be obtained prior to construction are also identified. This will inform and provide direction to investigations during the next (Detail Design) phase of the project. Also included is a description of the process for amending the Environmental Study Report to address any significant design changes, if required, in accordance with the Municipal Class EA process.

1.0 INTRODUCTION

1.1 Environmental Study Report

Municipal road projects in Ontario are subject to Ontario's *Environmental Assessment Act* (EA Act). The Municipal Engineers Association's *Municipal Class Environmental Assessment* (Municipal Class EA) process for planning, design and construction of municipal infrastructure was developed in accordance with the EA Act and is described in more detail in Section 2.1 of this document. This Environmental Study Report (ESR) documents the planning process conducted in accordance with the Municipal Class EA for improvements to Garner Road East/Rymal Road West (Highway 6 to West 5th Street) and Garth Street (Rymal Road West to Stone Church Road West).

The ESR is organized as follows:

Section 1 introduces the study, including background and the context with other projects, and presents the rationale for the project and related study objectives.

Section 2 summarizes the Municipal Class EA process and the overall approach to carrying out the study.

Section 3 describes the existing conditions in the study area, including traffic and planned development/projects, within a multi-disciplinary framework to establish the baseline conditions against which project alternatives have been assessed.

Section 4 presents the development and assessment of alternative planning and design solutions, including identification of the preferred design concept for the Garner Road/Rymal Road and Garth Street improvements.

Section 5 describes the selected roadway design in some detail, the potential impacts, proposed mitigation measures, and commitments to additional environmental investigations and monitoring.

Section 6 outlines the staging/timing of future phases of the project and the approvals required to implement the project.

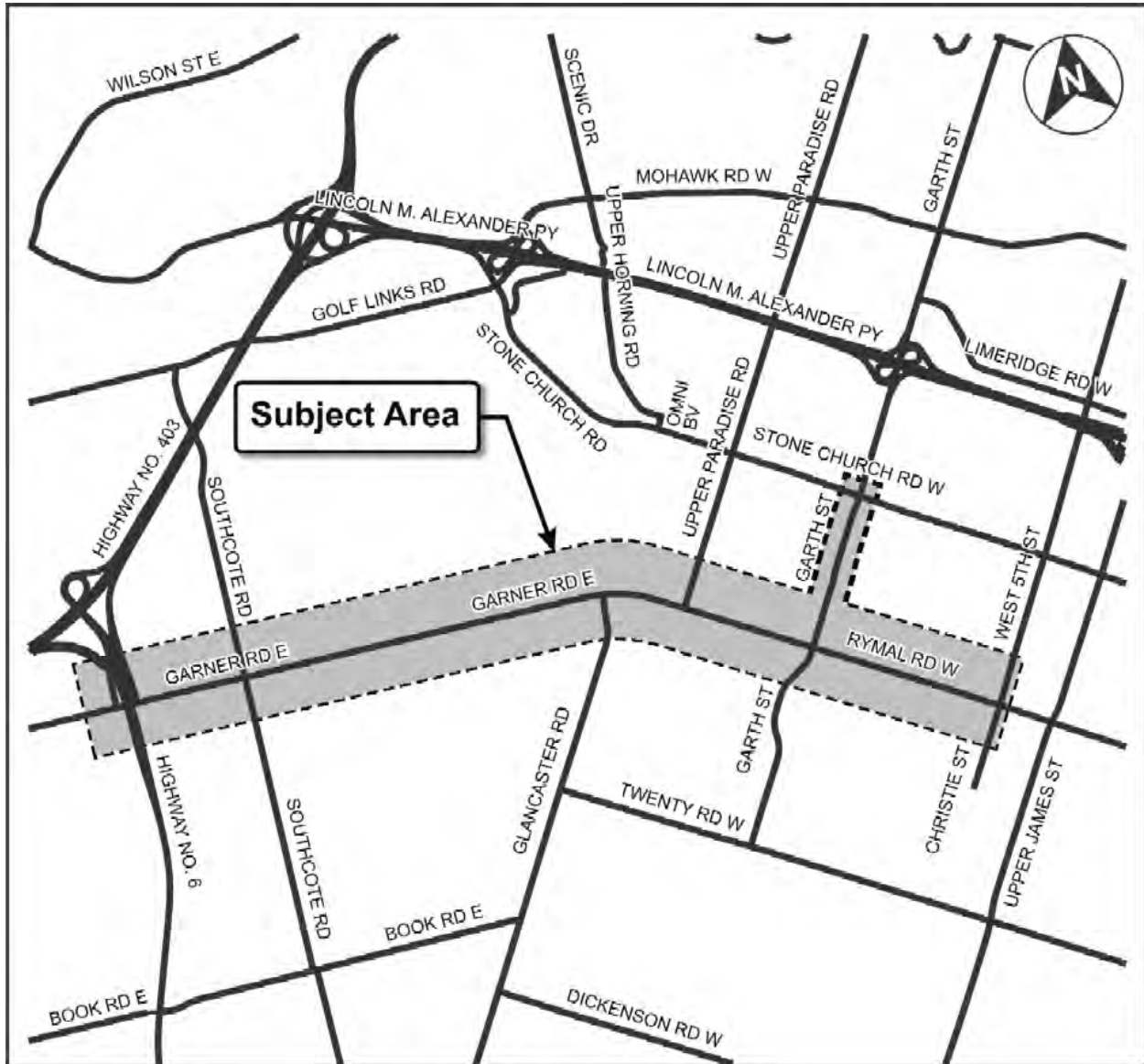
The ESR Appendices provide supplementary and more detailed information on the Consultation Record, documentation of study decisions, the proposed design of the roadway, and supporting technical investigations.

1.2 Purpose of the Project

1.2.1 Background and Related Studies

Land use and transportation planning studies completed within the last ten years have provided the rationale for addressing transportation needs and improving traffic carrying capacity in the Garner Road/Rymal Road and Garth Street corridors to accommodate future traffic demand. The City of Hamilton initiated this Municipal Class EA study in response to these needs. Figure 1.1 shows the subject area under consideration. The purpose of this study is to develop and assess design alternatives that address the identified transportation issues along these roads.

Figure 1.1: Garner Road/Rymal Road and Garth Street Improvements Project Area



The following planning studies have provided the rationale for widening the segments of Garner Road/Rymal Road and Garth Street under consideration, or otherwise exert some influence on the development of design concepts for transportation improvements in these corridors.

Meadowlands (Neighbourhoods 3, 4, and 5) Class EA (February 2000)

This study was prepared for the Meadowlands of Ancaster development proposal (north side of Garner Road from Southcote Road to Glancaster Road) to satisfy Environmental Assessment Act master planning level requirements. Various recommendations came from this study.

Findings and recommendations included:

- Identified the need to widen Garner Road to 4 lanes, and include additional left-turn lanes, between Southcote Road and Glancaster Road.
- Consider an additional connection to Garner Road and/or Southcote Road, or increased left-turn storage lanes on Garner Road, if Ancaster Fairgrounds are developed.

The study was reviewed by Town of Ancaster staff, an independent Peer Review Team retained by the Town, Region of Hamilton-Wentworth staff, and a broad range of regulatory agency and interest group stakeholders. The study process also included two public meetings.

South Mountain Area Transportation Master Plan Study (SMATMP) (May 2000)

The area of investigations for this study included the current Garner Road/Rymal corridor east of Southcote Road as part of a much broader study area extending from Southcote Road to Upper Centennial Parkway and from Twenty Road to the Niagara Escarpment. It focused on problems and opportunities associated with traffic carrying capacity, road and corridor safety, and road structural condition. The study also examined opportunities for access to a variety of transit options and transit improvements, including pedestrian friendly-streets within the study area.

The problem/opportunity analysis identified significant congestion on Rymal Road based on 2006 and 2021 traffic forecasts and possible traffic diversions from the Lincoln Alexander Parkway (Linc) as it becomes congested. The study stated the expectation that traffic volumes on Garth Street will double in the next 20 years (daily traffic of 16,000); would require reconstruction in 8-10 years; and would benefit from the addition of a left-turn lane for improved traffic operations and accessibility.

The study also assessed a range of transportation planning alternatives on a network basis and concluded that expanding and upgrading existing roadways to incorporate enhancements for all users is the preferred solution.

Recommendations included:

- Widen Rymal Road to 4 or 5 lanes from the limit of the 4-lane section recommended as part of the Meadowlands development to West 5th Street.
- Widen Garth Street south of Stone Church Road to 3 lanes, with Two-Way Left-Turn Lane (TWLTL).

The SMATMP was vetted through public consultation and endorsed by Regional Council with only minor changes. The study was reviewed in 2006 to reconfirm that any outstanding EA projects were still valid.

Airport Employment Growth District (AEGD) Study (May 2010)

This study presents a transportation system to guide the implementation of transportation infrastructure and strategic policies of the John C. Munro Hamilton International Airport area up to the 2031 planning horizon year. The study area was bounded by Garner Road and Twenty Road to the north, Fiddler's Green Road to the west, Upper James Street to the east and White Church and Carluke Road to the south.

The AEGD Study (May 2010)¹ recommended that Garner Road/ Rymal Road, between Fiddler's Green Road and Glancaster Road be widened to 4-lanes simultaneous with the full build-out (Phase II) of the AEGD areas. A similar recommendation to widen Garth Street between Rymal Road and Stone Church Road to a 4-lane section is also reflected in the AEGD Study to accommodate the AEGD developments.

The specific objectives of the study included:

- preparing a transportation strategy that supports development of the AEGD;
- identifying any problems or opportunities, including future transportation corridors; and
- developing a Transportation Master Plan for the AEGD area.

The study concluded that, with the ultimate build-out of the AEGD study area, the existing road network capacity will be constrained, especially on the east-west links within the AEGD. Other constraints include limited Highway 6 access and the location of the Hamilton International Airport relative to major municipal road access. The AEGD Study report indicated a scenario beyond 2031 under ultimate build-out conditions, anticipating approximately doubling of the primary estimated cargo freight and passengers with respect to that under full build-out conditions to the Hamilton Airport. This scenario indicated an abnormal increase of traffic volumes under the ultimate build-out AEGD area beyond 2031. The Garner Road study corridor will require close and continuous monitoring as the AEGD area grows further, inclusive of increasing passenger and freight carrying capabilities at the Hamilton Airport.

In light of the above, this EA Study evaluates the traffic conditions under the full build-out AEGD (Phase II) scenario and does not consider the ultimate build-out of AEGD scenario.

The study evaluated a number of alternatives for accommodating transportation demand, including the "Do Nothing" option.

Recommendations included:

- Widening existing roads, enhancing transit service delivery, improving the bike lane network and implementing Transportation Demand Management measures.
- The road network improvements included widening Garner Road to 4-lanes between Fiddler's Green and Glancaster Road and extending Garth Street, as a 4-lane road, from Twenty Road to Dickenson Road.

City of Hamilton Truck Route Master Plan Study (April 2010)

This was a city-wide study, initiated to develop a comprehensive truck route master plan, recognizing the City of Hamilton's role as a major transportation centre (road, rail, air, port) and the economic need for efficient goods movement.

The study recognized that King's Highway 53 (now Garner Road/Rymal Road), constructed in 1935 by the Province of Ontario and downloaded to the Regional

¹ Airport Employment Growth District (AEGD) Study. Dillon Consulting (May 2010).

Municipality of Hamilton Wentworth in 1997, has been a legal truck route from the day it officially opened for public use (1935). It also recognized that Garner Road/Rymal Road is a preferred corridor for trucks with over-sized loads.

Findings and recommendations included:

- Acknowledged concerns expressed by residents about through truck traffic on Garner Road/Rymal Road between Upper James Street and Highway 6, but still envisaged this corridor remaining a legal full-time truck route.
- Envisaged the section of Garth Street under consideration being part of a designated part-time truck route in the long term (after urbanization of the cross-section).

1.2.2 Project Rationale

The background studies cited in Section 1.2.1 provide the rationale for improvements to the Garner Road/Rymal Road and Garth Street corridors under consideration in this Class EA. Collectively, the Meadowlands Neighbourhoods 3, 4 and 5 Class Environmental Assessment and the South Mountain Area Transportation Master Plan recommend comprehensive transportation improvement projects for Garner Road/Rymal Road and Garth Street.

Specific projects that have been identified, as per the aforementioned studies, include:

- Garner Road East – widen to 4 lanes in order to accommodate for traffic demands. Further, the eastbound left turn lane on Garner Road at Southcote Road will require an increase in left-turn storage from 70 m to 90 m;
- Rymal Road (Glancaster Road to West 5th Street) – widen from 2 to 4/5 lanes in order to alleviate possible congestion across to Ancaster; and
- Garth Street (Rymal Road West to Stone Church Road West) – widen from 2 to 4 lanes. There may also be a need for left-turn access (local).

The Truck Route Master Plan study identified the Garner Road study corridor as a designated truck route, including the Garth Street corridor operating as a part-time truck route after improvements to the Garth Street corridor. The city's Cycling Master Plan includes bike lanes and sidewalks along both the sides of the Garner Road/Rymal Road corridor. The City of Hamilton is also anticipating moving forward with implementation of the 'S' Line Light Rail Transit along the study corridor in the long term. To minimize potential costs associated with relocating utilities and widening structures at watercourse crossings, the City is now considering securing property for the 36 m wide right-of-way and relocating or reconstructing these elements to accommodate the preferred cross-section adopted as part of this environmental assessment.

Therefore, this project is necessary in order to accommodate planned and approved development and associated growth in local and regional traffic demand, as well as accommodating planned future transportation infrastructure in the respective road corridors.

2.0 STUDY APPROACH

This section of the report outlines the procedural approach followed in the study to comply with the EA Act. In addition, the key study participants are identified and the conduct and results of the consultation program are summarized.

2.1 Class Environmental Assessment Process

This study is being conducted in accordance with the Municipal Engineers Association *Municipal Class Environmental Assessment* (October 2000, as amended in 2007/2011) (Municipal Class EA). The Municipal Class EA process was developed in accordance with the EA Act for a “class” of projects, including municipal road, water, wastewater and transit projects, that are recurring, similar in nature, limited in scale, responsive to mitigation measures, and have a predictable range of environmental effects. The purpose of the Municipal Class EA is to provide for the protection, conservation, and wise management of the “environment”, which includes the natural, social, cultural, built and economic environment, through comprehensive planning and informed decision-making. It allows municipalities to meet the requirements of the EA Act, while following a streamlined, self-administered process.

2.1.1 Project Classification

The Municipal Class EA process recognizes that potential environmental impacts may vary, depending on the nature of the project, and classifies projects into four “schedules”, as follows:

Schedule ‘A’ Municipal maintenance, operational and emergency activities. These projects are pre-approved and, therefore, allow the municipality to proceed without further approval under the EA Act.

Schedule ‘A+’ The environmental effects are usually minimal but may have a higher public profile than Schedule A projects. Therefore, the public is to be advised prior to implementation. These projects are also pre-approved.

Schedule ‘B’ Projects that may have minimal environmental effects on the environment. These projects are approved subject to a screening process, including consultation with directly affected public and agencies.

Schedule ‘C’ Projects that may have significant environmental effects on the environment and must proceed under the full planning and documentation procedures outlined in the Municipal Class EA Document.

In accordance with project classification criteria in the Municipal Class EA, this study is being conducted as a **Schedule ‘C’** undertaking² and involves completion of Phases 1 through 4 of the Municipal Class EA process:

Phase 1 Identification of problem or opportunity

² Construction of new roads or other linear facilities costing more than \$2.2 Million.

- Phase 2 Alternative planning solutions to address the problem or opportunity
- Phase 3 Alternative design concepts for the preferred planning solution
- Phase 4 Documentation of the study results (preparation of Environmental Study Report)
- Phase 5 Prepare Detail Design, proceed to construction/operations, and monitoring of environmental provisions and commitments

The requirements of Phases 1 and 2 of the Municipal Class EA process are deemed to have been satisfied by virtue of completion of the Class EA and master planning studies cited in Section 1.2.1 of this ESR.

Successful completion of Phase 4 of the Class EA process will permit the City of Hamilton to proceed to Phase 5 of the process (Project Implementation - Detail Design, Construction, Monitoring), which is not included in the scope of this EA.

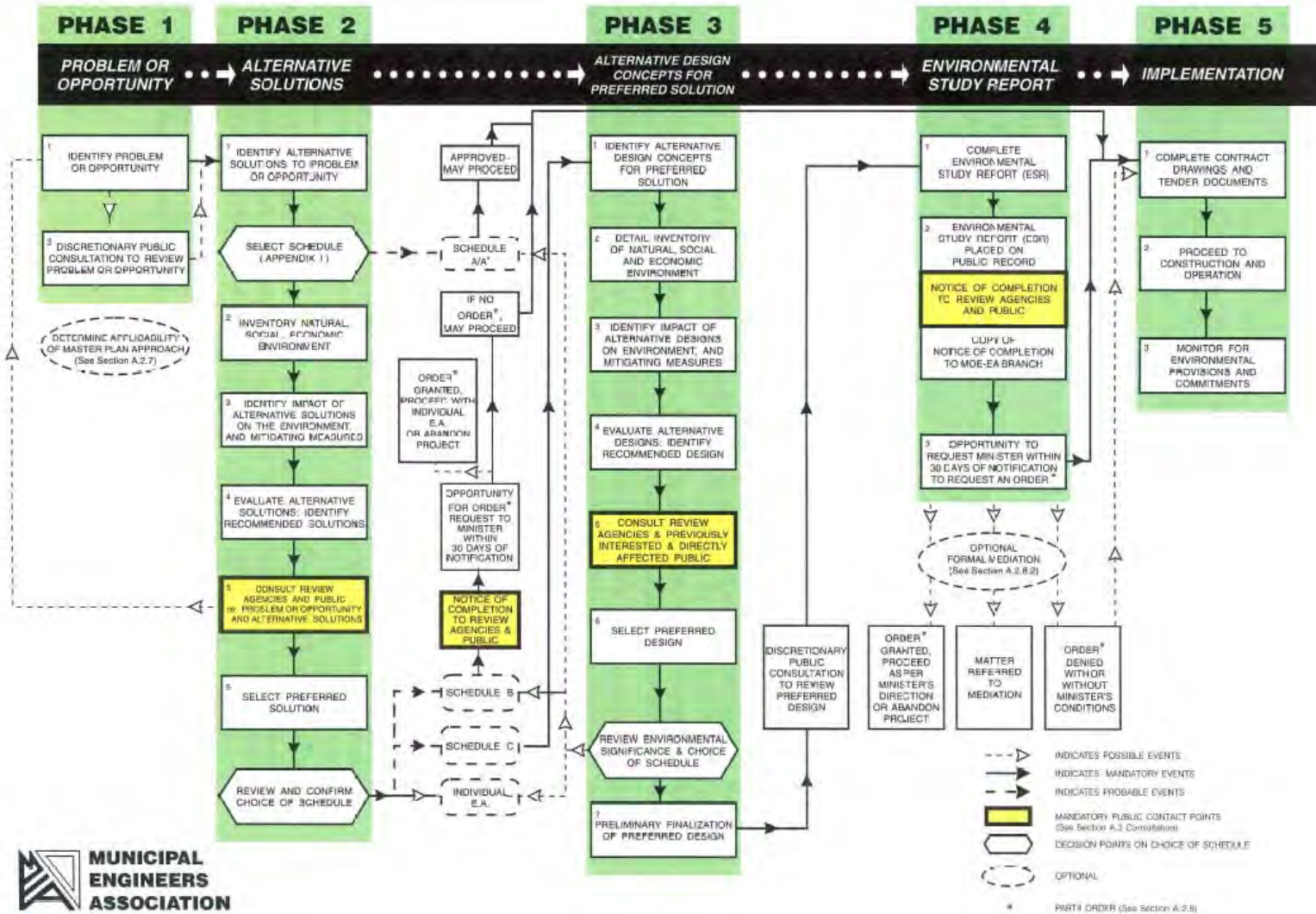
The step-wise Municipal Class EA process is illustrated in Figure 2.1. A simplified graphic showing the main study components for this EA study is presented in Figure 2.2.

The Garner Road/Rymal Road and Garth Street ESR will be filed with the Ontario Ministry of the Environment, and the City of Hamilton offices, and will be available for review at selected libraries in the City of Hamilton, as well as on the City's project website, for the mandatory 30 calendar day public review period. All parties previously expressing interest in this project through written comments have been notified directly regarding completion and filing of this ESR. An announcement of the ESR completion and filing has been placed in the City of Hamilton's At Your Service newspaper.

The City of Hamilton will address concerns and questions raised during the review period. Any significant changes to the project proposals presented in the ESR will be documented in an Addendum to the ESR, the process for which is described in Section 6.3.4 of this report.

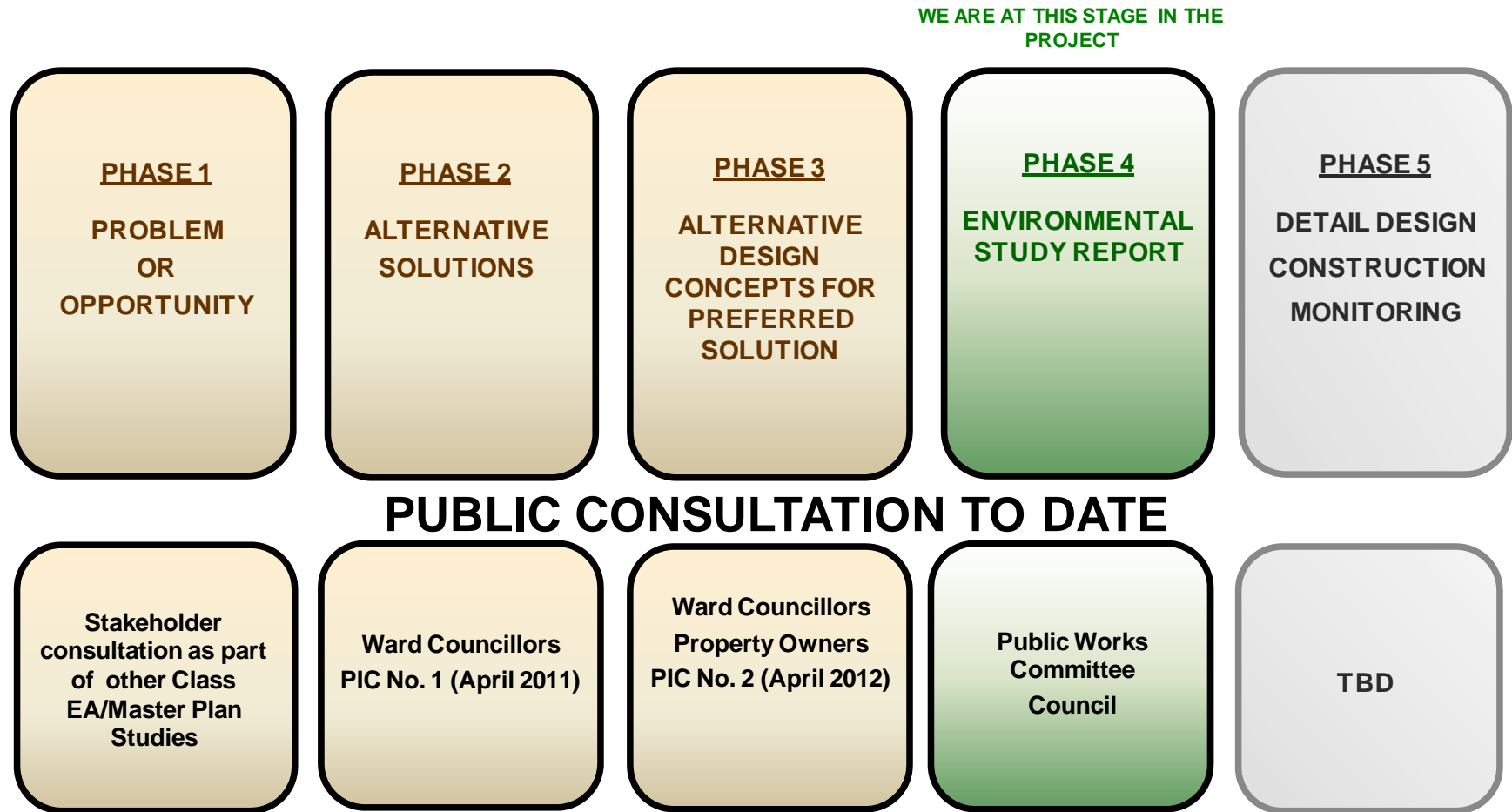
The Municipal Class EA process also includes provisions for interested parties to request that the Minister of the Environment elevate the status of the project to an Individual environmental assessment. The individual environmental assessment process normally addresses large scale projects with the potential to result in very significant impacts, and includes provisions for invoking more formal mechanisms for addressing stakeholders' concerns (i.e., tribunal hearing or mediation). If concerns regarding this project arise, which cannot be resolved in discussion with the City of Hamilton, a person or party may request that the Minister of the Environment make an order for the project to comply with Part II of the EA Act (referred to as a Part II Order), which addresses individual environmental assessments. Requests must be received by the Minister of the Environment within the 30-day period established for public review of the ESR. A copy of the request must also be sent to the City of Hamilton.

Figure 2.1: Municipal Class Environmental Assessment Process



Source: Municipal Engineers Association Municipal Class Environmental Assessment (2000, as amended in 2007)

Figure 2.2: Class Environmental Assessment Process



2.1.2 Scope of Environmental Assessment

The Class Environmental Assessment study included a comprehensive set of integrated environmental and engineering investigations (inventories; impact assessment; mitigation recommendations) conducted by specialist consultants, using established/approved methods and protocols, as well as consultation with technical staff of regulatory agencies and other stakeholders with knowledge of the study area. Table 2.1 presents the general scope of the Class EA investigations.

Table 2.1: Class EA Scope of Investigations

Terrestrial Ecosystems	Heritage Resources
<ul style="list-style-type: none"> • Wildlife <ul style="list-style-type: none"> ○ amphibians/reptiles habitat ○ breeding bird and other wildlife habitat • Vegetation inventories (Ecological Land Classification) • Roadside tree inventory 	<ul style="list-style-type: none"> • Stage 1 Archaeological Assessment • Heritage Resource Assessment (man-made Built Heritage Resources; Cultural Heritage Landscapes) • Recommendations for further archaeological investigations; heritage resource preservation
Aquatic Ecosystems	Noise
<ul style="list-style-type: none"> • Aquatic habitat and fish community assessment <ul style="list-style-type: none"> ○ watercourse physical attributes, flow, thermal regime ○ fish community supported; sensitivity 	<ul style="list-style-type: none"> • Identify noise sensitive areas; noise measurements • Noise modeling; impact assessment • Operations and construction phase impact assessment • Noise mitigation recommendations
Drainage, Hydrology, Stormwater Mgmt	Socio-Economic
<ul style="list-style-type: none"> • Confirm watershed drainage regime • Establish hydraulic requirements for drainage/watercourse conveyance • Develop stormwater management strategy to achieve watershed protection targets 	<ul style="list-style-type: none"> • Designated and approved land uses • Business operations • Community amenities and social/cultural linkages
Hydrogeology	Transportation Planning/Traffic Eng
<ul style="list-style-type: none"> • Groundwater regime (recharge/discharge; stream baseflow) • Potential for groundwater contamination, flow interruption 	<ul style="list-style-type: none"> • Roadway operations/capacity analyses (intersection/link volumes; Level of Service) • Safety analyses • Geometric/operational improvement recommendations
Civil Engineering	
<ul style="list-style-type: none"> • Roadway geometric design (cross-section; horizontal/vertical alignment; grading, drainage; lighting) • Drainage structure design 	

2.2 Project Organization

The City of Hamilton established a Project Team to provide technical input and direction on the project. The multi-disciplinary Project Team, representing a broad range of mandates and interests within the City, included staff from the following groups:

City of Hamilton

- Community Services - Planning
 - Planning and Economic Development
 - Community Planning
- Infrastructure Services - Engineering
 - Development Engineering
 - Traffic Engineering
 - Transportation Planning
 - Strategic Planning, Rapid Transit
- Infrastructure Services – Operations

In addition to providing technical input and direction, the Project Team was responsible for selection of the Preferred Design for the Garner Road/Rymal Road and Garth Street widening project.

Conservation Authorities

Portions of the study area are located within areas regulated by the Niagara Peninsula Conservation Authority's (NPCA) and the Hamilton Conservation Authority (HCA) under the Ontario *Conservation Authorities Act*. Although they were not part of the Project Team, NPCA and HCA staff provided information on and assisted in the delineation of environmental sensitivities within their watersheds, and identified future permitting requirements within their mandate.

SNC-Lavalin Inc. (SLI) was retained to lead the Class EA study and assembled a multi-disciplinary Consultant Team to conduct the technical investigations required to develop and assess the project alternatives, including specialists in the following disciplines:

- Terrestrial Biology
- Aquatic Biology
- Drainage, Hydrology and Stormwater Management
- Hydrogeology
- Heritage Resources (Archaeology, Built Heritage, Cultural Heritage Landscapes)
- Noise
- Land Use/Socio-economics
- Transportation Planning and Traffic Engineering
- Civil Engineering

2.3 Communications Program

This section of the ESR describes the communications program conducted by the City for engaging known stakeholders and potentially interested parties at both mandatory and discretionary points in the environmental assessment process.

Public, regulatory agency and other stakeholder consultation has been recognized as an important component of the Garner Road/Rymal Road and Garth Street Improvements Municipal Class EA study. The Communications Plan established by the City was designed to capture a full range of opinions and perspectives at regular intervals and at milestone junctures throughout the study. In this regard, it provided multiple and ongoing opportunities for feedback during the planning and design process.

2.3.1 Guiding Principles

To address the needs inherent in the study scope of work, the guiding principles for the Consultation Plan included:

- The consultation program was **highly inclusive** and **balanced**, engaging the broadest range of audiences reasonably deemed to be potentially affected by the project.
- The program provided **early and ongoing** opportunities for stakeholders to provide **constructive input**, the timing of which was commensurate with the need to incorporate such input in the decision-making process, as appropriate.
- The program was **transparent** (utilizing multiple communication mechanisms) and **traceable** (documenting the comments, how they have been addressed, the results of any conflict resolution efforts, and the effects of the program on the decision-making process).
- The program was **adaptive**, incorporating the **flexibility** to be modified to meet the needs of participating stakeholders and the Project Team.

2.3.2 Consultation Mechanisms and Tools

The principal consultation mechanisms that employed to implement the Communications Plan in included:

Notice of Commencement

- Prospective EA study participants were formally notified of the study commencement through published advertisements in the Hamilton Spectator and Hamilton Community Newspapers on two separate dates. This is a mandatory contact point in the Municipal Class Environmental Assessment process. The notification included information on the study background, purpose, location, EA process, and opportunities/contacts for obtaining information and providing input.

Project Team Meetings

- Municipal technical representatives from the City of Hamilton, as well as the Consultant, formed the Project Team (refer to Section 2.2 for Study Organization), which met at regular intervals with the Consultant Team to receive information on study progress and provide direction on technical matters. The Consultant Team also met with separate factions of the Project Team off line from the regular Project Team meetings, as required, to convey information and discuss various technical matters in additional detail. To

date, there have been four (4) technical meetings to discuss project status update and technical matters.

Public Information Centres (PIC)

- Milestone PICs, also mandatory points of contact, were formally announced through advertisements in the Hamilton Spectator and Hamilton Community Newspapers on two separate dates. The notification provided information on the PIC purpose, date, time, location and Project Team contacts for obtaining information and providing input. In addition, letter and/or flyer invitations were distributed to participating government agencies, elected representatives, aboriginal communities, interest groups and individuals. The PICs disseminated information through the use of one-on-one discussion; text and graphic display boards, including interactive displays at the alignment screening stage; reference to background resource materials brought to the PIC venue; handouts of selected display material; and comment sheets that were to be left at the PIC or returned to the Project Team via mail, fax or email. Two (2) PICs in the form of drop-in open house forums were held at strategic milestones in the study (refer to Section 2.3.2) to present the project findings/recommendations and provide an opportunity for public feedback.

Property Owner Meetings

- Meetings were established with property owners (such as business owners and churches) to provide information to and receive feedback from owners that may be directly affected by the Project.

Agency Consultation

- Federal, Provincial and Municipal agencies with policy or regulatory mandates that may affect the project development or implementation were identified and contacted with respect to obtaining technical information, and their desire to participate in the studies.

Aboriginal Consultation

- At a minimum, each of the aboriginal communities that may have an interest in the project were identified and were included in the notification process for Study Commencement/PIC No. 1 and PIC No. 2. As deemed appropriate, individual meetings/briefings will be provided to participating communities.

On-line Consultation

- A project website was developed and is maintained by city staff. The consultant has provided input to the website as required. This input included background information, presentation materials from PICs and draft/final reports. The Consultant also assisted with the preparation of the “frequently asked questions page and responds to messages sent to the Project Team.

Notice of Completion

- A Notice of Completion has been issued to advise the public that the Environmental Study Report has been filed for a minimum of 30 day review period. It provided information on the location(s) where the Environmental Study Report is available for review, the period within which the document will be available for review and comments must be submitted, the Project Team contacts for obtaining information and providing input, and the Ministry of the Environment contact for submitting objections to the project.

2.3.3 Consultation with Government Agencies and Other Stakeholders

In addition to the Project Team described in Section 2.2, the study involved participation by several levels of government. Appendix A includes a detailed listing of principal agency staff and other stakeholders that were engaged during the study. Table 2.3 presents a summary of the agencies/stakeholders contacted for technical information.

Table 2.2: List of Government Agencies and Other Stakeholders Contacted

Provincial

Ministry of Transportation
Ministry of Agriculture and Food
Ministry of Environment
Ministry of Natural Resources
Ministry of Tourism, Culture and Sport
Ontario Secretariat for Aboriginal Affairs

Municipal

Niagara Peninsula Conservation Authority
Hamilton Conservation Authority
City of Hamilton

- Planning & Economic Development
- Community Planning
- Development Engineering
- Transportation Planning
- Traffic Engineering
- Strategic Planning, Rapid Transit
- Customer Service & Community Outreach
- Operations & Maintenance
- Emergency Services
- Hamilton Police Services

Utilities

TransCanada Pipelines
Hydro One
Enbridge Pipelines Inc.
Union Gas
Cogeco Cable Inc.
Hamilton Utilities Corporation
Sun Canadian Pipeline
South Mount Cable Ltd.
Mountain Cablevision
Imperial Oil Products & Chemical Division
Horizon Utilities Corporation
Bell Canada

Schools

Hamilton-Wentworth District School Board
Hamilton District Catholic School Board
Redeemer University College

Letters of notification were sent to these groups at the following study junctures with invitations:

- Notice of Commencement and Public Information Centre No. 1 (refer to sample letter in Appendix A.1)
- Public Information Centre No. 2 (refer to sample letter in Appendix A.2)
- Notice of Completion (refer to sample letter in Appendix A.4)

In addition to the information conveyed and received through written correspondence and Project Team meetings, the Project Team met with government agencies, as required, to provide supplementary information and seek direction on regulatory matters. Table 2.4 provides a summary of these meetings.

Table 2.3: Meetings with Regulatory Agencies

Agency	Date	Meeting Purpose/Discussion/Outcome
Hamilton Conservation Authority	February 29, 2012	<ul style="list-style-type: none"> • Provide brief project update on study status • Outline project alternatives • Review of Evaluation Criteria for assessing the alternatives • Discuss HCA comments based on information to date
Niagara Peninsula Conservation Authority (NPCA)	August 14, 2013	<ul style="list-style-type: none"> • Provide brief project update on study status • Describe project alternatives and design scheme • Discuss drainage and stormwater management approach/ issues • Outline other watershed sensitivities and issues

2.3.4 Public Consultation

This section summarizes the conduct and results of the public consultation program of the study, including the information presented and the principal concerns and questions received at the public information centres. A more detailed Consultation Record is presented in Appendix A.

Table 2.5 summarizes the dates on which the mandatory public notices for the consultation mechanisms described above were placed in Hamilton Spectator and Hamilton Community Newspapers.

Table 2.4: Summary of Mandatory Study Notification Dates

Notification	Date of Placement in the Hamilton Newspaper
Notice of Commencement and Public Information Centre No. 1	Friday, April 15, 2011 and Friday, April 22, 2011
Notice of Public Information Centre No. 2	Friday, March 23, 2012 and Friday, March 30, 2012
Notice of Completion	Friday, March 7, 2014 and Friday, March 14, 2014

Public Information Centre No. 1

Public Information Centre No. 1 was held on Thursday, April 28, 2011. The purpose of the information centre was to present alternative design concepts that address the identified transportation needs, and the evaluation criteria that will be used to assess the alternative design concepts. The information presented at the PIC included:

- Welcome, requesting that attendees sign the register for future notification purposes; informing attendees that Project Team members were available to answer questions and receive comments/concerns; and requesting attendees to complete a comment sheet (provided at the PIC or available on the city’s project website);
- Study Background and Purpose, including study area limits;
- Overview of Municipal Class EA Process;
- Municipal Class EA Process for Schedule “C” Projects;
- Results of Previous and Adjacent Planning Studies;
- Existing Environmental Conditions and Constraints;
- Existing Peak Hour Traffic Conditions (2008);
- Future Peak Hour Traffic Conditions (2031)
- Traffic Study Findings;
- Required Road/Intersection Improvements;
- Problem/Opportunity Statement;
- Road Widening Cross-Section Alternatives;
- Development and Assessment of Conceptual Design Options;
- Preliminary Evaluation Criteria; and
- Next Steps.

Following is a summary of participation and comments emanating from PIC No. 1:

- 24 people attended the PIC. Written comments were received from 17 people via comment sheets or email.
- General comments and questions were received regarding:
 - Public information meeting lacked information regarding the environmental impact of the project;
 - How the roadway expansion may affect a local business;

- Preference for road widening Alternative 2 due to pedestrian safety;
- Use of roundabouts instead of stop signs;
- Municipal service access for property in the vicinity of Rymal Road East;
- Improvements to be made to the St. Elizabeth Village property;
- Pedestrian and cyclist safety;
- Property frontage;
- Timeframe of project;
- Speed limit/widening of Garner Road to a 4-lane high speed expressway; and

Specific comments included:

- Agreement with the incorporation of enhanced cycling and pedestrian facilities.
- Need for left-turn lanes for increased safety.
- The need for signalization and pedestrian crossing facilities at the entrance to Redeemer University College.
- Provision of additional intersection improvements and pedestrian crossing facilities on Rymal Road for St. Elizabeth Village.
- Potential impacts to Bowman United Church/Cemetery.
- Potential impacts to commercial/agricultural business operations (signage; parking; access).
- Potential impacts to individual properties (loss of frontage).
- Potential for use of roundabouts instead of stop signs at intersections.
- Staging and cost-sharing for municipal servicing (storm/sanitary sewers) in the Garner/Rymal corridor.
- Safety concerns associated with increased traffic speed and proximity of cyclists/pedestrians to travelled lanes on an approved truck route that is preferred by carriers with wide loads.
- The need for protection of Ancaster Creek and Tiffany Creek headwaters and associated natural areas.
- HSR bus stop locations and service provisions at Hamilton District Christian High School.

The Project Team addressed these comments and questions verbally, provided a written response to all written comments received, convened site meetings with a number of property owners, and posted information on the city's project website.

Public input was used to refine the Evaluation Criteria and the scope of investigations, and to develop and screen the initial set of alignment alternatives.

A more detailed summary of comments received and responses provided is presented in the Consultation Record in Appendix A.2.

Public Information Centre No. 2

Public Information Centre No. 2 was held on Tuesday, April 3, 2012. The purpose of the information centre was to present the evaluation of the alternative design concepts and identify the preferred design concept.

The information presented at the PIC included:

- Welcome, requesting that attendees sign the register for future notification purposes; informing attendees that Project Team members were available to answer questions and receive comments/concerns; and requesting attendees to complete a comment sheet (provided at the PIC or available on the City's project website);
- Study Background and Purpose;
- Overview of Municipal Class EA Process;
- Municipal Class EA Process for Schedule "C" Projects;
- Results of PIC No. 1 (April 18, 2011);
- Existing Environmental Conditions and Constraints;
- Cultural Heritage Resources;
- Required Road/Intersection Improvements;
- Development and Assessment of Alternative Design Concepts;
- Road Cross-Section Improvement Alternatives;
- Alternative Design Concept Plans;
- Evaluation Criteria;
- Summary Assessment of Alternative Design Concepts (Garner/Rymal);
- Summary Assessment of Alternative Design Concepts (Garth);
- Rationale for Technically Preferred Design Concepts; and
- Next Steps.

Following is a summary of participation and comments emanating from PIC No. 2:

- Approximately 28 people attended the PIC.
- Written comments were received from 5 people via comment sheets or email regarding:
 - Concern about damaging trees;
 - Concern about increased traffic;
 - Concern for southbound traffic on Garth Street;
 - Incorporation of both cyclists and pedestrian traffic into the re-design of the transportation corridor;
 - Plans to maintain and repair the existing road; and
 - Concern about accident potential.

The project team addressed these comments and questions verbally, provided a written response to all written comments received.

Public input was considered by the Project Team in finalizing its detailed assessment of the short-listed alignments.

A more detailed summary of comments received and responses provided is presented in the Consultation Record in Appendix A.2.

2.3.5 First Nations Consultation

The City contacted the Ontario Ministry of Aboriginal Affairs and the federal Department of Aboriginal Affairs and Northern Development (AANDC) with respect to information on established or potential Aboriginal and treaty rights in the vicinity of the project, and

advice on consultation with First Nations communities and groups representing First Nations.

AANDC's Consultation and Accommodation provided information regarding potentially affected Aboriginal communities within 100 km of the project site from its Aboriginal and Treaty Rights Information System (ATRIS), which brings together information regarding Aboriginal groups, such as their location, related treaty information, claims (specific, comprehensive and special) and litigation.

Based in the information provided, the City contacted the following First Nations groups (refer to letters in Appendix B):

- Assembly of First Nations
- Huron Wendat First Nation
- Métis Nation of Ontario
- Council of Ontario Chiefs
- Association of Iroquois and Allied Indians
- Six Nations of the Grand River Territory
- Métis Women's Circle
- Haudenosaunee Resource Centre
- Mississaugas of the New Credit First Nation
- Ontario Federation of Indian Friendship

The City has also followed up the initial contacts with phone calls and/or email contact.

The City received one (1) response from the cited First Nations groups (Assembly of First Nations, April 21, 2011). The comment advised the City and Project Team to provide project information to First Nation communities in the vicinity of the Hamilton area. A list of First Nation communities in the Hamilton area was provided. A response was provided to this First Nation group to acknowledge the letter and to advise that the information and advice have been noted and will be addressed in the refinement and assessment of the Garner Road/Rymal Road and Garth Street widening.

3.0 EXISTING CONDITIONS

This chapter of the EA describes the project study area in the context of the foregoing EA scope described in Section 2.2, including transportation infrastructure and the natural, socio-economic and cultural environments. It provides the baseline, including approved infrastructure and land use plans, against which the project alternatives and the effects of the project have been measured.

Information on the following components is presented here and, for selected components, is supplemented with detailed technical reports supporting the EA in Appendix D:

- Transportation Network
- Traffic Analysis
- Municipal Services and Utilities
- Surface/Stormwater Drainage
- Geotechnical
- Natural Environment Report
- Groundwater
- Contaminated Property
- Noise Assessment
- Built Heritage and Cultural Landscapes
- Archaeology

3.1 Study Area and General Environmental Conditions

The project study area is limited to the lands immediately adjacent, north and south of Garner Road East/Rymal Road West, from west of Highway 6 easterly to West 5th Street, as well as the lands east and west of Garth Street from Rymal Road West to Stone Church Road West. The majority of these areas are urbanized and most of the vegetated landscapes have been created as part of streetscaping, or landscaped property holdings, which are subject to periodic maintenance. Agriculture and rural residential development is more prevalent along Garner Road west of Glancaster Road. Those natural areas remaining have been subject to significant human impact, which has degraded the natural attributes of those vegetative assemblies that remain. Cultural meadow or groomed open spaces dominate the study area, along with some small remnant woodlots, thickets and wetland pockets associated with roadside drainage, Tiffany Creek, Upper Twenty Mile Creek and their tributaries.

The study area is located within the Lake Erie Lowland Ecoregion. This is part of the Mixedwood Plain Ecozone which encompasses the lower Great Lakes basin and St. Lawrence River valley. The combination of gentle topography, fertile soils, warm growing season and abundant rainfall, have made the Mixedwood Plain Ecozone the most intensely used and populated area in Canada.

This ecoregion extends from Windsor to Toronto, including the Niagara Peninsula at the southern tip of Ontario. The dominant land cover is cultivated land with small, often isolated areas of mixed and deciduous forests. Urban development is the other significant land cover. Sugar maple, beech, white and red oak, shagbark hickory, black

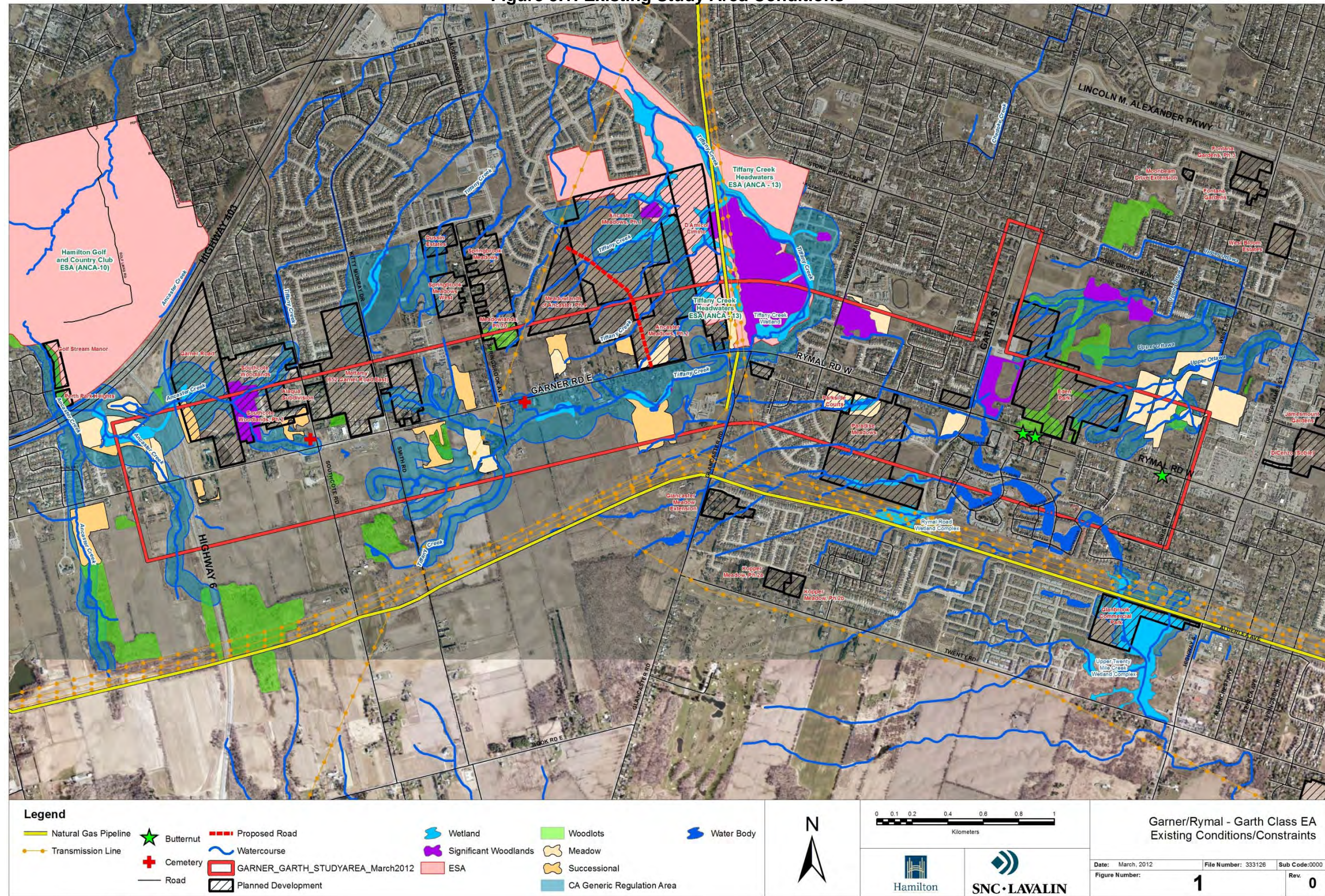
walnut, and butternut, among others, characterize climax vegetation. White elm, eastern cottonwood, balsam poplar, red and black ash, and silver maple characterize moist sites. Drier and warmer sites contain black maple, chestnut, and chinquapin oak. Tulip tree, sycamore, and bitternut hickory occur on moist slopes.

The ecoregion is underlain by carbonate-rich, Palaeozoic bedrock. Surficial deposits are dominated by a wide variety of deep glacial deposits. Southwest of the Niagara Escarpment, the land surface slopes gradually southwestward through low-relief, rolling topography. Bedrock outcrops are mainly limited to the area between Hamilton and Georgetown. Clayey Gleysolic and Gray Brown Luvisolic soils are dominant in the ecoregion.

The ecoregion has one of the warmest climates in Canada, marked by humid, warm to hot summers and mild, snowy winters. The mean annual temperature is approximately 8°C. The mean summer temperature is 18°C and the mean winter temperature is –2.5°C. The mean annual precipitation ranges 750–900 mm. Precipitation is evenly distributed throughout the year.

Figure 3.1 illustrates the general study area limits, features and sensitivities. Additional details on the study area conditions are provided in the following sections of this chapter.

Figure 3.1: Existing Study Area Conditions



3.2 Engineering

This section of the ESR describes existing and anticipated engineering conditions in the study area, including consideration of the transportation network; existing and forecast traffic demand and intersection operations; municipal services and utilities; and surface and stormwater drainage.

3.2.1 Transportation Network

Garner Road East

Garner Road East, between Fiddler's Green Road and Glancaster Road, is a basic two-lane rural arterial with a 60 km/h posted speed. The length of the section is approximately 4.5 km. It is classified as arterial, is a full time truck route, and is used by three public transit (bus) routes operated by the Hamilton Street Railway (HSR). This segment of roadway is also designated as a future/long term Light Rail Transit corridor within the City of Hamilton's B.L.A.S.T. rapid transit network plan (the S Line). The corridor is also an integral part of the city's planned cycling network, including plans to incorporate bike lanes.

The major north-south roads (Fiddler's Green Road, Southcote Road and Glancaster Road) intersecting Garner Road East are operated under signal control. The major unsignalized intersections are as follows:

- Garner Road East and Highway 403 Off-Ramp;
- Garner Road East and Highway 403 On-Ramp;
- Garner Road East and Redeemer University College access;
- Garner Road East and Springbrook Avenue; and
- Garner Road East and Raymond Road.

Widening of Garner Road East from two to four lanes was recommended by previous reports to accommodate for future traffic demand. Further, previous reports also recommended the increase of the storage length in the eastbound left-turn lane on Garner Road East at Southcote Road. It was previously noted that Garner Road East and Kitty Murray Lane intersection was unsignalized, which has changed since the commencement of this study.

Rymal Road West

Rymal Road West, between Glancaster Road and West 5th Street, is a basic two-lane rural arterial with a 60 km/h posted speed. The length of the section is approximately 2.7 km. It is classified as arterial, is designated a full time truck route, and is used by three public transit route operated by the Hamilton Street Railway (HSR) Company. This segment of roadway is also designated as part of the aforementioned LRT S Line. Bike lanes are also to be incorporated in this segment of the project corridor as part of the cycling network plan.

The major north-south roads (Upper Paradise Road, Garth Street and West 5th Street) intersecting Rymal Road West are operated under signal control. The major unsignalized intersections are as follows:

- Rymal Road West and Spadara Drive;
- Rymal Road West and Bishop Ryan Way;
- Rymal Road West and Westlawn Drive; and
- Rymal Road West and Krieghoff Drive.

Widening of Rymal Road from two to four or five lanes was recommended by previous reports to alleviate forecast traffic congestion in the corridor.

Garth Street

Garth Street, between Rymal Road West and Stone Church Road West, is a basic two-lane road with a posted speed of 50 km/h within the study limits. The length of the section is approximately 1.0 km. It is classified as arterial, is used by one public transit route operated by the HSR Company, and is expected to become a designated part-time truck route once road network improvements have been completed in the area in order to serve the Airport Employment Growth District (AEGD). The only major intersection within the study area is the Stone Church Road West/Garth Street, which operates under signal control. The major unsignalized intersections are as follows:

- Garth Street and Regent Avenue;
- Garth Street and Claudette Gate/Sabrina Boulevard;
- Garth Street and Westvillage Drive; and
- Garth Street and Gisele Drive.

Widening of Garth Street from two to four lanes was recommended by previous reports. Previous reports also suggested the addition of a left-turn local access lane.

3.2.2 Traffic Analysis

As part of the EA study, SNC-Lavalin Inc. (SLI) was retained by the City of Hamilton to undertake a traffic study report to identify existing short term and long term transportation capacity deficiencies, as well as recommendations to address these deficiencies. In addition, the traffic study reviewed opportunities for access to a variety of transit options and transit improvements, including pedestrian friendly streets within the study area. The Traffic Study Report is included in Appendix D.1 of this ESR.

The information for existing traffic volumes along Garner Road East/Rymal Road West/Garth Street were provided by the City of Hamilton. The existing traffic volumes reflect the turning movement counts conducted in 2008. The existing (2008) signal timing plans were utilized to assess the performance of the existing signalized intersections within the study area (refer to Figure 3.2). In addition to the existing traffic data, the forecast traffic volumes from the planned developments in the AEGD, the primary study area land developments applications provided by the City, and the growth targets in the Hamilton Transportation Master Plan were used to predict the traffic condition in Year 2031 for the study area (refer to Figure 3.3).

The traffic analysis revealed that the existing Garner Road East/Rymal Road West corridor and the Garth Street corridor operate well during the weekday peak hours under the existing traffic conditions, while the intersections on these corridors operate within their respective capacities during the weekday morning and afternoon hours. The

respective average delays are moderate to low and well within the acceptable limit. During the afternoon peak period, the signalized intersections within the study area operate within their respective capacities, although the average delay increases in comparison to that during the weekday morning peak hour. Table 3.1 presents the intersection performance summary for existing (2008) and future (2013) traffic conditions.

Figure 3.2: 2008 Peak Hour Traffic Conditions

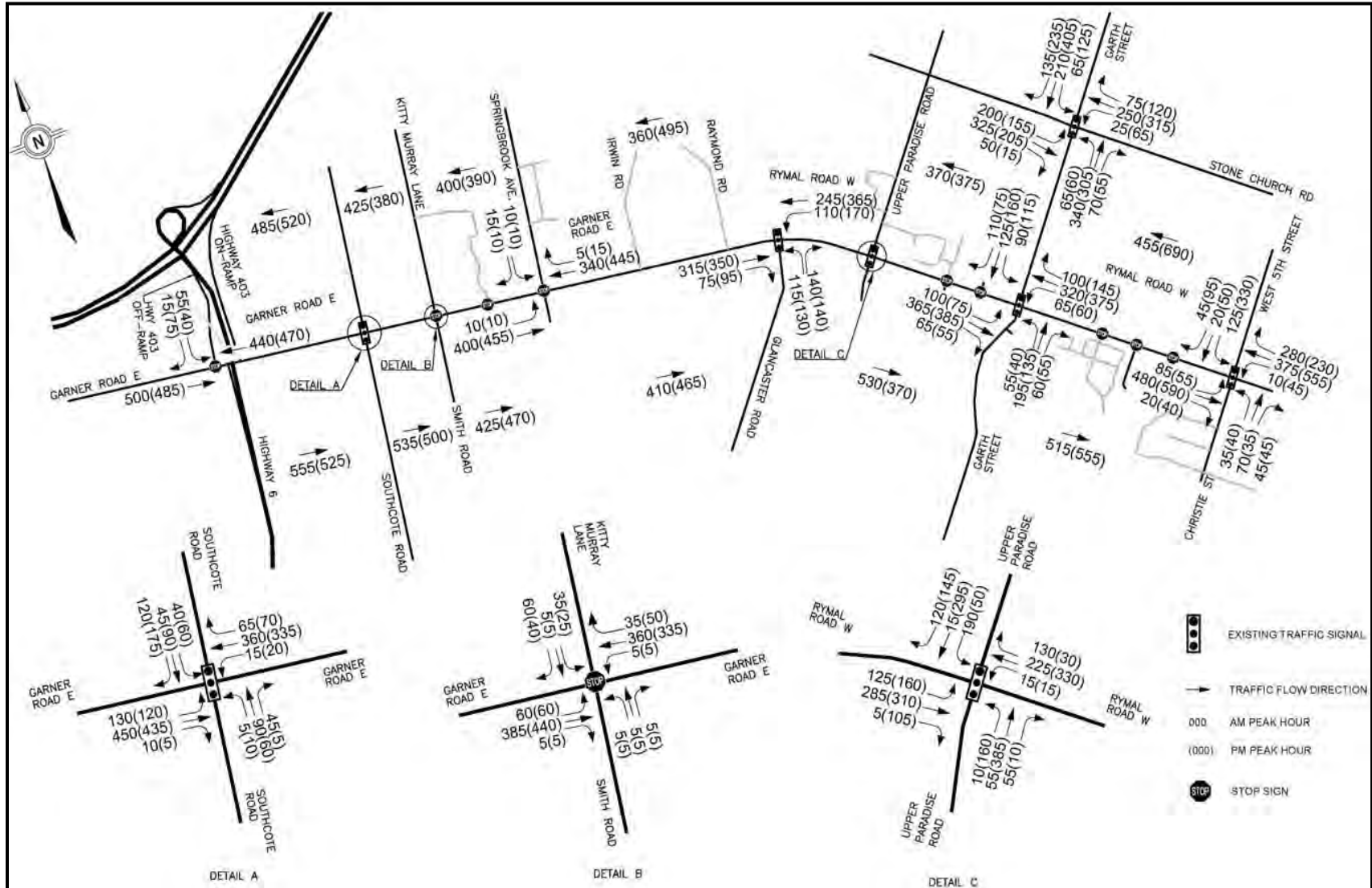
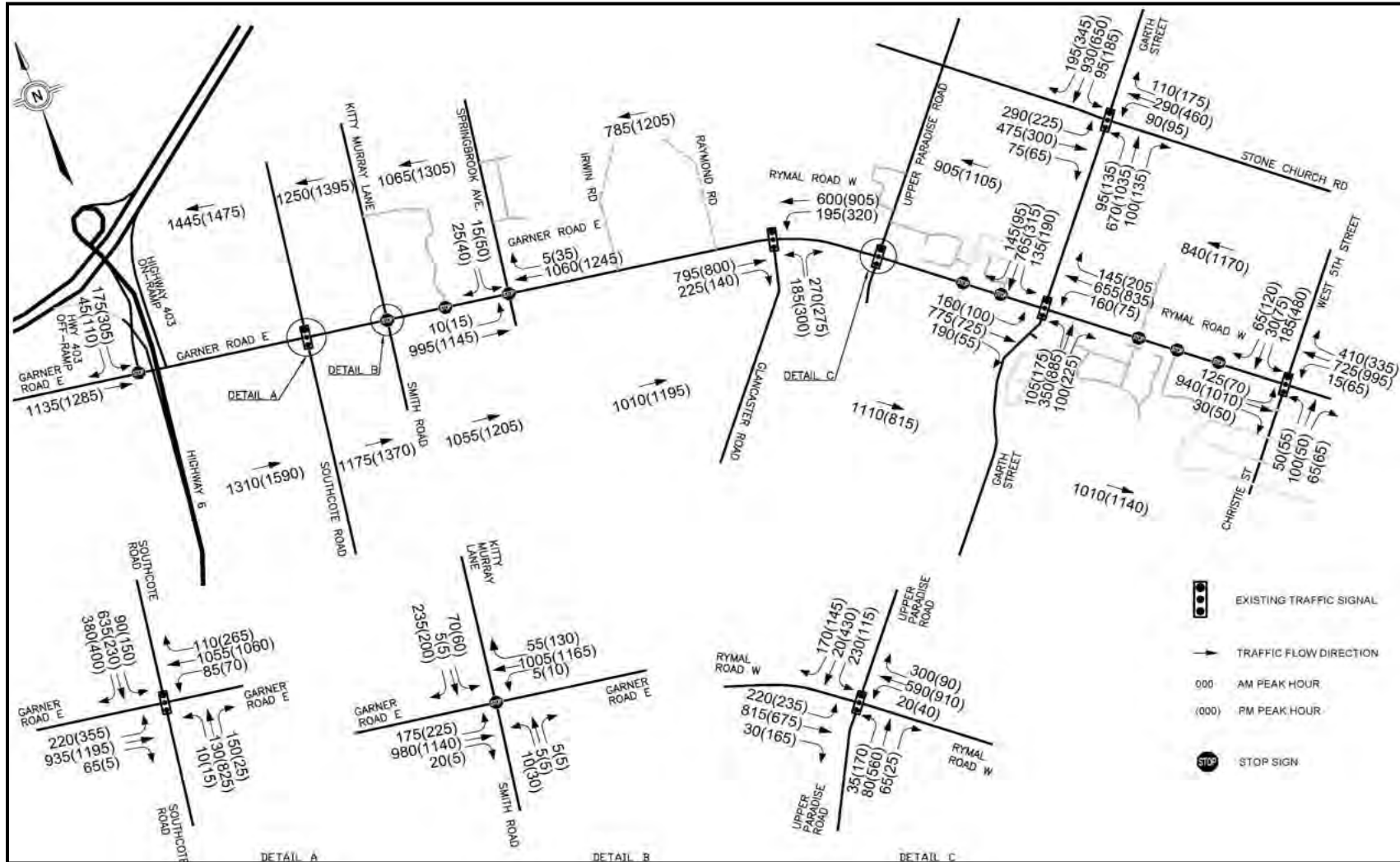


Figure 3.3: 2008 Peak Hour Traffic Conditions



Performance Measure – Summary – Existing Traffic Condition (2008)

Intersection	Weekday AM Peak			Weekday PM Peak		
	V/C	Avg. Delay (s)	LOS	v/c	Avg. Delay (s)	LOS
Garner Road / Fiddler's Green Road	0.38	16.1	B	0.31	15.7	B
Garner Road / Southcote Road	0.28	14.0	B	0.33	14.9	B
Garner Road / Glancaster Road	0.31	12.5	B	0.36	11.8	B
Garner Road/ Upper Paradise Road	0.46	18.0	B	0.64	21.8	C
Garner Road/ Garth Street	0.54	13.8	B	0.59	14.3	B
Garner Road/ West 5 th Street	0.57	15.1	B	0.94	36.7	D
Garth Street/ Stone Church Road West	0.35	18.8	B	0.52	18.6	B

Performance Measure – Summary – Future Traffic Condition (2031)

Intersection	Weekday AM Peak			Weekday PM Peak		
	V/C	Avg. Delay (s)	LOS	v/c	Avg. Delay (s)	LOS
Garner Road / Fiddler's Green Road	1.03	31.5	C	0.74	42.4	D
Garner Road / Southcote Road	2.00	168.3	F	3.79	237.7	F
Garner Road / Glancaster Road	0.96	24.2	C	1.60	71.2	E
Garner Road/ Upper Paradise Road	1.71	220.6	F	2.09	208.2	F
Garner Road/ Garth Street	2.10	193.5	F	1.85	264.5	F
Garner Road/ West 5 th Street	1.04	58.2	E	1.50	210.6	F
Garth Street/ Stone Church Road West	0.83	31.8	C	1.47	93.8	F

- **V/C** represents the ratio of demand volumes at an intersection during the weekday peak hour (morning/afternoon) to the available capacity at the intersection;
- **Avg. Delay** at any intersection represents the average waiting time for the demand volumes to pass through that intersection during the weekday peak hour;
- **LOS** represents the overall "**Level of Service**" of any intersection during the weekday peak hours. The "Levels of Service" are generally governed by the Avg. Delay at the intersection. The transportation level of service (LOS) system uses the letters 'A' through 'F', with 'A' being best and 'F' being worst.

With the planned developments identified in the AEGD Report, the predicted average daily traffic in 2031 in the Garner Road East/Rymal Road West corridor and the Garth Street corridor will be approximately double the 2008 traffic volumes. This will be further increased by approximately 20% upon implementation of the primary land developments to the north of the Garner Road East/Rymal Road West corridor and the northeast quadrant of the Garth Street/Rymal Road West intersection. In summary, daily traffic volumes in the Garner/Rymal and Garth corridors are expected to increase from approximately 10,000 vehicles in 2008 to approximately 25,000 vehicles by 2031, subject to full build-out of the AEGD area and proposed developments to the north of Garner Road East/Rymal Road West.

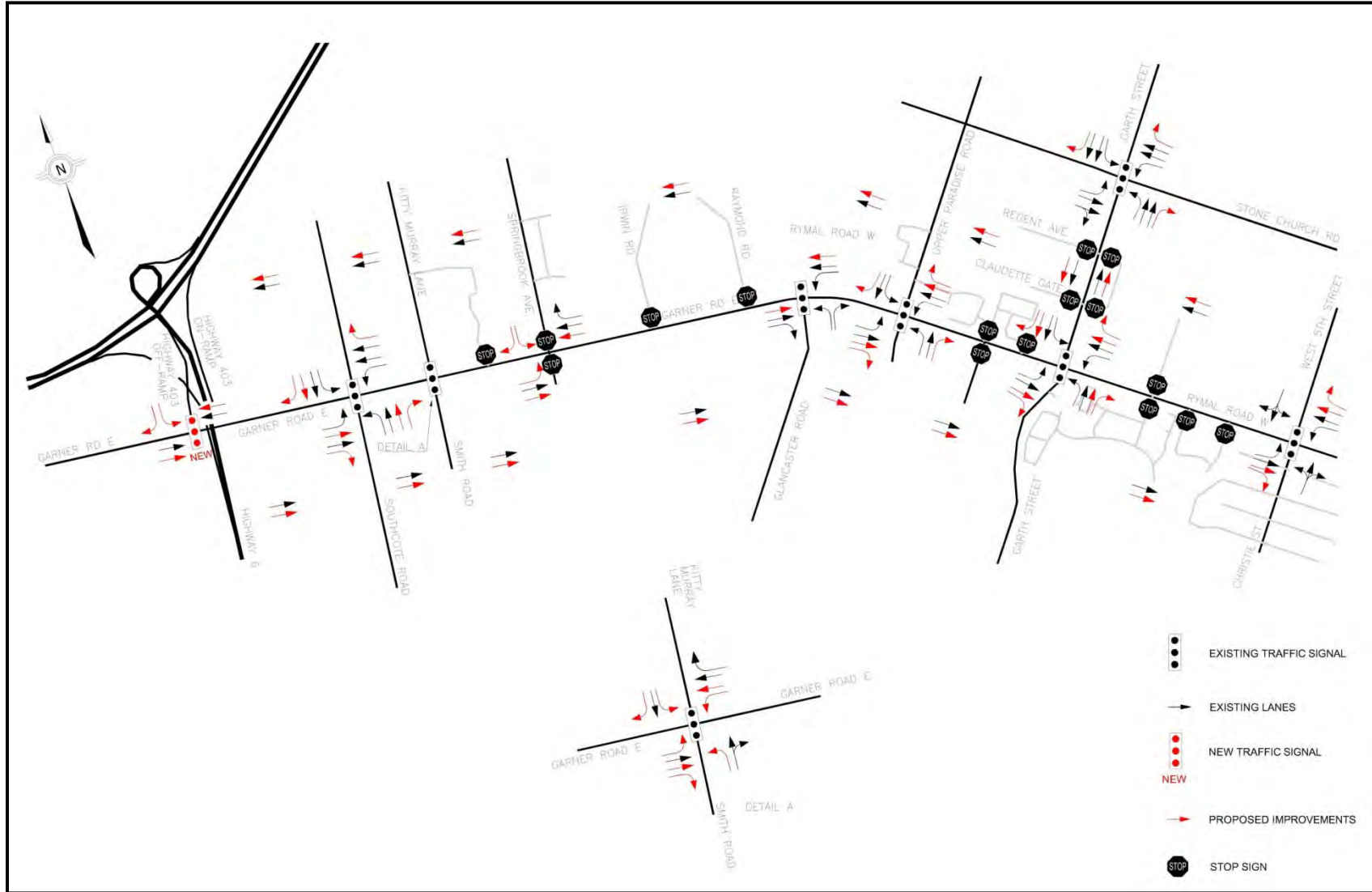
In order to accommodate the forecast 2031 traffic volumes, the following improvements are recommended in the Traffic Study Report.

- Widen the Garner Road East/Rymal Road West corridor to a 4/5-lane cross-section;
- Provide an exclusive right-turn lane at all the approaches to the Garner Road East/Southcote Road intersection and optimize the traffic signal plan with added sub-phasing;
- Install traffic signals and provide exclusive left-turn lanes at the approaches to the Garner Road East and Kitty Murray Lane intersection³;
- Provide an exclusive right-turn lane at all the approaches to the Rymal Road West/Upper Paradise Road intersection and optimize the traffic signal plan with added sub-phasing;
- Provide an exclusive right-turn lane at all the approaches to the Rymal Road West/Garth Street intersection and optimize the traffic signal plan with added sub-phasing;
- Provide an exclusive right-turn lane at the eastbound and westbound approaches to the Rymal Road West/West 5th Street intersection and optimize the traffic signal plan with added sub-phasing; and
- Provide an exclusive right-turn lane on all approaches, except the eastbound leg, to the Garth Street/Stone Church Road intersection and optimize the traffic signal plan with added sub-phasing.

The foregoing proposed improvements are shown in Figure 3.4.

³ Kitty Murray Lane intersection has been signalized since the Traffic Study Report.

Figure 3.4: Required Road/Intersection Improvements



3.2.3 Municipal Services and Utilities

The following utilities are located within the project limits:

- Hydro;
- Bell Canada/Cable;
- Watermain;
- Sanitary sewer; and
- Storm sewer.

The detail locations of the above services and utilities are summarized in the Table 3.2. Chainage (stationing) can be found on the design plates presented in Appendix C.

Table 3.2: Existing Services and Utilities

	Garner Road East	Rymal Road West	Garth Street
Hydro	Located along south side of the road	Located along south side of the road	Located along west side of the road
Bell Canada/Cable	South side: STA. 1+040 to 1+630 STA. 2+580 to 2+620 STA. 2+580 to 2+620 North side: STA. 1+200 to 1+460 STA. 1+620 to 1+920 STA. 2+250 to 2+320 STA. 3+450 to 3+650	South side: STA. 4+080 to 6+275 North side: STA. 4+080 to 4+300 STA. 4+550 to 5+000	East side: STA. 0+000 to 1+050 West side: STA. 0+450 to 1+020
Gas	South side: STA. 0+320 to 1+630 STA. 1+780 to 1+920 STA. 2+250 to 2+340 STA. 2+690 to 2+740 STA. 2+880 to 3+320 STA. 3+560 to 4+100 North side: STA. 0+880 to 3+280	South side: STA. 4+100 to 5+130 STA. 5+400 to 5+480 STA. 5+650 to 6+275 North side: STA. 4+150 to 6+275	East side: STA. 0+000 to 0+700 West side: STA. 0+540 to 6+275
Watermain	South side: STA. 0+320 to 4+100 North side: STA. 1+170 to 4+100	South side: STA. 4+100 to 6+275 North side: STA. 4+100 to 4+130 STA. 5+890 to 6+275	East side: STA. 0+000 to 1+060 West side: STA. 0+000 to 1+060

	Garner Road East	Rymal Road West	Garth Street
Sanitary Sewer		North side: STA. 4+120 to 4+980 Centre of road: STA. 5+530 to 6+275	Centre of road: STA. 0+000 to 1+040
Storm Sewer		North side: STA. 4+120 to 5+080 South side: STA. 5+520 to 6+275	Centre of road: STA. 0+000 to 1+040

These services, particularly Bell Canada/Cable aerial lines will be sensitive to roadway improvements in the context of potential relocation and/or service disruptions.

The underground utilities such as gas lines, storm sewers, sanitary sewers and watermains may need adjustment/relocation or additional protection as a result of roadway improvements. During the Detail Design stage, liaison with the above utility stakeholders will be required to determine the exact nature and staging of any modifications to their plant and service.

3.2.4 Surface Water/Stormwater Drainage

Existing Drainage Systems

The Stormwater drainage systems within the study limits are located in headwater reaches of four separate watersheds. Garner Road from Highway 6 in the west to just east of Southcote Road is located in the Ancaster Creek Subwatershed. The section of Garner Road from east of Southcote Road to west of Upper Paradise Road is located in the Tiffany Creek Subwatershed. From Upper Paradise Road to east of Garth Street, the Rymal Road drainage area is located in the Twenty Mile Creek watershed. The remainder of Rymal Road to the east limits at West 5th Street and the north section of Garth Street are located in the Upper Ottawa Creek Subwatershed, which is a tributary of Redhill Creek. The Twenty Mile Creek watershed is under the jurisdiction of the Niagara Peninsula Conservation Authority (NPCA), while the remaining areas are under the jurisdiction of the Hamilton Conservation Authority (HCA). None of the existing watercourses are sufficiently large to be regulated. However the regulation limit on Tiffany Creek terminates just north of the existing culvert on Garner Road. Additional descriptions of the local watercourses are located in Section 3.3.2.

The Garner Road section west of Upper Paradise Road is in a rural cross-section, with drainage provided by roadside ditches and crossing culverts. Overall drainage direction is from south to north; there are locations at the top end of Tiffany Creek where the flow direction is from north to south. While development is proceeding at a number of locations north of Garner Road, the previous planning has not generally considered drainage from the Garner Road right of way. The one exception is at Raymond Road, where a new storm sewer has been constructed northward from Garner Road that

appears to have been designed to capture about 100 m of Garner Road west of Raymond Road.

On Rymal Road from Upper Paradise Road to the Twenty Mile Creek outlet at St. Elizabeth Village, there is a large (3000 mm x 1800 mm) concrete box storm sewer installed under Rymal Road, with connections to the crossing culverts and the adjacent ditches. The catchment area for this storm sewer includes subdivisions on Upper Paradise Road, the southern half of Garth Street and external areas south of Rymal Road draining to the existing crossing culverts. This storm sewer discharges to an existing series of on-line ponds located on Twenty Mile Creek within St. Elizabeth Village south of Rymal Road. The east end of Rymal Road between Westlawn Road and West 5th Street is serviced by a 900 mm storm sewer discharging to the storm sewer system on Upper James Street. The north end of Garth Street is drained by a 750 mm storm sewer connected to storm sewers north of Stone Church Road.

Previous Drainage Planning Studies

There are a number of existing planning studies for the Garner Road section of the project. These studies have assessed land use issues, including general storm drainage requirements.

Garner Neighbourhood Master Drainage Plan (Oct. 2006): This study prepared a master drainage and Stormwater management plan for the development lands located within the Ancaster Creek watershed west of Southcote Road. The development area considered is all located north of Garner Road. However, there is no specific consideration of future improvements to Garner Road as part of this development study. Several stormwater management facilities are proposed on the tablelands adjacent to the creeks within the development, but the future Garner Road drainage was not considered in the planning or design of these facilities.

Meadowlands Neighbourhoods 3, 4 and 5, Class EA Master Plan (Feb. 2000): This master plan considered development within the Tiffany Creek watershed north of Garner Road between Southcote Road in the west and Rymal Road in the east. The drainage and stormwater management plan proposed numerous stormwater management ponds on the headwater tributaries of Tiffany Creek. An existing pond at Redeemer University College (Bungalows of Ancaster South) has been expanded as part of this plan. However, the pond design does not include the existing or future drainage from Garner Road.

Airport Employment Growth District (AEGD) - Phase 2 - Draft Subwatershed Study and Stormwater Master Plan (December 2009): This study addressed development and planning issues in the Twenty Mile Creek and Sulfur Creek watersheds (including Ancaster Creek and Tiffany Creek subwatersheds) south of Garner Road and south of Twenty Road. This high-level study did not specifically address future drainage of Garner Road. However, it did include a comprehensive review of stormwater management technologies and Low Impact Development (LID) measures in particular. The recommendations for implementation of LID conveyance controls along roadways may be applicable to future Garner Road improvements.

Falkirk East Neighbourhood Class EA (December 2003): This study evaluated the impact of diverting the Falkirk West neighbourhood minor drainage system from Tiffany Creek to the Upper Paradise Road trunk sewer in the Twenty Mile Creek watershed. The Upper Paradise Road trunk sewer is connected to the concrete box sewer on Rymal road, which discharges to the St. Elizabeth Village ponds. The study included hydrologic and hydraulic analysis of the ponds and the Rymal Road storm sewer. The study was based upon previous hydraulic analysis carried out for the Southwest Mountain Drainage Study in 1991. The Falkirk study demonstrated that the Rymal Road and Upper Paradise storm sewer systems are under surcharge for existing development levels and that street flooding occurs at the sag point on Upper Paradise Road. A number of alternatives were investigated to mitigate these flooding impacts including on-site controls, conveyance controls, relief sewers and modification to the ponds. The study recommended that a runoff detention facility be constructed in William Schwenger Park and that a relief sewer be considered for the Rymal Road sewer in conjunction with future road improvements. The study also recommended that a maintenance easement for the St. Elizabeth ponds should be acquired by the City to permit access for maintenance and design improvements. It is understood that an agreement with St. Elizabeth Village to acquire this maintenance easement has been completed in 2013.

Eden Park Phase 1 Stormwater Management Report: (September 2010): This report was undertaken to evaluate the impact of the proposed Eden Park development north of Rymal Road and east of Garth Street on the existing surcharge and flooding problems in the Rymal Road storm sewer system. It included an updated analysis of the Rymal Road storm sewer and the water levels in the St. Elizabeth ponds. The drainage plan for the development included partial diversion of major system flows out of the system to compensate for increased minor system flows to Rymal Road. The study concluded that the Rymal Road drainage system could accommodate the additional development and there would be minimal impact on the existing flooding problems.

St. Elizabeth Village Stormwater Management Facilities Functional Servicing Report (AECOM 2013 – ongoing): The City is currently conducting a study of the St. Elizabeth Village pond system to identify modifications needed to improve their performance and address the existing erosion problems. The report is expected at the end of 2013.

Design information for existing and proposed drainage systems was also available from a number of studies, design calculations and drawings:

- Ancaster Glen Subdivision Functional Servicing Study, MTE Ltd. – Phase 2 Update- December 12, 2012
- Bungalows of Ancaster South, A.J. Clarke Ltd., (March 2011) -Redeemer University College lands and stormwater management pond
- Ancaster Meadows Phase 1, Metropolitan Consulting Ltd. - Raymond Road storm sewer design
- Redeemer University College, Van der Woerd & Assoc. Ltd. (March 2005) – Kitty Murray Lane storm sewer design
- Rymal Road West storm sewer design – City of Hamilton (February 1991)
- Garth Street storm sewer design – City of Hamilton (October 1991)

Existing Drainage System Analysis

Hydrologic and hydraulic analyses were undertaken for the existing drainage systems within the project limits. The details of the analyses and the results are presented in the Drainage and Stormwater Management Report in Appendix D.2.

Garner Road (Ancaster Creek and Tiffany Creek Subwatersheds)

The Garner Road section of the project is predominantly in a rural section, with roadside ditches connected to 13 crossing culverts. The existing catchment boundaries and culvert locations are shown in Figures 3.5a and 3.5b. The majority of the culverts are corrugated steel pipe (CSP), ranging in size from 600 mm to 1000 mm. Two of the crossings are permanent watercourses with catchment areas greater than 25 ha. At Tiffany Creek, there is a 1800 mm x 900 mm open footing concrete box culvert with the catchment area of about 150 ha. At the west end of the project, the Ancaster Creek culvert is a 2440 mm x 1750 mm CSP with a catchment area of about 120 ha.

The hydraulic analysis of the culverts for existing conditions indicated that the majority of the pipes are of adequate size. However, a field inspection of the culverts determined that many of the small CSP pipes were in poor condition. The results of the analysis of the existing culverts on Garner Road are summarized in Table 3.3. At three locations it was determined that the existing culverts have inadequate capacity. These locations are:

- C7 - Tiffany Creek (Station 3+695)
- C15 - East Ancaster Creek (Station 1+176)
- C19 - Ancaster Creek (Station 0+338)

At C7 and C19, the culverts do not meet the freeboard requirement for the 100-year storm. At C15, the road overtops for the 100-year storm. At all three locations, the road overtops for the Regional Storm.

Figure 3.5a: Existing Garner Road Culverts and Catchment Boundaries

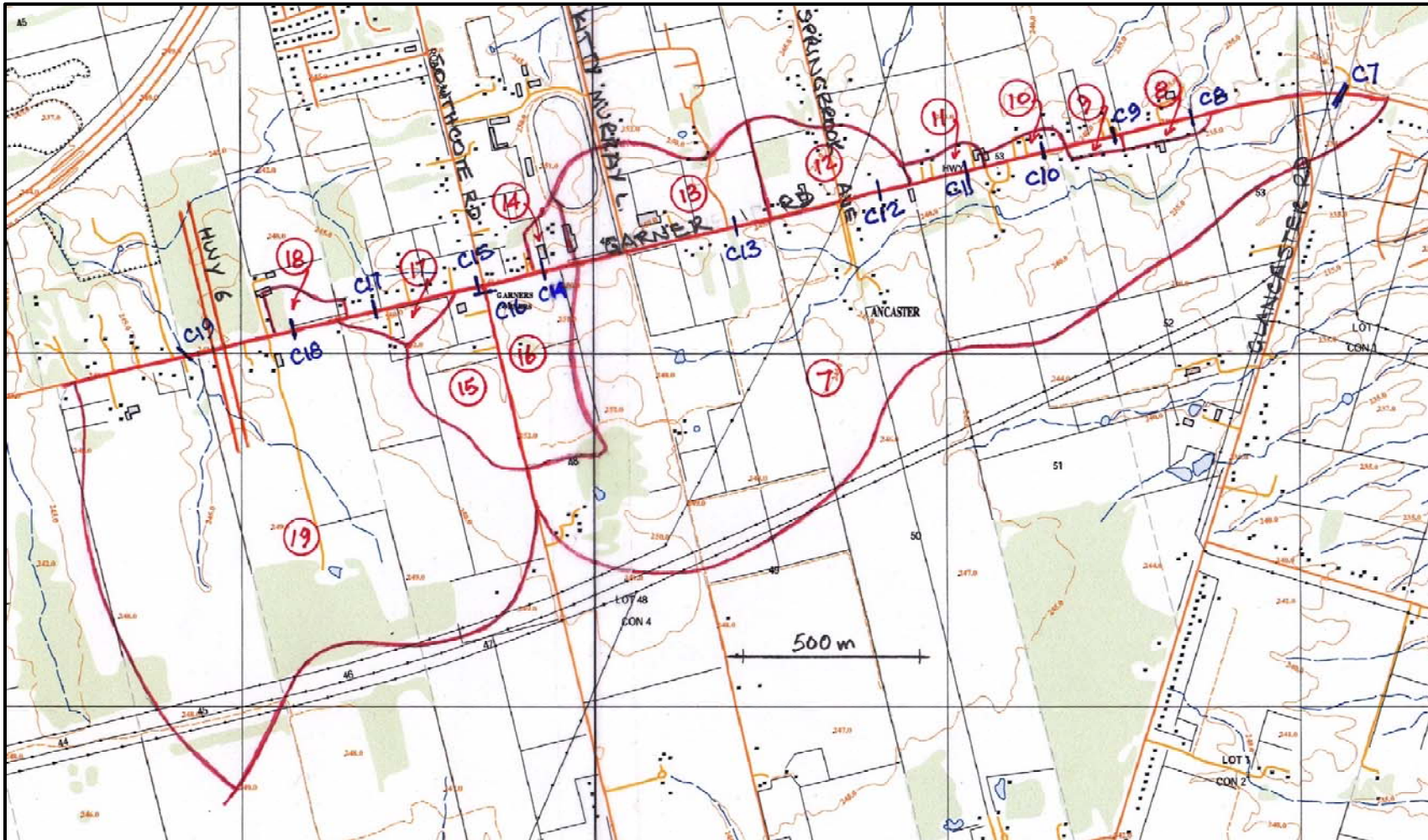


Figure 3.5b: Existing Rymal Road Culverts and Catchment Boundaries

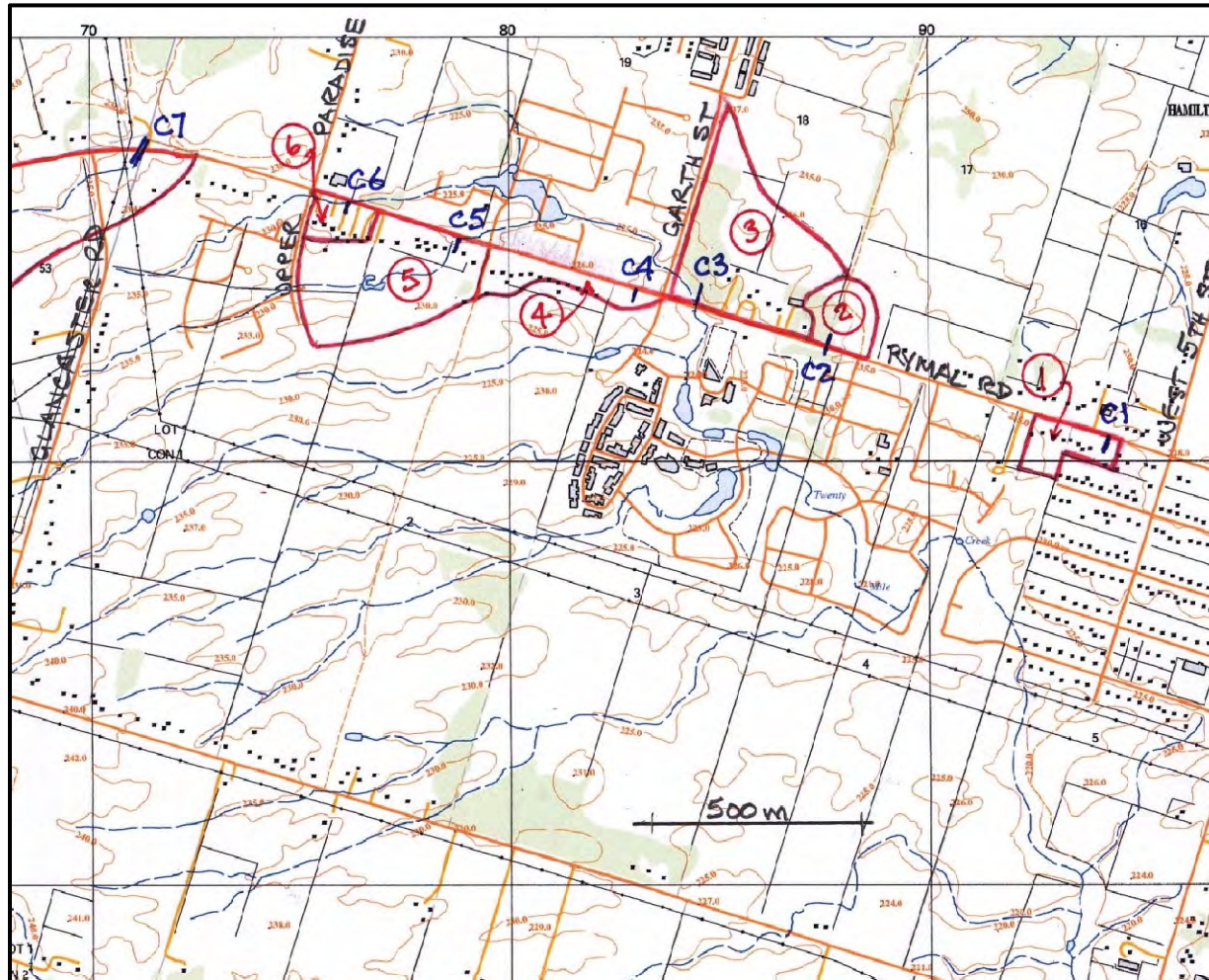


Table 3.3: Hydraulic Analysis of Garner Road Culverts

Hydraulic Analysis of Garner Road Culverts -Existing Conditions																			
Culvert ID	Station (sta.-m)	Type	Ex. Size		Length (m)	Invert Elevations		U/S Culvert Obvert Elevation (m)	Centerline Road Elevation [4] (m)	Min. Road Elevation [1] (m)	Computed U/S Water Elevation			Culvert Clearance [2]		Freeboard [3]			Comments
			W (mm)	H (Dia.) (mm)		U/S (m)	D/S (m)				50 yr (m)	100 yr (m)	Reg. St. (m)	50 yr (m)	100 yr (m)	50 yr (m)	100 yr (m)	Reg. St. (m)	
C7	3+695	Conc. Box	1800	900	31.0	228.98	228.90	229.88	230.76	230.63	230.28	230.46	230.93	-0.40	-0.58	0.35	0.17	-0.30	Assume invert is 0.5m below surveyed level of sediment at d/s end and 0.6m below survey level at u/s end, based on field observations. >Q25 capacity but freeboard too low.
C8	3+269	CSP		800	18.86	235.96	235.85	236.76	237.86	237.78	236.22	236.25	n/a	0.54	0.51	1.56	1.53	n/a	Culvert damaged
C9	3+040	CSP		750	35.0	238.30	238.19	239.05	239.76	239.63	238.49	238.51	n/a	0.56	0.54	1.14	1.12	n/a	
C10	2+842	CSP		800	22.05	238.85	238.34	239.65	241.32	241.23	239.17	239.17	n/a	0.48	0.48	2.06	2.06	n/a	Culvert damaged
C11	2+619	CSP		800	22.04	241.42	241.06	242.22	243.30	243.15	239.14	242.59	n/a	3.08	-0.37	4.01	0.56	n/a	Culvert damaged; too shallow for road reconstruction
C12	2+345	CSP		800	15.38	242.80	242.34	243.60	245.00	244.91	243.89	244.01	n/a	-0.29	-0.41	1.02	0.90	n/a	
C13	1+960	Conc.		1,000	28.33	244.30	243.98	245.30	246.70	246.51	245.56	245.64	n/a	-0.26	-0.34	0.95	0.87	n/a	Culvert C13 comprised of two barrels located downstream of Bungalows of Ancaster pond outlet.
	1+960	Conc.		600	28.33	244.30	243.98	244.90	246.70	246.51	245.56	245.64	n/a	-0.66	-0.74	0.95	0.87	n/a	
C14	1+364	CSP		700	21.08	247.92	247.77	248.62	249.25	249.10	248.33	248.37	n/a	0.29	0.25	0.77	0.73	n/a	Too shallow for road reconstruction
C15	1+176	CSP		800	31.27	245.65	245.38	246.45	248.53	248.38	248.27	248.52	248.57	-1.82	-2.07	0.11	-0.14	-0.19	Road overtops for Q100
C16	1+203 rt	CSP		600	19.25	246.62	246.54	247.22	248.59	248.30	248.09	248.11	n/a	-0.87	-0.89	0.21	0.19	n/a	Culvert located on Southcote Rd. - Culvert damaged
C17	0+850	CSP		800	18.61	246.01	245.79	246.81	247.80	247.65	246.55	246.59	n/a	0.26	0.22	1.10	1.06	n/a	Culvert damaged
C18	0+665	CSP		700	24.33	245.41	245.21	246.11	247.10	246.96	245.87	245.91	n/a	0.24	0.20	1.09	1.05	n/a	Culvert damaged
C19	0+338	CSPA	2,440	1,750	34.4	239.83	239.23	241.58	242.20	241.92	241.65	241.85	242.11	-0.07	-0.27	0.27	0.07	-0.19	Freeboard too low; Road overtops for Reg. Storm

- Notes:**
- [1] Minimum road EOP for freeboard calculation.
 - [2] Distance from water elevation to culvert obvert.
 - [3] Distance from water elevation to minimum road EOP elevation.
 - [4] Centerline Road elevation adjacent to culvert

Rymal Road (Twenty Mile Creek Subwatershed)

Rymal Road, from Station 3+880 west of Upper Paradise Street to Station 5+355 east of Bishop Ryan Way, discharges to Pond C in St. Elizabeth Village just east of Garth Street at Station 5+078. This section includes the southerly portion of Garth Street up to Station 0+480. The roadways are not urbanized at present. West of the outlet, drainage from Rymal Road and external areas from the south is conveyed in roadside ditches to several crossing culverts. These culverts are connected to the existing 3000 mm x 1800 mm concrete box storm sewer under Rymal Road. The Garth Street drainage is captured in a number of ditch inlets connected to the existing storm sewer that discharges to the Rymal Road storm sewer. The Rymal Road drainage from the east is conveyed in road side ditches to the outlet.

The Rymal Road storm sewer system has been studied extensively. Previous studies have determined that this system is undersized for the existing development conditions and there are known flooding problems at the sag points on Upper Paradise Road. Flooding and erosion problems have also been documented within the St. Elizabeth Village pond system downstream of the Rymal Road storm sewer outlet. Due to these previous results, further analysis of the Rymal Road storm sewer for existing conditions was not needed in this study. However, an assessment of the existing Garth Street storm sewer draining to Rymal Road was undertaken and it was determined that this storm sewer has sufficient capacity for the existing conditions.

East Rymal Road and Garth Street North (Upper Ottawa Watershed)

These sections of the project area have existing storm sewers that pick up runoff from the roadside ditches connected to cross culverts and ditch inlets. An assessment of these storm sewers was undertaken that it was determined that they provide adequate capacity for the existing minor system drainage requirements. However, on the Garth Street north section there is a significant sag in the road profile at Station 0+900. Under major system flow conditions (i.e., 100-year) ponding depths at this location could exceed 0.8 m. The additional inflows to the storm sewer under these conditions could also lead to surcharging and flooding in the downstream storm sewers.

3.3 Natural Environment

This section of the ESR describes natural heritage features and sensitivities in the study area, including consideration of the designated environmentally sensitive areas; fish and fish habitat; vegetation communities; wildlife; and the groundwater regime. Major features are identified in Figure 3.1. Additional details are presented in the Natural Environment Report in Appendix D.3 of this ESR.

3.3.1 Provincially and Locally Identified Natural Heritage Features

Tiffany Creek ESA

The Tiffany Creek (ESA #46) is the only designated environmentally sensitive area located in close proximity to the study area. It is located immediately north of Rymal Road within the eastern headwaters of Tiffany Creek, and is one of the few remaining natural areas in a highly urbanized setting. Habitat composition found within the area is diverse, with cultural meadow dominating the northwestern portion, with pockets of

thicket, pioneer aspen and elm woodlots, and cattail marsh found throughout. This is also found to the southwest. The remainder is a mosaic of remnant forests mainly dominated by red oak in the more mature units, with black walnut found in the lower valley slopes. Meadow marsh is prevalent in the bottom lands. A number of locally rare species are found in the area, all of which are considered secure or apparently secure by the Ministry of Natural Resources.

Tiffany Creek crosses Rymal Road near the intersection with Glancaster Road. Adjacent to the road are meadow marsh communities associated with the roadside ditch and Tiffany Creek crossing, as well as early successional cultural meadow and thickets where the natural vegetation was disturbed by the hydro and natural gas pipeline rights-of-way and service entrances.

3.3.2 Fish and Fish Habitat

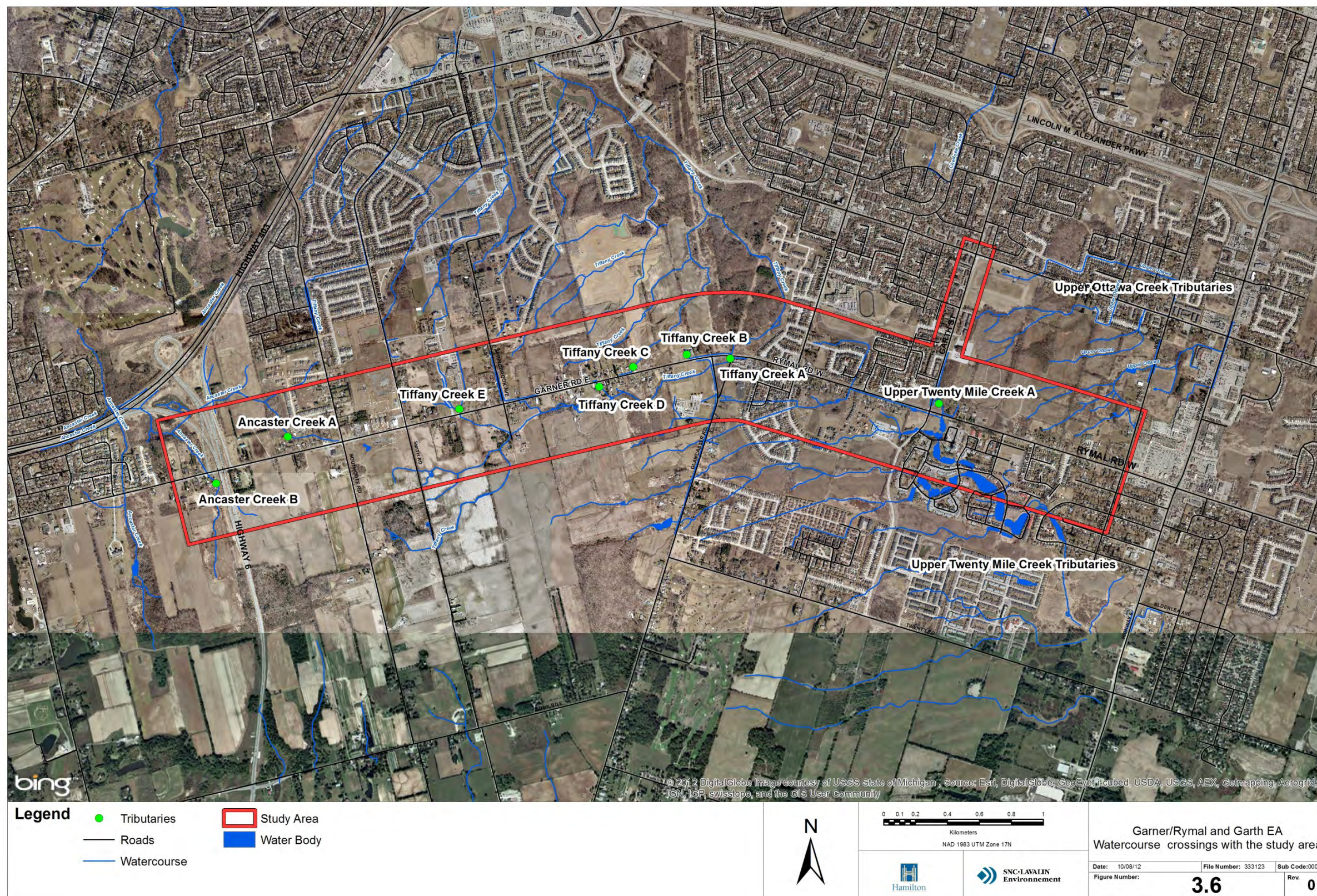
The following is a summary from the Natural Environment Report (refer to Appendix D.3) documenting the existing aquatic habitat conditions of all the watercourses within the study area. The study area is located within three watersheds: Twenty Mile Creek watershed (Upper Twenty Mile Creek), Red Hill Creek watershed (Upper Ottawa Creek) and Spencer Creek watershed (Tiffany Creek and Ancaster Creek). All of the watercourses within the study area have reaches that have been altered through a combination of agricultural operations and urban development, and are generally considered to have degraded habitat conditions.

The description of the existing aquatic habitat involved the review of secondary sources and collection of data during the field investigation by SNC-Lavalin Environment (SLE) on December 22, 2011. Fish community sampling and inventory was not completed, as background data was deemed sufficient for the assessment of the fish community present at the watercourses in the study area. The fish habitat assessment was conducted utilizing the general methods and procedures outlined in the *Ontario Stream Assessment Protocol*⁴. There is one designated aquatic species at risk – Northern Brook Lamprey (*Ichthyomyzon fossor*) identified in the Twenty Mile Creek watershed located well outside of the study area⁵. The upstream watercourses contribute indirectly to important fish habitat through baseflows and the allochthonous energy inputs to downstream reaches. The location of all sites is shown in Figure 3.6.

⁴ Stanfield (ed.), 2010

⁵ Government of Canada, 2011

Figure 3.6: Watercourse Crossings with the Study Area



Upper Ottawa Creek Subwatershed

Upper Ottawa Creek is a tributary of Red Hill Creek and the headwaters of Upper Ottawa Creek are located at the northeast corner of Garth Street and Rymal Road. These headwater tributaries are ephemeral grassed agricultural swales that flow northeasterly out of the study area. The upper parts of the headwaters of Upper Ottawa Creek are located within an agricultural area, but development in the area has already removed nearly half of the remaining agricultural fields and it is likely that some of these headwater watercourses may be buried beneath the development. Upper Ottawa Creek is classified as small riverine warmwater habitat⁶. No fish were observed in the watercourses during the SLE field visit and fish use of the watercourses is likely limited by the lack of sufficient flow to maintain baseflow.

Upper Twenty Mile Creek Subwatershed

Upper Twenty Mile Creek is a subwatershed of the Twenty Mile Creek watershed, on the south side of Rymal Road. An intermittent watercourse (Tributary A) crosses Rymal Road immediately east of Garth Street, originating north of the woodlot that borders Garth Street. Immediately downstream of Rymal Road, this watercourse flows into a stormwater pond that is part of the St. Elizabeth Village on-line pond complex. South of the study area, there are several tributaries of Upper Twenty Mile Creek that are conveyed in agricultural drainage swales, roadside ditches, as well as some natural channels in varying states of preservation. No fish were observed in the watercourse from the SLE field visit in 2011. These watercourses are classified as warmwater habitat and indirectly support (e.g., baseflow, food source contribution) and one aquatic species at risk – Northern Brook Lamprey (*Ichthyomyzon fossor*) identified in the Twenty Mile Creek watershed located well outside of the study area.



Tiffany Creek Subwatershed



Tiffany Creek originates in a mixed agricultural and residential area near the Town of Ancaster, flowing in an easterly direction before turning north and crossing under Garner Road East where it flows into the Tiffany Creek Headwaters Environmentally Sensitive Area (ESA #46) through riparian wetlands. There are five crossings of Tiffany Creek along Garner Road East. As this is the headwater area, each tributary is similar in character and classified as small riverine warmwater⁶. Flow and temperature are variable due to less groundwater discharge; some sections of Tiffany Creek may cease to flow in dry periods in the summer months. The tributaries are listed below:

1. Tributary A: a permanent watercourse with direct fish use, located east of the transmission line corridor at Glanaster Road.

⁶ Bowlby et al., 2009.

2. Tributary B and Tributary C: intermittent watercourses with no direct fish use, originating northwest of Garner Road and Glancaster Road, flowing along the north side of Garner Road East in a ditch. They combine with Tributary A and flow north into the Tiffany Creek wetland.
3. Tributary D: an ephemeral watercourse with no direct fish use, originating north of Garner Road East between Springbrook Avenue and Glancaster Road.
4. Tributary E: an ephemeral watercourse with no direct fish use, originates north of Garner Road East between Smith Road and Springbrook Avenue. Upstream of the study area, the watercourse has undergone major anthropomorphic change to accommodate stormwater management at Redeemer University College.

Ancaster Creek Subwatershed

Ancaster Creek originates as small grassed swales through agricultural lands south of Garner Road East and flows in a northerly direction across Garner Road East to the Hamilton Golf and Country Club ESA, where most of the valleylands have been developed as a golf course, although there are a few remnant woodlots and some wetland pockets. Much of the Ancaster Creek valley in the vicinity of Garner Road East is located in remnant agricultural lands that are slated for future development. There are two crossings of Ancaster Creek and both watercourses are classified as small riverine coldwater. Tributary A is an intermittent watercourse that is located northwest of Southcote Road and Garner Road East, with no direct fish use. Tributary B is a permanent coldwater watercourse that originates south of Garner Road and flows through the study area in a defined channel. This tributary has direct fish use.

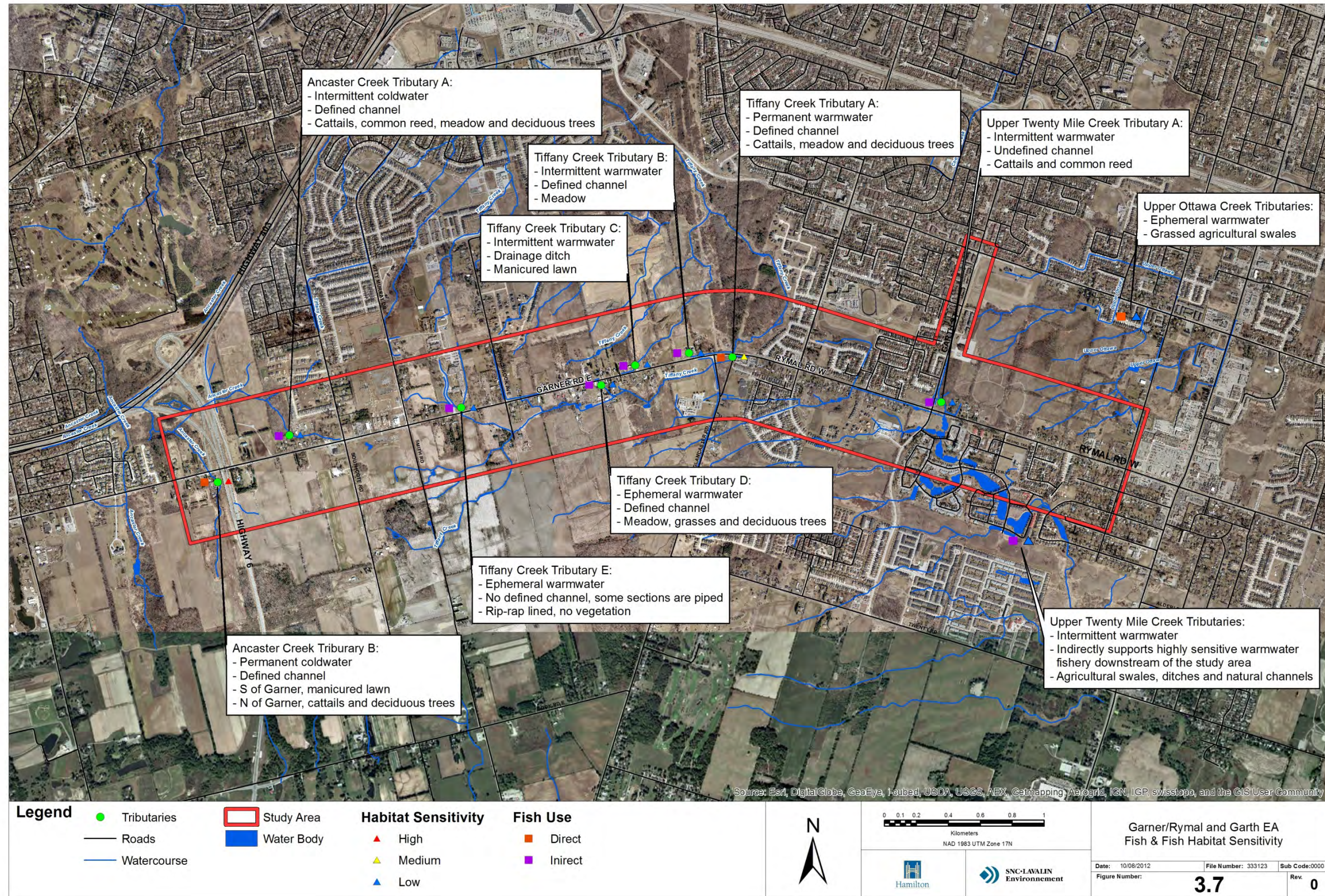


Fish Habitat Sensitivity and Constraints

Fish and fish habitat sensitivity was determined according to the *Guide to the Risk Management Framework for DFO Habitat Management Staff Practitioners*⁷ and SLE field investigation (Figure 3.7). The tributaries within the Upper Ottawa Creek and Upper Twenty Mile Creek Subwatersheds do not support direct fish habitat and, therefore, have low sensitivity. The permanent tributaries within the Tiffany Creek and Ancaster Creek Subwatershed provide direct fish habitat and these watercourses have been classified as moderate to high sensitivity. The ephemeral and intermittent tributaries provide indirect fish habitat through flow and allochthonous inputs to downstream reaches; these reaches are considered to have low sensitivity.

⁷ Fisheries and Oceans, 2010.

Figure 3.7: Fish and Fish Habitat Sensitivity



3.3.3 Vegetation Communities

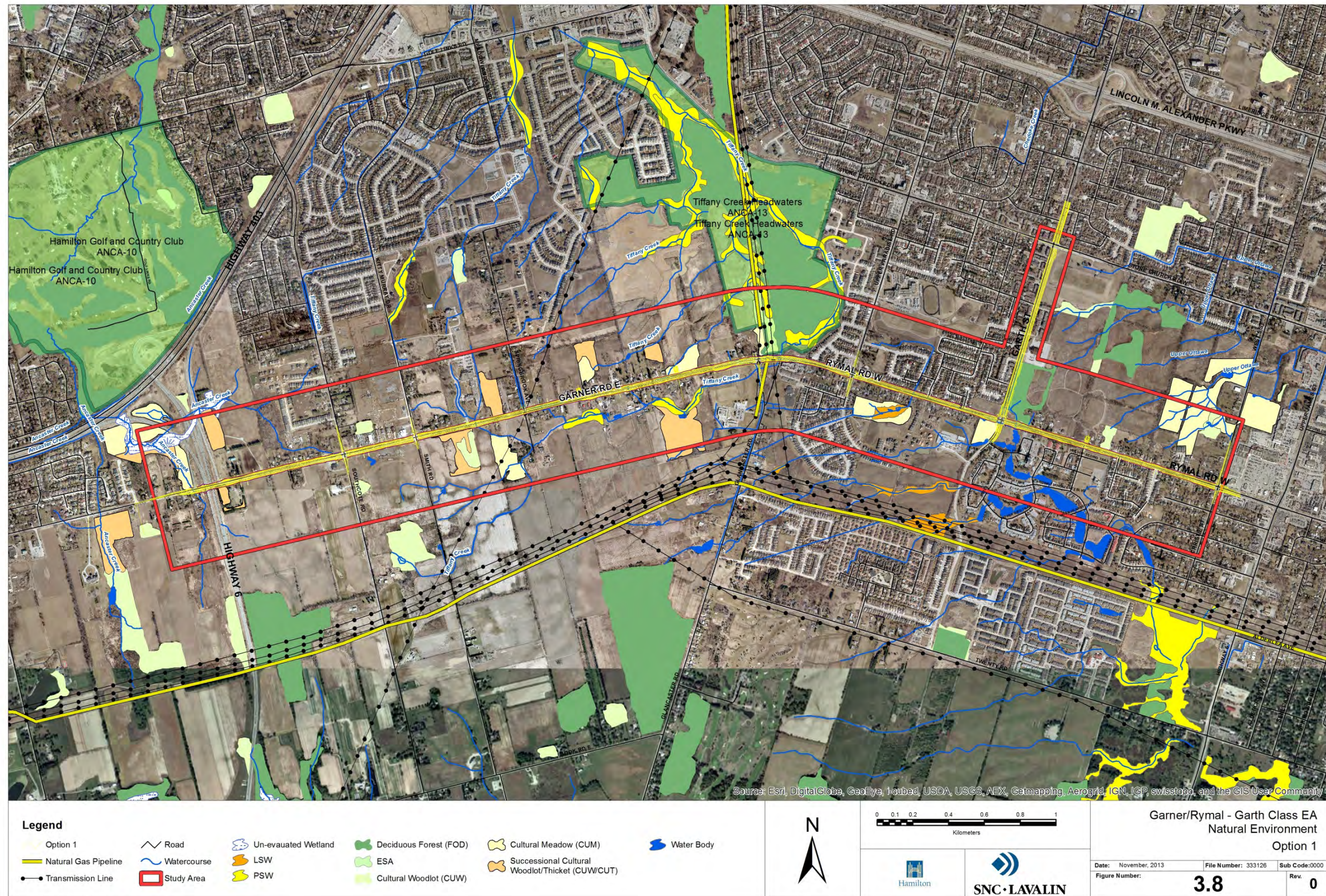
Field surveys were conducted with the goal of confirming the initial delineation and characterization of habitat types using aerial photography provided by the City of Hamilton, as well as the initiation of the vegetation survey/field investigations to confirm desktop analysis. A tree inventory prepared by the City of Hamilton (Stantec, 2012) was cross-referenced for tree identification and used during the assessment of impacts to roadside trees.

The field survey was conducted on March 7, 2012, using visual inspections from the road side at each significant or characteristic vegetative assemblage. Due to lack of access to some lands outside the road right-of-way, all vegetation assemblages identified using aerial photography were characterized to the Community Series level using the Ecological Land Classification (ELC) protocol. Groomed areas or parklands where designated as Manicured Grass/Trees (MGT).

Plant species were documented as they were encountered during the field surveys. A complete list of the vascular plant species found is presented in Appendix B of the Natural Environment Report. Nomenclature is based on the Ontario plant list (Newmaster et al, 1998).

Vegetation communities adjacent to Garner/Rymal Road and Garth Street affected by the proposed roadworks are principally restricted to roadside trees and vegetation associated with the frontage of homes and businesses, and do not lend themselves to assessment under the Ecological Land Classification (ELC) protocol. However, adjacent vegetation units have been described to ELC Community Series level in order to provide context for the project setting. A description of these can be found below, and mapping is provided in Figure 3.8. A photo record of typical vegetation types can be found in Appendix C of the Natural Environment Report (Appendix D.3).

Figure 3.8: Vegetation Communities



Manicured Grass/Trees (MGT)

The majority of the habitat found within the study area, adjacent to the subject roads, is best described as Manicured Grass/Trees. This vegetation type is associated with the residential and commercial properties along Rymal Road and Garth Street, and the rural residential properties and businesses along Garner Road. Typical tree species observed in these areas include, Norway spruce (*Picea abies*), Austrian pine (*Pinus nigra*), Norway maple (*Acer platanoides*), Manitoba maple (*Acer negundo*), sugar maple (*Acer saccharum*), black locust (*Robinia pseudo-acacia*), black walnut (*Juglans nigra*), white ash (*Fraxinus americana*), and various ornamental elms (*Ulmus sp.*). For full details on roadside trees, refer to the tree inventory.



Cultural Meadow (CUM)



The second most common habitat type is Dry Moist Cultural Meadow, which is dominated by grasses, along with sun tolerant broad-leaf vegetation typical of old fields and disturbed areas. This vegetation type dominates the road right-of-way (R.O.W), and historic farm fields found in various locations, including the hydro and natural gas R.O.W.'s located just east of Glancaster Road.

Herbaceous vegetation in the cultural meadow areas consists of old field type vegetation, such as introduced forage grasses (e.g., smooth brome (*Bromus inermis*), timothy (*Phleum pretense*), reed canary grass (*Phalaris arundinacea*), red fescue (*Festuca rubra*) and Kentucky blue grass (*Poa pratensis*)). Broad-leaved ground cover includes common milkweed (*Asclepias syriaca*), common mullien (*Verbascum thapsus*), chickory (*Cicorium intybus*), common burdock (*Arctium minus*), wild carrot (*Daucus carota*), rough fruited cinquefoil (*Potentilla recta*), common plantain (*Plantago major*), white sweet clover (*Melilotus alba*), crown vetch (*Coronilla varia*), common St. John's wort (*Hypericum perforatum*), common ragweed (*Ambrosia artemisiifolia*), yarrow (*Achillea millefolium*), bull thistle (*Cirsium vulgare*), bouncing bet (*Saponaria officinalis*), teasel (*Dipsacus fullonum*), as well as perennial asters (*Aster sp.*) and goldenrods (*Solidago sp.*).

There are also a number of hedgerow and naturalized/planted isolated and clustered trees and shrubs of various ages within these areas. Tree species are typically as those described under the manicured grass/trees section, while shrub species were similar to those described later under cultural thicket.

Deciduous Forest (FOD) – Garth Street Woodlot

One pocket of deciduous forest was observed within the study area, along the east side of Garth Street between Rymal Road and the West Highland Baptist Church property. This woodlot, a significant woodlot in the Urban Official Plan, contains a relatively mature community and is bounded on its western edge by a chain link fence, although many trees and shrubs grow between the fence and the road shoulder.



This woodlot is an upland forest community dominated by red oak (*Quercus rubra*) and black cherry (*Prunus serotina*). The canopy cover is quite dense (<60%) and other species noted within the woodlot included occasional white ash, basswood (*Tilia americana*), Hop hornbeam (*Ostrya virginiana*), and several scattered white pine (*Pinus strobus*).

The sub-canopy and understory vegetation is relatively sparse, though this increases near the edges of the woodlot. Sub-canopy species observed include sugar maple, and white ash saplings, as well as bitternut hickory (*Carya cordiformis*), and choke cherry (*Prunus virginiana*). The understory consisted of tartarian honeysuckle, red-berried elderberry (*Sambucus racemosa*), red raspberry (*Rubus idaeus*), staghorn sumac, riverbank grape (*Vitis riparia*), and slender willow (*Salix petiolaris*). Herbaceous vegetation follows a similar pattern, with rough avens (*Geum laciniatum*), large leaved aster (*Aster macrophyllus*), common buttercup (*Ranunculus acris*), gill over the ground (*Glechoma hederacea*), and celandine (*Chelidonium majus*) found scattered within the interior areas and vegetation similar to the cultural meadow areas observed along the roadside edges and disturbed areas observed towards the margins of the woodlot.

Cultural Woodlot (CUW)



A number of cultural woodlots and large individual tree specimens were observed to the west of Glancaster Road, where the land use becomes more rural residential. The majority of these within the study area are part of historic farmsteads or agricultural fields that have naturalized. Trees observed in these



areas include sugar maple, Manitoba maple, red oak, balsam poplar (*Populus balsamifera*), black walnut, black locust, Scots pine (*Pinus sylvestris*), and white pine. These woodlots are quite small and the sub-canopy and understory can vary significantly depending the size of the unit and the amount of periodic disturbance occurring. Sub-canopy species include common buckthorn, hawthorn (*Crataegus sp.*) and tree species saplings, and the understory is a combination of tartarian honeysuckle, grey dogwood (*Cornus foemina ssp. racemosa*), red currant (*Ribes rubrum*), red raspberry, and Virginia creeper (*Parthenocissus quinquefolia*), with red osier dogwood observed in the wetter areas. Herbaceous vegetation was typically dominated by garlic mustard (*Alliaria petiolata*), bittersweet nightshade (*Solanum dulcamara*), and yellow avens (*Geum aleppicum*), with cultural meadow species found in edge and open areas.

Cultural Thicket (CUT)

A number of Cultural Thickets were also observed west of Glancaster Road, where the land use becomes more rural residential. These areas are typically naturalized farm fields or grazing areas in early successional stages. Cover varies within these areas, but most contain a mixture of dense cover interspersed with small open cultural meadow inclusions. Canopy vegetation observed consists of hawthorn, common buckthorn, tartarian honeysuckle, grey dogwood, red osier dogwood, staghorn sumac, choke cherry, and some scattered green ash. Ground cover was typical of the cultural meadow areas described above.

Meadow Marsh (MAM)



The only wetlands found within the study area are Meadow Marsh types located along the north and south sides of Garner Road/Rymal Road. At the Tiffany Creek and Upper Twenty Mile Creek tributary crossings, these are associated with the headwater tributaries. Other small patches exist as part of the roadside drainage ditches. Most of these areas are dominated by common cattail (*Typha latifolia*), or common reed grass (*Phragmites australis*). Shrub cover varies, with some dense inclusions and scattered individuals of red osier dogwood, grey dogwood, choke cherry, field rose, winterberry (*Ilex verticillata*), and tartarian honeysuckle. At the Tiffany Creek crossing near Glancaster Road, there were also a number of crack willow, as well as green ash (*Fraxinus pennsylvanica*) and balsam poplar. Herbs such as jewel-weed (*Impatiens sp.*) and spotted water hemlock (*Cicuta maculate*) were observed, as well as many of the common meadow species, due to their proximity to disturbed habitats in the utility R.O.W.'s as well as the road corridor.

Vascular Plants

A complete species list of vascular plants observed and noted within the study area can be found in Appendix B of the Natural Environment Report. The list is organized by scientific family name, genus and species, and nomenclature is based on the Ontario plant list (Newmaster et al, 1998). Given the limited nature of access to the site, the species list generated as part of the field program is somewhat limited. A total of 108 vascular plant species were observed. Of these, 58 (54%) are listed as native species, and 50 (46%) are listed as invasive. Of the species observed, the majority are listed a S5 or SE5 by OMNR, with a few S4 or S4? (black walnut, rough avens, calico aster and Virginia creeper). One species, butternut, observed within the study area is listed as Endangered under COSEWIC (Committee on the Status of Endangered Wildlife in Canada), the federal Species at Risk Act (SARA), and the Committee on the Status of Species at Risk in Ontario (COSSARO).

The majority of the species observed are typical of disturbed environments, or have been planted as part of landscaping initiatives, and as such provide no real indication of the true floristic quality of the sites. The disturbed and fragmented nature of the areas studied is apparent in the small size of the vegetative communities found and the even distribution of native and non-native species observed within the majority of these units.

It should be noted that the species list is not a complete list of the plants of the area. This is particularly applicable to short-term seasonal plants, since the area was not observed throughout the growing season. Nomenclature is primarily in accordance with the Ontario Plant List (Newmaster et al. 1998), and secondarily with NHIC (2010).

Plant Species at Risk

A review of all background information available from the NHIC Biodiversity Explorer database identified eighteen significant plant species known from the vicinity of the study area (OMNR, 2011). The names of these significant species, and their given significance ranks are outlined below in Table 3.4 (modified from Stantec, 2012).

Table 3.4: Significant Vegetation Species Potentially Occurring in the Study Area

Common Name	Scientific Name	S-Rank ¹	COSEWIC Status ²	SARO Status ³
Fern-leaved Yellow False Foxglove	<i>Aureolaria pedicularia</i>	S2?		
Downy Yellow False Foxglove	<i>Aureolaria virginica</i>	S1		
White-tinged Sedge	<i>Carex albicans var. albicans</i>	S3		
Pignut Hickory	<i>Carya glabra</i>	S3		
American Chestnut	<i>Castanea dentata</i>	S2	END	END
Northern Hawthorn	<i>Crataegus dissona</i>	S3		
Forked Panic Grass	<i>Dichanthelium dichotomum</i>	S2		
Burning Bush	<i>Euonymus atropurpureus</i>	S3		
Panicled Hawkweed	<i>Hieracium paniculatum</i>	S2		
Butternut	<i>Juglans cinerea</i>	S3?	END	END
Scarlet Beebalm	<i>Monarda didyma</i>	S3		
Large Yellow Pond-lily	<i>Nuphar advena</i>	S3		
Soft-hairy False Gromwell	<i>Onosmodium molle ssp. hispidissimum</i>	S2		
Woodland Pinedrops	<i>Pterospora andromedea</i>	S2		
Sharp-leaved Goldenrod	<i>Solidago arguta</i>	S4		
Shiny Wedge Grass	<i>Sphenopholis nitida</i>	S1		
Clinton's Clubrush	<i>Trichophorum clintonii</i>	S2S3		
Perfoliate Bellwort	<i>Uvularia perfoliata</i>	S1		

¹OMNR 2010; ²COSEWIC 2009; ³OMNR 2009; ⁴OMNR 2000.

S1- Critically Imperiled, S2- Imperiled, S3- Vulnerable, S4- Apparently Secure
NAR- Not at Risk, THR- Threatened, SC- Special Concern, END – Endangered

Field work conducted as part of the study identified only one potential SAR plant species, butternut, in the study area. Butternut is listed as endangered by both COSEWIC and COSSARO due to butternut canker, an infection with high rates of mortality. This species is intolerant of shade and grows best on rich, moist, well-drained loams, such as stream banks. In Ontario, butternut is typically found scattered individually or in small groups in deciduous woodlands, or in hedgerows (COSEWIC).

Four individual butternut trees were identified during the field program and are found along the south side of Rymal Road between Garth Street and West 5th Street (Figure). Subsequent genetic testing carried out by the City in October 2013 determined that these individuals are butternut/Japanese walnut (*Juglans ailantifolia*) hybrids and are not protected under provincial or federal legislation.

3.3.4 Wildlife Resources

Wildlife resources were evaluated using background material and the incidental wildlife observations made during the SLE field visit on December 22, 2011. All wildlife species known to occur within the vicinity of the study area were cross-referenced with updated listings of species identified as nationally significant or provincially significant⁸.

Birds

Seven species were observed during the field visit on December 22, 2011. A total of 114 bird species are known from the Ontario Breeding Bird Atlas⁹ (OBBA) square that overlaps with the study area (17NH88). Most of these species lack suitable breeding habitat within the study area. Background information from the OBBA indicates that nine significant bird species are recently known from the vicinity (within approximately 10 km) of the study area. Based on aerial imagery, ecological land classification (ELC), and on-site observations, barn owl (*Tyto alba*), chimney swift (*Chaetura pelagica*), bobolink (*Dolichonyx oryzivorus*), eastern meadowlark (*Sturnella magna*), and barn swallow (*Hirundo rustica*) may have suitable habitat within the study area. However, because the road widening is generally limited to existing transportation corridors, it will not likely impact any of these species.

Herpetofauna (Reptiles and Amphibians)

Twenty-nine species of herpetofauna (reptiles and amphibians) are known to occur within the vicinity of the study area according to both the Ontario Herpetofaunal Atlas¹⁰ and the Ontario Reptile and Amphibian Atlas¹¹. Based on compiled data from the two atlases, eight significant species are known to occur in the study area. Aerial imagery, ELC, and on-site observations show that snapping turtle (*Chelydra serpentina*), Blanding's turtle (*Emydoidea blandingii*), eastern milksnake (*Lampropeltis triangulum*), and Jefferson/blue-spotted salamander polyploids (*Ambystoma jeffersonianum-laterale polyploids*) may have suitable habitat within the study area. Since some of these sightings are extremely dated (Blanding's Turtle, 1921), and Garner/Rymal and Garth Street improvement activities will generally remain within the existing disturbed corridor footprint, the habitat should not be impacted.

Mammals

Thirty mammal species are known from the vicinity of the study area based on information from the Atlas of the Mammals of Ontario, all of which are common species

⁸ OMNR, 2009.

⁹ Cadman et al., 2007.

¹⁰ Oldham and Weller, 2000.

¹¹ Ontario Nature, 2011.

in Ontario. In addition, a review of the NHIC Biodiversity Explorer database identified records of woodland vole (*Microtus pinetorum*) from the vicinity of the study area. This species of provincial and federal special concern prefers habitat of mature Carolinian deciduous forests, grasslands, meadows, and orchards, with groundcover of duff or grass. Such meadow and orchard habitats are limited, but present, in the west portion of the study area. Given that the most recent local record of this species occurred in 1951, it is very unlikely that woodland vole inhabits the study area. Furthermore, Garner/Rymal and Garth improvement activities will generally remain within existing disturbed corridor footprint, so potential woodland vole habitats should not be impacted.

Significance and Sensitivity of Natural Features

The majority of the study area consists of developed urban lands within the City of Hamilton, with some agricultural, recreational (i.e., golf courses) and natural areas in the southern portion. A number of significant species are known from the vicinity of the study area, including 16 species of birds, 5 species of herpetofauna, 1 mammal species and 33 plant species. Suitable habitat for a limited number of these significant species is present within the study area. In particular, seven bird species (peregrine falcon, barn owl, bobolink, chimney swift, common nighthawk, and red-headed woodpecker) and two herpetofauna species (eastern milksnake, Jefferson/blue-spotted salamander polyploids) all have the potential to inhabit the study area. None of these species are likely to be directly impacted by the proposed road improvements based on the degree to which the widening of Garner/Garth will be located within the urbanized area of the City, or will otherwise be situated within existing road allowances. However, additional investigations to assess the implications of the most recent general habitat protection provisions under the Ontario Endangered Species Act, 2007 may be warranted, depending on the extent of any encroachment into adjacent natural areas required by Detail Design proposals.

3.3.5 Hydrogeology

The local geologic data compares favourably with the regional geologic setting. The Garner Road section of the study area transitions in the west (i.e., Highway 6) from the eastern edge of the Dundas re-entrant valley onto the glaciolacustrine plain that exists on top of the Niagara Escarpment. The Dundas re-entrant valley contains a mixture of soils; but consists primarily of coarse grained sediments, which are interbedded as one transitions from the re-entrant valley. The bedrock contact in the Highway 6/Garner Road area has been eroded into the Dundas re-entrant valley and, as such, the groundwater table is depressed since it drains into this feature. A variable seasonal water table condition can be anticipated with dry/unsaturated conditions in the summer and wet/saturated conditions during wetter seasons. The geotechnical, reporting along with several water well records, attest to an interbedded sequence of sand and silt layers that are associated with the Dundas re-entrant valley.

Outside of this feature, which extends to Raymond/Glancaster Roads, a glaciolacustrine plain (i.e., the Haldimand Clay Plain) exists over the Niagara Peninsula south and west of the escarpment face. The sediments are primarily silts and clays; although seams of sands and gravels are reported in the geotechnical logs. These seams are not considered to be continuous and the majority of domestic wells in the area extend into

the underlying limestone bedrock where conduct bedding plane fractures provide potable waters of sufficient quantity for domestic supplies. The various borehole logs indicate that, in most cases, the soil colour in the boreholes along Rymal Road changed from an oxidized brown to a saturated grey about 4m below ground surface (bgs), suggesting that the water table is located at or above this depth.

3.4 Socio-Economic Environment

3.4.1 Land Use

Land use and transportation planning studies completed within the last ten years have provided the rationale for addressing transportation needs and improving traffic carrying capacity in the Garner Road/Rymal Road and Garth Street corridors to accommodate future traffic demand. Garner Road functions as an important intra- and inter-regional arterial road corridor and is a designated (legal) full-time truck route. Improvements to this segment will serve a significant role in supporting and stimulating economic development in the City of Hamilton (City).

The Garner Road/Rymal Road and Garth Street corridors have been reviewed within the context of land use policy initiatives, including;

- Ontario Municipal Board (OMB) Approved Urban Hamilton Official Plan (UHOP), August 2013;
- OMB Approved Rural Hamilton Official Plan (RHOP), March 2012;
- Growth Related Integrated Development Strategy (GRIDS) Integrated Infrastructure Master Plans, February 2003;
- Airport Employment Growth District (AEGD) plans;
- South Mountain Area Transportation Master Plan (SMATMP), May 2000;
- Ancaster Transportation Master Plan, June 2011;
- City of Hamilton Truck Route Master Plan, April 2010;
- Spencer Creek Stewardship Action Plan (and its constituent plans for Ancaster Creek and Tiffany Creek); and
- Hamilton's Strategic Road Safety Program.

Influence of Design Options

In the Municipal Class Environmental Assessment process, the design options are assessed for compatibility with the City's broad based growth management plan and Official Plan land use designations. The configuration of the roadway expansion (symmetrical/asymmetrical), intersection treatments and provisions for multi-modal operations within the designated road right-of-way width may result in differential property requirements, thereby affecting the viability of adjacent existing and proposed land uses, including a number of approved Draft Plans for large land parcels that already include dedicated blocks for the roadway expansion.

Influence of Proposed Improvements

The proposed roadway expansion is generally designed to suit its intra- and inter-regional arterial road function and may incorporate design features that dictate how intersecting roadways and property are accessed. Potentially, this can affect the viability of existing adjacent land uses and service operations; how land is assembled

for development; and social and recreational linkages in and across the corridor, including transit service, emergency services, school bus routes, and trail systems.

Designated Land Use

The OMB approved two official plans for the City of Hamilton, one for urbanized areas (UHOP) and the other for the rural areas (RHOP)¹², as shown in Figures 3.9 and 3.10.

¹² The RHOP was amended over the course of this study, the 2006 plan being replaced by the 2012 plan (approved by the Ontario Municipal Board on March 7, 2012). The major change to the RHOP for the purposes of this study is the introduction of policies that address the needs of the Airport Employment Growth District on the south side of the Garner Road corridor.

Figure 3.9: UHOP Cut-out

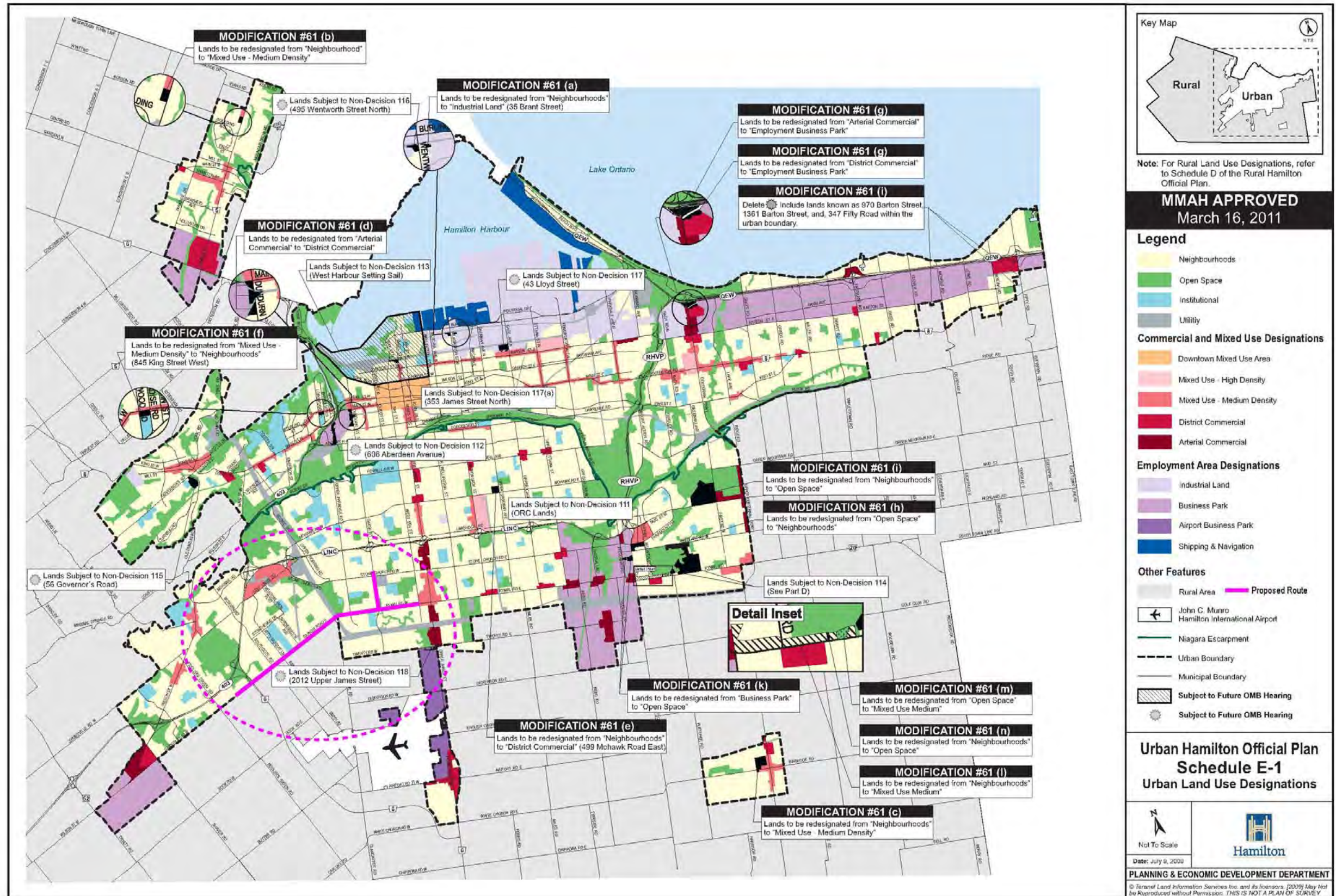
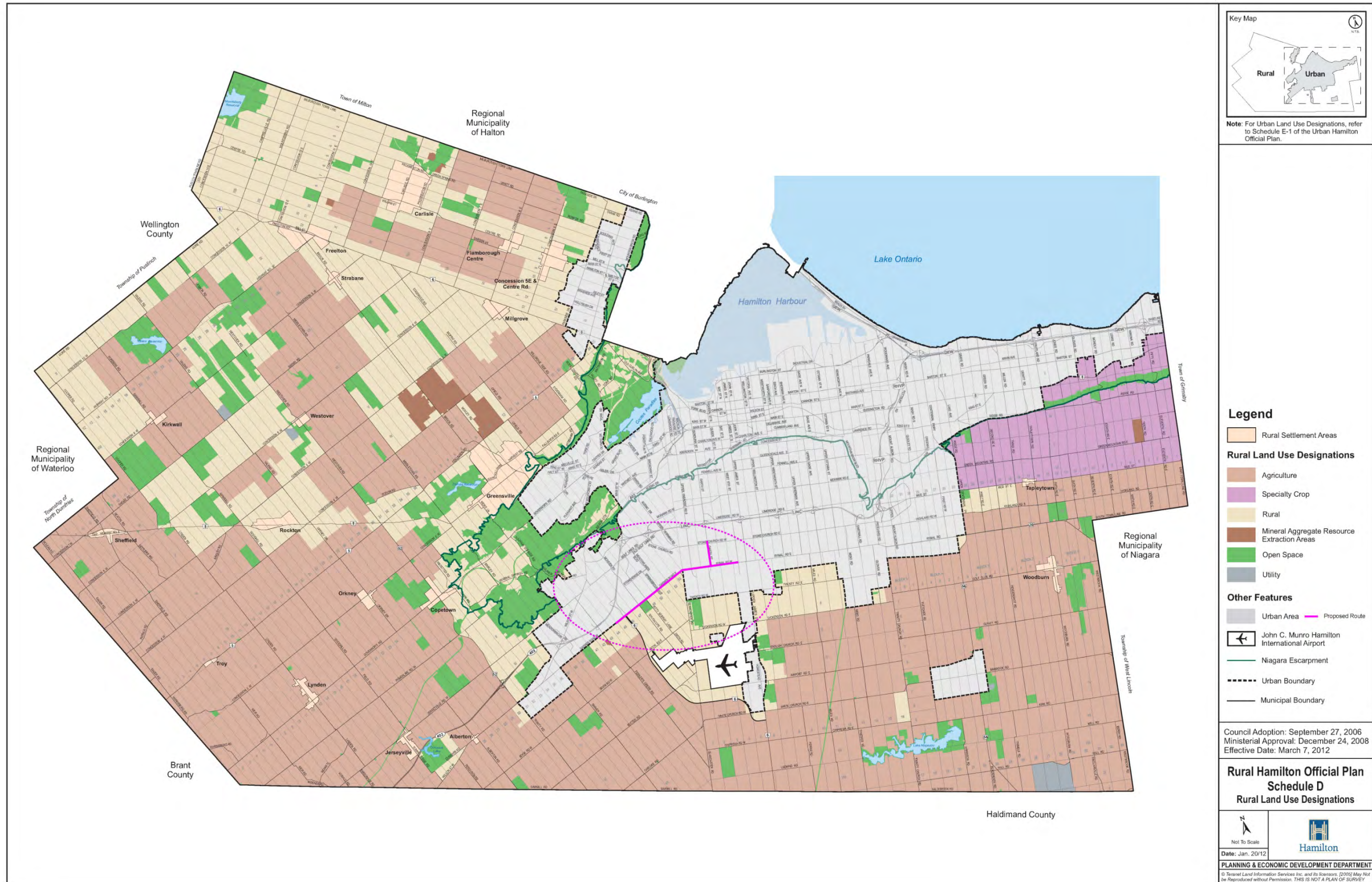


Figure 3.10: RHOP Cut-out



Garner Road East from Highway 6 to Glancaster Road

Designated land use for the Garner Road East corridor, from Miller Drive to Glancaster Road is split between the two official plans.

The south side of this portion of Garner Road East falls under the RHOP. Lands are within the “Airport Influence Area”. The RHOP supports the John C. Munro Airport as a 24 hour, 7 day a week operation. The Airport and the adjacent Airport Business Park “is one of the City’s major economic nodes and valued transportation facility which links the movement of goods and people”. The land use is completely designated as rural settlement, except between Southcote Road and Smith Road which is designated as open space. The Rural designation in this area includes complementary uses that support the primary function of the Airport. These lands are intended to have full municipal services. Within the Airport Influence Area, the City will restrict development that is noise or land use sensitive to airport operations, or will limit the opportunities for expansion of airport operations or land uses that may cause a potential aviation safety hazard.

The north side of this portion of Garner Road East falls under the UHOP, including Secondary Plans developed for the Garner, Meadowland III and IV Neighbourhoods. It is primarily designated as low density residential neighbourhoods interspersed with open spaces, and local commercial blocks fronting on Garner Road. A larger medium density residential block with supporting local commercial uses is proposed in the northeast quadrant of the Highway 6 Interchange area. A portion of the area between Kitty Murray Lane and Springbrook Avenue is designated as institutional to accommodate the Redeemer University College lands. Designated utility corridors cross the road corridor east of Springbrook Avenue and at Glancaster Road, within which power transmission lines are located. There are “gateway” features identified in the Meadowland IV Neighbourhood at the intersection of Garner Road and new collector roads. Gateways defined as visually prominent sites located at the entry points into the City, local communities, or specific areas or districts, and serve to enhance community image. Two on-street bikeways and a potential multi-use trail connecting with Garner Road are also identified in this Secondary Plan.

Rymal Road West from Glancaster Road to West 5th Street

Garner Road East / Rymal Road West, from Glancaster Road to West 5th Street is designated under the UHOP. Land use for this portion of the road is designated as neighbourhoods interspersed with designated open spaces and employment designated area for industrial land. The east corner of Rymal Road West and West 5th Street is designated as medium density commercial and mixed use.

Garth Street, from Rymal Road West to Stone Church Road West

Garth Street, from Rymal Road West to Stone Church Road West falls under the UHOP. The west side of Garth is comprised of residential neighbourhoods and the east side of Garth Street is designated open space.

Existing Land Use



Existing land use in the study corridor along Garner Road East is a mix of rural residential, agricultural, open space, institutional (church, cemeteries, Redeemer University College, Hamilton District Christian High School) and highway commercial. Business operations include automotive supplies and repair; small residential improvements/building contractors;



health/well being services; a golf centre (driving range); a restaurant and a farm market. Due to their proximity to the travelled portion of the road, particularly sensitive uses include the Garner Corners Cemetery (northwest corner of Southcote Road) and the Bowman United Church and cemetery (south side, east of Springbrook Avenue).



Existing land uses in the study corridor along Rymal Road West corridor are primarily urban, dominated by low density residential uses fronting onto Rymal Road, except on the north side from west of Upper Paradise



Road to west of Garth Street, where reverse frontage is prevalent. Other uses include the aforementioned power distribution corridor at Glancaster Road, open space/vacant parcels, institutional (Paradise Corner Children's Centre), and neighbourhood commercial plazas. A major use of interest to the study is the St. Elizabeth Village (SEV) retirement residences in the southeast quadrant of the Rymal Street/Garth Street intersection. The landowner and operator of the SEV complex (St. Elizabeth Home Society) has advised the Project Team of their expansion plans for SEV activities in the northeast quadrant of the Garth Street intersection, and has requested consideration of access provisions across the Rymal Road corridor to facilitate access for residents and visitors, as well as provision of traffic signal controls at its eastern access (Rymal Road/Bishop Ryan Way) (refer to April 26, 2011 correspondence in Appendix B).



Business operations in the corridor are generally multiple tenant single storey plazas at two locations with single accesses onto Rymal Road or a crossroad. These include the Westmount Community Health centre, attendant to the Westmount Terrace seniors' residence (south side east of Glancaster Road; Rymal Road access) and a variety of small retail outlets in the plaza in the northwest quadrant of Upper Paradise Road (Upper Paradise Road access).



The Garth Street corridor is dominated by reverse frontage single and medium density residential uses on the west side, including linked town homes and condominium units. The Rymal Road intersection lands are vacant in the west quadrants.



The east side of the corridor features open space (remnant woodlot) in the northeast quadrant of the Rymal Road intersection and the West Highland Baptist Church to the north. North of the Claudette Gate-Sabrina Boulevard intersection, there are reverse frontage residential townhouse units (condominiums) with generous setbacks, and a city-owned underground reservoir that also serves as an open space/recreational area.

3.4.2 Noise

SNC-Lavalin Inc. conducted a noise survey for the Garner Road – Rymal Road Municipal Class Environmental Assessment for the City of Hamilton.

To conduct the noise survey, the following activities were performed:

- Ambient sound level measurements were taken at critical Outdoor Living Areas (OLAs) at residences along the Garner Road, Rymal Road, and Garth Street areas (study area).
- Daytime and night time ambient sound levels were collected over several consecutive days. The values were found to be in the range of $Leq(16h)$ 60 to 68 dBA during the day and $Leq(8h)$ 50 to 62 dBA during the night. The following sections and figures detail the Noise Survey findings.

Four locations (Figure 3.11) were selected at OLAs in order to characterize the noise emissions for NSAs near three main areas of interest (i.e., center, east end, west end, and north end of the study area), as follows:

- Location 1: northeast corner of Garner Rd. E. and Garth St.;
- Location 2: northeast corner of Garth St. and Stone Church Rd. W.;
- Location 3: 95 Rymal Rd. W. (just southwest of Rymal Rd. and West 5th St.); and,
- Location 4: 581 Garner Rd. E. (just northwest of Garner Rd. and Southcote Rd. intersection).

Figure 3.11: Noise Monitor Locations within the Study Area



From this noise survey, the measured existing background levels were found to be in the range of 60 to 68 dBA during the daytime period and 50 to 62 dBA during the night time period.

Noise Sensitivities

The roadway corridor is flanked by residential and institutional uses, translating into potential for noise sensitivities to adjacent land users. Increased roadway capacity may result in positive or negative changes in sound depending on traffic levels and the proximity of adjacent uses (e.g., an asymmetrical road expansion may result in different effects than a symmetrical road expansion).

3.5 Cultural Environment

3.5.1 Built Heritage and Cultural Landscapes

Archaeological Services Inc. (ASI) was retained by the City of Hamilton to conduct a built heritage and cultural landscape inventory, identify general impacts to the identified cultural heritage resources, and propose appropriate mitigation measures associated with this project. This section of the ESR presents the inventory of above-ground cultural heritage resources. Additional details are presented in the built cultural heritage assessment report in Appendix D.6 Built Heritage and Cultural Heritage Landscapes.

In order to make a preliminary identification of existing built heritage resources and cultural heritage landscapes within the study area, a number of municipal resources were consulted. ASI consulted the City of Hamilton Register of Property of Cultural and Historical Interest and the City of Hamilton Heritage Inventories, which include properties that are both designated under the *Ontario Heritage Act* and those that are not, but are deemed by the City to have cultural heritage value.

A review of the inventories of designated properties revealed that there are no properties that are designated under Part IV or Part V of the *Ontario Heritage Act* in the vicinity of or within the study area. A review of the City of Hamilton Heritage Register revealed that there are also no non-designated properties of heritage interest in the vicinity of the study area within the City limits.

A field review was undertaken by ASI in September 2010 to document the existing conditions of the study area. The streetscape of Garth Street is wholly modern and is characterized by late twentieth century/early twenty-first century residences and subdivisions. The present-day appearance of the Garner Road/Rymal Road area ranges from late nineteenth and early twentieth-century residences and farmsteads to recent residential subdivisions and commercial enterprises (including malls). The western section, closest to the Highway 6 interchange, is much more rural and includes some working farms and barns with smaller early to mid-twentieth century small scale residences in between. Towards the east, particularly east of the intersection of Glancaster Road where Rymal Road and Garner Road meet, the area becomes more densely settled with a number of modern subdivisions (some currently under construction) and malls in the section nearest West 5th Street.



A total of nine (9) cultural heritage landscapes and sixteen (16) built heritage resources were identified within the study area. Table 2 in the Built Heritage and Cultural Heritage Landscapes Report provides a list of identified cultural heritage



resources, which includes a photograph and brief description of the resource. The identified cultural heritage resources consist of seven farm complexes (CHL 1, CHL 2, CHL 4, CHL6-7 and CHL 9); two cemeteries (CHL 3), one with an attached church (CHL 5); one commercial/industrial complex (CHL 8); fifteen residences (BHR 1-14 and BHR 16) and one public building (CHL 15). Four properties (CHL 3, CHL 5, BHR 14 and BHR 15) were previously identified by the municipality as being of cultural heritage interest).

In summary, the results of historical research confirmed that the study area features historically-surveyed thoroughfares, residences and farm complexes that date back to the nineteenth century. The field review confirmed that the study area retains elements associated with early residential development, dating predominantly to the late nineteenth century and early twentieth century. In the western section, farm complexes give a strong sense of the rural landscapes that predominated in this area in the late nineteenth and early twentieth century. The early twentieth-century character of this area may be seen in two sets of early to mid twentieth-century houses (one each on Garner Road and Rymal Road) that lend clues to the earlier streetscape.

3.5.2 Archaeological Resources

A Stage 1 Archaeological Assessment was undertaken by ASI to provide information about the geography, history, previous archaeological fieldwork and current land condition of the proposed Garner Road/Rymal Road and Garth Street improvements study area and to evaluate in detail the archaeological potential of the study area that

can be used, if necessary, to support recommendations for a Stage 2 Archaeological Assessment for all or parts of the study area. A property inspection of the study corridor was conducted by ASI on July 28 2010, in order to gain first-hand knowledge of its geography, topography, and current conditions, and to evaluate and map its archaeological potential. The property inspection was a visual inspection only and does not include excavation or collection of archaeological resources.

A Stage 1 Archaeological Assessment involves a background study to provide detailed documentary research on the archaeological and land use history and present conditions of the study area. Specifically, the background study provides information about previous archaeological fieldwork within and around the study area, its geography and history, and current land conditions. In order for an inventory of archaeological resources to be compiled for the study area, three sources of information were consulted: the site record forms for registered sites housed at the Ministry of Tourism, Culture and Sport (MTCS); published and unpublished documentary sources; and the files of ASI.

In Ontario, information concerning archaeological sites is stored in the Ontario Archaeological Sites Database (OASD) maintained by MTCS. According to the OASD, 72 archaeological sites have been registered within 500 m of the study corridor, two of which are located immediately adjacent to the study corridor. A review of the geography and local nineteenth century land use of the study corridor suggested that it has potential for the identification of Aboriginal and Euro-Canadian archaeological sites.

Based on the results of the property inspection, it was determined that the Garner Road, Rymal Road, and Garth Street rights-of-way (R.O.W.) have been subject to extensive and deep land alterations. However, minimal disturbances have occurred beyond the disturbed R.O.W. and there is some potential for discovery of archaeological resources in these areas.

3.6 Problem and Opportunity Statement

Land use and transportation planning studies completed within the last ten years have provided the rationale for widening Garner Road/Rymal Road and Garth Street to accommodate future traffic demand. Most recently, the AEGD Transportation Master Plan indicated that Garner Road and Garth Street will require 4 through lanes, and additional turning lanes at intersections. In particular, these studies drew attention to future potential traffic carrying capacity problems associated with:

- Additional trip-making resulting from the intensification of existing land uses immediately adjacent to the Garner Road/Rymal Road corridor;
- Additional trip-making resulting from new development on vacant lands surrounding the John C. Munro Hamilton International Airport (i.e., AEGD lands);
- Increased travel demand in the corridor as a result of other major transportation corridors (e.g., the Linc) reaching their carrying capacity; and
- Retention of the Garner/Rymal corridor as a designated/preferred full-time truck route, and future designation of the section of Garth Street under consideration as a part-time truck route in the long term.

Daily traffic volumes in the Garner/Rymal and Garth corridors are expected to increase from approximately 10,000 vehicles in 2008 to approximately 25,000 vehicles by 2031, subject to full build-out of the AEGD area and proposed developments to the north of Garner Road East/Rymal Road West. If the roadway is not widened to provide additional capacity, the Garner/Rymal Road and Garth Street corridors will operate over their respective capacities. The overall traffic volumes at major intersections on Garner Road will approach or exceed double the available capacity, resulting in much higher waiting times, and the respective level of service (LOS¹³) will drop well below the acceptable level. The traffic volumes at the Garth Street/Stone Church Road intersection will be well in excess of the available capacity, resulting in high delay and an unacceptable LOS.

Adopting a road widening strategy represents an opportunity to develop and implement other City of Hamilton transportation and servicing strategies for the Garner/Rymal and Garth corridors in a coordinated manner. These include:

- Enhanced transit service (Rapid Transit S Line) in the Garner/Rymal corridor.
- Enhanced opportunities for active transportation (dedicated pedestrian and cyclist facilities).
- Construction of improved municipal services (water, sewer) in conjunction with construction of the roadway.
- Policies as to the number of access provisions for new development in the Garner-Rymal corridor to complement the policy for reduced/limited access.

¹³ LOS represents the overall “Level of Service” of any intersection during the weekday peak hours. The “Levels of Service” are generally governed by the Avg. Delay at the intersection. The transportation level of service (LOS) system uses the letters ‘A’ through ‘F’, with ‘A’ being best and ‘F’ being worst.

4.0 ALTERNATIVE DESIGNS

As stated in Section 1.2.1 of this ESR, the principal purpose of this study is to develop and assess design alternatives that address the identified transportation issues along the Garner Road East/Rymal Road West and Garth Street corridors. This chapter of the report documents the development and assessment of conceptual design alternatives, leading to selection of the preferred option.

4.1 Design Criteria

Design alternatives were developed for the reconstruction/widening of Garner Road East/Rymal Road West from Highway 6 to West 5th Street and Garth Street from Rymal Road to Stone Church Road. These alternatives were developed using the design criteria presented in Table 4.1.

Table 4.1: Engineering Design Criteria for Development of Design Alternatives

Design Parameters	Present Conditions	Design Standards		Proposed Standards
		TAC	MTO	
ROW Width	Varies (20 m – 36 m)	20 m – 45 m	N/A	36 m ⁽¹⁾
Posted Speed	60 km/h	60 km/h	60 km/h	60 km/h
Design Speed	70 km/h	70 km/h	70 km/h	70 km/h
Minimum Stopping Sight Distance	110 m	95 m - 110 m	110 m	110 m
Equivalent Minimum 'K' Factor	30 Sag 35 Crest	20 – 25 Sag 16 – 23 Crest	25 Sag 25 Crest	30 Sag 35 Crest
Grade Range	0.3% - 4.0%	0.5% - 6.0%	0.5% - 6.0%	0.3% - 4.0% ⁽²⁾
Minimum Radius	900 m	190 m	190 m	900 m
Number of Lanes	2 (Rural)	4	4	4 (Urban)
Lane Width	2 x 3.6 m	3.5 m – 3.7 m	3.5 m	2 x 3.75 m Curb Lane 2 x 3.75 m Through Lane 3.0 m Left-Turn Lanes 3.5m Right-Turn Lanes
Boulevard Width	N/A	3.0 m	3.0 m	3.5 m – 6.5 m ⁽³⁾
Superelevation	0.03	0.06	0.06	0.06 ⁽⁴⁾

- Notes: (1) Right-of-way width will vary based on grading.
(2) Upgrading to the design standard will have extensive impact on the property requirements and will also affect the existing and approved developments abutting the road corridors.
(3) Boulevard width includes the 0.5 m curb and gutter.
(4) Superelevation rates are according to Table 2.1.2.9 of the TAC Manual.

4.2 Development of Alignment Alternatives

The following three design alternatives for expansion of the road corridor were developed:

- Alternative 1** Widening to a 5-lane urban cross-section, consisting of 5.0 m continuous median, 1.5 m bike lanes and a 3.5 m continuous boulevard;
- Alternative 2** Widening to a 4-lane urban cross-section (no continuous median), 1.5 m bike lanes and a 6.0 m continuous boulevard; and
- Alternative 2A** Widening to a 4-lane urban cross-section, 1.5 m bike lanes and a 3.5 m continuous boulevard.

Alternative 2A is essentially the same as Alternative 2 with a reduced continuous boulevard.

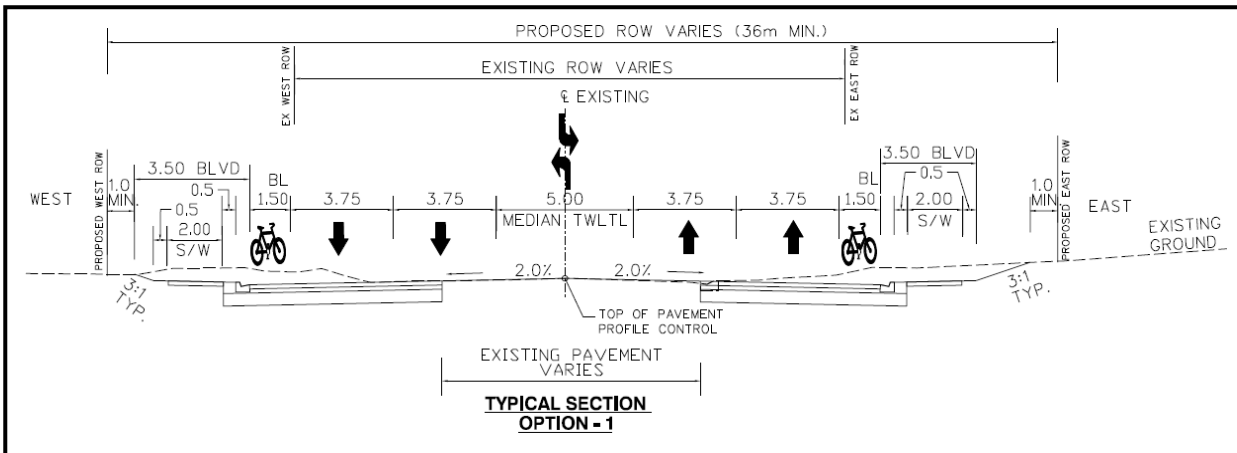
4.3 Development of Cross-Section Alternatives

The urban cross-sections developed for incorporation in the corridor expansion options described in Section 4.1 are as follows:

Alternative 1 (refer to Figure 4.1)

- Four 3.75 m through lanes;
- Two 1.5 m bike lanes;
- 5.0 m continuous median that accommodates left-turn lanes and raised medians at most intersections;
- Exclusive right-turn lanes as per the recommendations from the Traffic Study Report
- Curb and gutter; and
- 3.5 m continuous boulevard width.

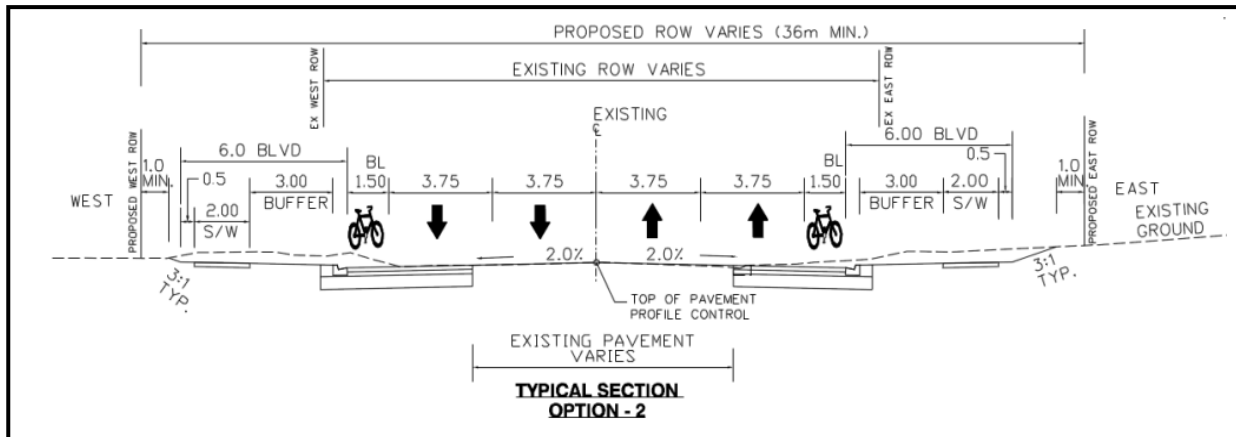
Figure 4.1: Alternative 1



Alternative 2 (refer to Figure 4.2)

- Four 3.75 m through lanes;
- Two 1.5 m bike lanes;
- Exclusive right-turn lanes and left-turn lanes, as per recommendations from Traffic Study Report; and
- Curb and gutter.

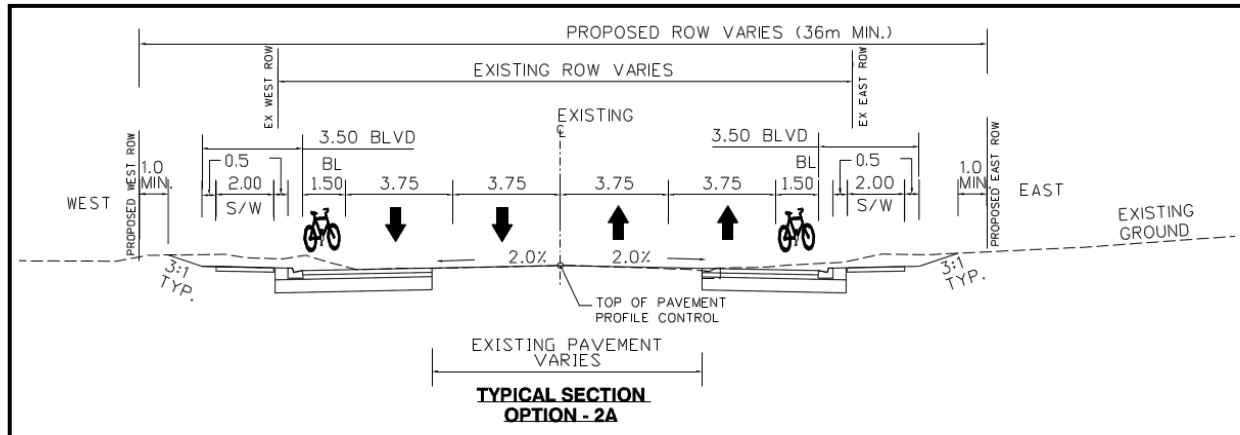
Figure 4.2: Alternative 2



Alternative 2A (refer to Figure 4.3)

- Four 3.75 m through lanes;
- Two 1.5 m bike lanes;
- Exclusive right-turn lanes and left-turn lanes, as per the recommendations from Traffic Study Report;
- Curb and gutter; and
- 3.5 m continuous boulevard width.

Figure 4.3: Alternative 2A



Horizontal and Vertical Alignment for the Alternatives

The existing horizontal and vertical alignments have been maintained for all alternatives, with the widening being symmetrical about the centerline, except at one location, where an alignment shift to the north has been implemented to mitigate property constraints at the Bowman United Church/Cemetery location. The shifts required are as follows:

- Alternative 1 has an alignment shift to the north at the Bowman United Church/Cemetery by a maximum of 8.0 m between Stations 2+076 to 2+784.
- Alternative 2 and 2A have an alignment shift to the north at the Bowman United Church/Cemetery of a maximum of 5.5 m between stations 2+130 to 2+730.

For Alternative 2, the 6.0 m continuous boulevard width cannot be provided at the following locations:

- Between Stations 1+100 to 1+200, the boulevard width is reduced to 3.5 m on the north side with an offset of 0.5 m to sidewalk, to eliminate the property impact to the cemetery at the northeast corner of Garner Road East and Southcote Road intersection; and
- Between Stations 2+330 to 2+570, the boulevard width is reduced to 3.5 m on the south side with an offset of 0.5 m to sidewalk, to eliminate the property impact to the Bowman’s Cemetery;

The proposed standard 36.0 m right-of-way will be required within most of the project limits, with additional property being required at locations where there is an alignment shift or where the grading limit exceeds the 36.0 m.

Drainage

The Garner Road East/Rymal Road West corridor and the Garth Street corridor currently have rural cross-sections, with drainage primarily by ditching with short sections of urban storm sewers. All alternatives above include converting the existing rural cross-section on Garner Road East and Rymal Road West from Highway 6 to

West 5th Street and on Garth Street from Rymal Road West to Stone Church Road to an urban cross-section. This will eliminate the majority of the existing ditching, and drainage via storm sewer systems will be required. Some ditching may still be retained/reinstated as required. In areas where there are existing sewers (between Westlawn Drive and West 5th Street), with adequate capacity, the existing drainage infrastructure may be retained and/or relocated/modified as needed. This will have to be confirmed during the Detail Design phase.

4.4 Evaluation Criteria

Based on identified study area sensitivities, and the approved scope of the EA investigations for this project (refer to Table 2.1), in addition to the Design Criteria presented in Table 4.1, the following considerations were accounted for in developing the evaluation criteria against which the design alternatives were assessed.

Natural Environment

Considerations

- The west half of the project corridor lies within the headwater areas of the Ancaster Creek and Tiffany Creek subwatersheds and expansion of the corridor may result in additional stresses on these sensitive ecosystems.
- Tiffany Creek crosses the Garner Road corridor several times and is a receiver for stormwater runoff from the roadway.
- The Tiffany Creek subwatershed immediately north of the Garner Road corridor includes the designated Tiffany Creek Environmentally Significant Area (ANCA-13), which may be affected by the corridor expansion proposals. The ESA includes a Provincially Significant Wetland, supports vascular plants and wildlife species that are locally uncommon or rare, and provides habitat for a COSEWIC special concern species. A number of common herpetofauna, breeding birds and mammals also use the natural features in the Tiffany Creek ESA.
- The project corridor lies within the headwaters of Upper Ottawa Creek, Upper Twenty Mile Creek, Ancaster Creek and Tiffany Creek. The headwaters of these watercourses have been affected by adjacent development, including serving as receivers for stormwater management facilities. These watercourses are classified as warmwater intermittent, likely supporting common warmwater fish communities, with the exception of Upper Twenty Mile Creek, which is classified as cold water.
- There are numerous roadside vegetation assemblages (natural and ornamental) in the project corridor, including significant individual tree specimens that are associated with residential, agricultural and other properties outside the Ancaster Creek and Tiffany Creek corridors, which may be directly or indirectly affected by the proposed roadway expansion.

Evaluation Criteria

- Potential impacts to Upper Ottawa Creek, Upper Twenty Mile Creek, Ancaster Creek and Tiffany Creek subwatersheds and Tiffany Creek Environmentally Significant Area (ANCA-13).

- Potential impacts to roadside vegetation, including significant individual tree specimens and Species at Risk.

Historical and Cultural Environment

Considerations

- The proximity of the Garner-Garth study area to watercourses, and the roadway's significance as an historical transportation corridor, create the potential for discovery of archaeological resources and impacts to built heritage features and cultural landscapes if the roadway infrastructure is physically expanded onto previously undisturbed areas or improved properties.

Evaluation Criteria

- Potential for discovery of archaeological resources and impacts to built heritage features and cultural landscapes if the roadway infrastructure is physically expanded onto previously undisturbed areas or improved properties.

Socio-Economic Environment

Considerations

- Garner Road functions as an important intra- and inter-regional arterial road corridor and is a designated (legal) full-time truck route. Improvements to this segment will serve a significant role in supporting and stimulating economic development in the City of Hamilton. This component should be reviewed in the context of the City's major area-specific policy initiatives, such as the Airport Employment Growth District (AEGD), the South Mountain Area Transportation Master Plan, the Ancaster Transportation Master Plan, the Truck Route Master Plan, and the Spencer Creek Stewardship Action Plan (and its constituent plans for Ancaster Creek and Tiffany Creek), as well as the City's Strategic Road Safety Program.
- Design alternatives should be assessed for compatibility with the City's broad based growth management plan (GRIDS) and Official Plan land use designations.
- The configuration of the roadway expansion (symmetrical/asymmetrical), intersection treatments and provisions for multi-modal operations within the designated road right-of-way width may result in differential property requirements, thereby affecting the viability of adjacent existing and proposed land uses, including a number of approved Draft Plans for large land parcels that already include dedicated blocks for the roadway expansion.
- The roadway expansion to suit its intra- and inter-regional arterial road function may incorporate design features that will dictate how intersecting roadways and property are accessed. This may affect the viability of existing adjacent land uses and service operations; how land is assembled for development; and social and recreational linkages in and across the corridor,

- including transit service, emergency services, school bus routes, and trail systems
- The roadway corridor is flanked by a number of noise sensitive receivers (residential and institutional uses). Increased roadway capacity may result in positive or negative changes in sound levels for such receivers, based on how traffic levels of service are affected and the proximity of the travelled portion of the road to such receivers (e.g., an asymmetrical expansion may result in different effects than a symmetrical expansion).

Evaluation Criteria

- Garner Road/Rymal Road's economic function as an important intra- and inter-regional arterial road connector.
- Compatibility with the City's broad-based growth management plan (GRIDS) and Official Plan land use designations.
- Property requirements, and effects on the viability of adjacent existing and proposed land uses.
- Access requirements for large approved/planned developments.
- Need to accommodate social and recreational linkages in and across the corridor, including transit service, emergency services, school bus routes, and pedestrian and cycling networks.
- Potential impacts to noise sensitive areas/receptors.

Technical

Considerations

- With respect to successfully accommodating the efficient movement of a variety of vehicles within the Garner/Rymal corridor, the configuration of the roadway expansion (symmetrical/asymmetrical), intersection treatments and provisions for multi-modal operations within the Official Plan designated road right-of-way width (36 m) may also affect, or be affected, by different design standards or the need for special transit or truck operations provisions. For example, Garner/Rymal corridor is designated for enhanced transit services requiring additional or different operating provisions (stops, movement priority, etc.) than those that currently exist. In addition, the corridor is a legal/designated truck route and is favoured for moving over-dimensional loads through Hamilton.
- Both the AEGD and Truck Route MP envisage the section of Garth Street under consideration as being part of a designated part-time truck route in the long term (after urbanization of the cross-section). The AEGD recommendations for the extension and increased use of Garth Street could influence decisions on the cross-section on Garth through the EA study area.
- The AEGD study indicated increased traffic volumes along the Garner Road/Rymal Road and Garth Street corridors under the full build-out scenario of the AEGD. The increased traffic volumes and multi-modal use will have an influence on the proposed cross-section of both the road corridors within the study limits, and might influence the types of traffic control measures used.

- The west end of the project corridor is situated within the influence area of the Highway 6/Garner Road East interchange. MTO requirements governing operation of the interchange ramp terminals must be considered. Potential changes to the means of intersection control at the Highway 6 exit terminal on Garner Road might be required due to increased traffic volumes.
- Development and selection of the roadway design must also incorporate safety considerations, which include goals and objectives that are separate from and, in some situations, conflict with those of improved traffic operations. For example, is a curbed road edge (urban cross-section) safer than a ditched roadside (rural cross-section); will a wider road within a restricted right-of-way width put drivers closer to utility poles at the road edge, if such utilities cannot be relocated?
- The South Mountain Area Transportation Master Plan recommends that all identified road improvements include consideration of providing enhanced pedestrian facilities as part of the road design. This is consistent with other City of Hamilton policies addressing the need to enhance and incorporate opportunities for active transportation in planning transportation infrastructure. The City's Cycling Master Plan designates the segments of Garner-Rymal Road and Garth Street under study as proposed bike lanes. Therefore, decisions on the Garner-Rymal and Garth cross-sections must include pedestrian and cycling provisions in compliance with both City and provincial policy (e.g., bike lane specifications; sidewalks on both sides; Access for Ontarians with Disabilities Act requirements for acceptable sidewalk dimensions).
- To promote multi-modal transportation, as recommended in the AEGD Study Report, development and implementation of multi-use trails might become evident. Multi-use trails are generally safer under urban conditions and might influence decisions on the proposed road cross-section.
- Due to the sensitivity of a portion of the project corridor to the stresses associated with the construction and operation of transportation facilities, the strategic implementation of a drainage and stormwater management plan for the expanded roadway will be of interest to the Hamilton Conservation Authority. Opportunities for integrating all or parts of the roadway drainage plan with the stormwater management plans for adjacent residential subdivisions will be identified and assessed.
- The design alternatives may have impacts on, or be influenced by, existing or planned major municipal services (water, sewer) and private utilities that must also be located within the road right-of-way.
- Constructability is related principally to how construction of the roadway expansion can or will be staged. The roadway expansion design alternatives for the two major projects segments (Highway 6 – Glancaster; Glancaster – West 5th) will be assessed in relation to the time frame within which they will be needed. They will also be assessed with respect to how they can be constructed while ensuring that traffic flows can be maintained in a manageable fashion.

Evaluation Criteria

- Special design standards for truck traffic and future rapid transit operations (over-dimensional truck loads; transit stops, transit vehicle movement priority).
- Need to enhance existing intersections and incorporate new intersections for major planned development.
- MTO requirements governing operation of the Highway 6 interchange ramp terminals at Garner Road.
- Balance of cross-section requirements with respect to safety, drainage and relocation of existing utilities.
- Need to enhance and incorporate opportunities for active transportation (sidewalks, bike lanes, multi-use trails).
- Strategic implementation of a drainage and stormwater management plan in cooperation with approved planned developments that also addresses Hamilton Conservation Authority and Niagara Peninsula Conservation Authority surface water management objectives.
- Existing or planned major municipal services (water, sewer) and private utilities that must also be located within the road right-of-way.
- How construction of the roadway expansion will be staged in relation to need (year of construction).
- How construction will be staged to ensure that traffic flows can be maintained in a manageable fashion.

Financial Implications

Considerations

- The estimated construction and operations and maintenance costs of the design alternatives will be compared, quantitatively and qualitatively, to each other and to the availability of financial resources within the City of Hamilton's Capital and Operating Budgets (i.e., affordability). The relationship of the design schemes' benefits against their operational benefits (value for money) will also be assessed.
- Financial considerations will also include staging of implementation to facilitate other future infrastructure works and minimize throw-away costs (i.e., minimizing conflicts with future rapid transit initiatives and installation of trunk municipal services).
- Design alternatives may have differential land requirements (number of owners affected; zoning of land required) that will affect the overall cost of the project with respect to the financial resources or time required for property acquisition.

Evaluation Criteria

- Estimated construction and operations/maintenance costs in relation to the City of Hamilton's Capital and Operating Budgets (affordability). Refer to Appendix E for a detailed cost estimate for each alternative.

- Relationship of the design schemes' benefits against their capital and operating costs (value for money).
- Project staging to facilitate other future infrastructure works and minimize throw-away costs.

A summary listing of the Evaluation Criteria is presented in Table 4.2.

Table 4.2: Evaluation Criteria for Assessing Design Alternatives

Evaluation Factor Group	Evaluation Criteria
Natural Environment	<ul style="list-style-type: none"> • Aquatic Habitat • Terrestrial Habitat/Roadside Vegetation • Designated Areas
Historical / Cultural Environment	<ul style="list-style-type: none"> • Archaeological Resources • Built Heritage Features • Cultural Landscapes
Socio-Economic Environment	<ul style="list-style-type: none"> • Conformity with Planning/Development Policies • Existing Adjacent Land Uses • Compatibility with Future Land Uses • Community Access and Linkages • Noise Impacts
Technical Considerations	<ul style="list-style-type: none"> • Traffic Operations • Transit Operations • Provincial Highway Operations • Safety • Pedestrian/Cyclist Facilities • Drainage/Stormwater Management • Other Municipal Infrastructure / Utilities • Constructability (site-specific design issues) • Staging of Implementation to Meet Growth Needs
Financial Implications	<ul style="list-style-type: none"> • Construction Costs • Operations and Maintenance Costs • Staging Implementation Costs • Land Requirements

These Evaluation Criteria include refinements made on the basis of input by stakeholders during the spring of 2010, including comments received at Public Information Centre No. 1.

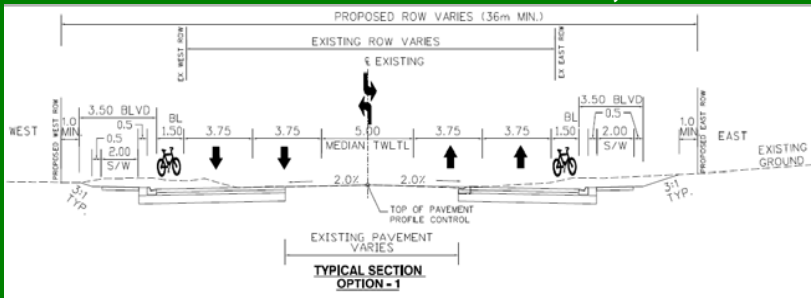
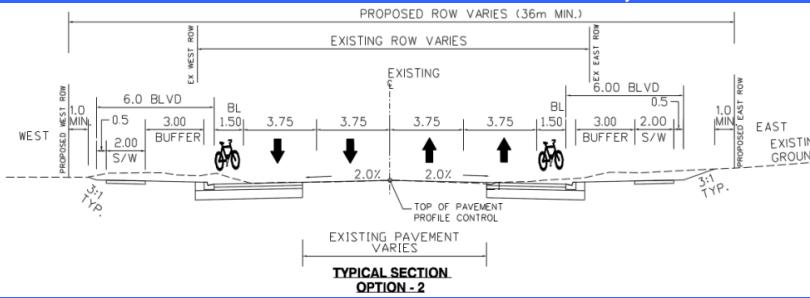
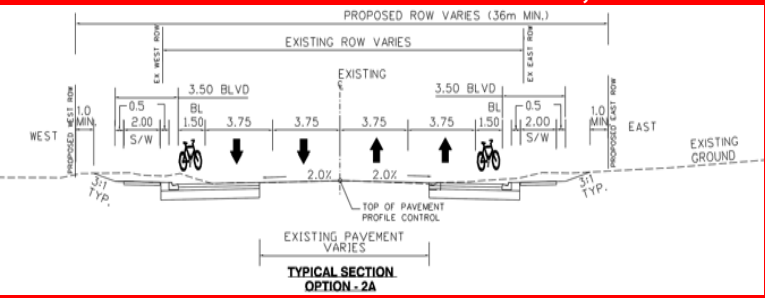
4.5 Assessment of Design Alternatives

A comparative assessment and evaluation of the conceptual design alternatives was conducted by the Project Team to arrive at the preferred option. The evaluation involved rating the design alternatives based on the comparative assessment, using the following scoring scheme:

- 1 – Major negative effect/no positive effect
- 2 – Some negative effect/very little positive effect
- 3 – Little negative effect or positive effect
- 4 – Very little negative effect/some positive effect
- 5 – No negative effect/major positive effect

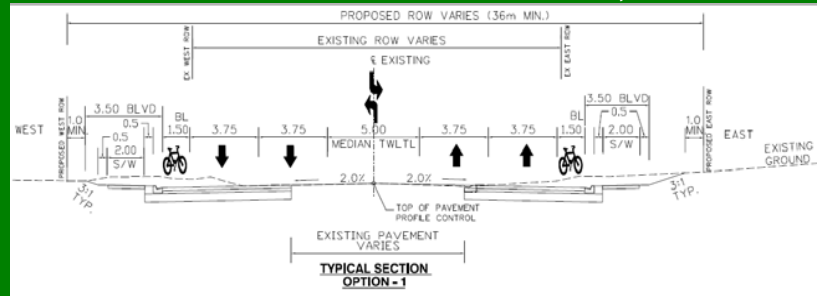
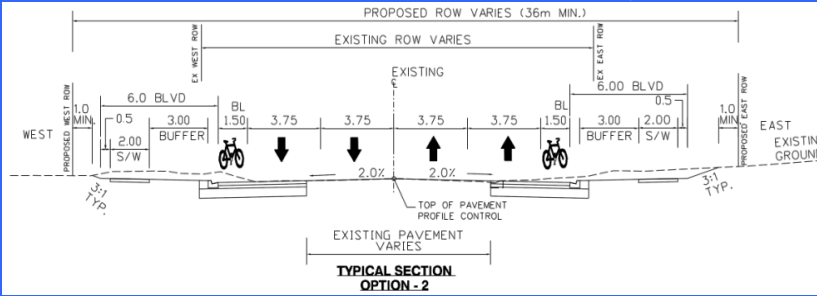
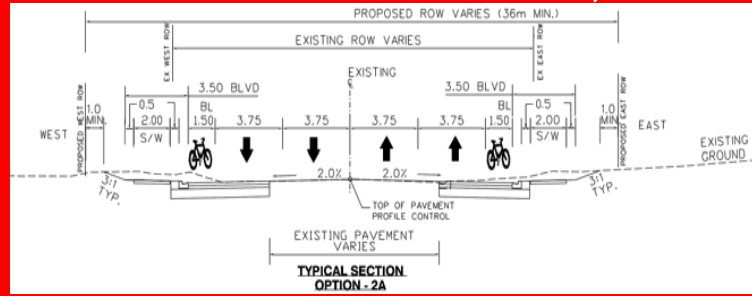
The results of the assessment and evaluation are presented in Tables 4.3 and 4.4.

Table 4.3: Comparative Assessment and Evaluation of Alignment Alternatives – Garner Road East/Rymal Road West

EVALUATION FACTOR	ALIGNMENT ALTERNATIVES – GARNER/RYMAL					
	<div style="background-color: #008000; color: white; padding: 2px;">Alternative 1 - 5.0m Continuous Median, 3.5m Blvd.</div> 	Score	<div style="background-color: #0000FF; color: white; padding: 2px;">Alternative 2 - No Continuous Median, 6m Blvd.</div> 	Score	<div style="background-color: #FF0000; color: white; padding: 2px;">Alternative 2A- No Continuous Median, 3.5m Blvd.</div> 	Score
Natural Environment						
Aquatic Habitat	<ul style="list-style-type: none"> • Direct impact to fish and fish habitat with this alternative. • Key watercourse crossings include 0+340 (Ancaster Creek), 1+175 (Ancaster Creek Tributary), 1+960 Tiffany Creek Tributary, 2+840 (Tiffany Creek Tributary), 3+040 (Tiffany Creek Tributary), 3+270 (Tiffany Creek Tributary), 3+700 (Tiffany Creek Tributary) and 5+080 (Upper Twenty Mile Creek Tributary). • There will be a loss of riparian vegetation at each crossing. • Culvert extensions will be required at all watercourse crossings, but no HADD is expected as result of the works with the application of mitigation. 	2	<ul style="list-style-type: none"> • Direct impact to fish and fish habitat with this alternative. • Key watercourse crossings include 0+340 (Ancaster Creek), 1+175 (Ancaster Creek Tributary), 1+960 Tiffany Creek Tributary), 2+840 (Tiffany Creek Tributary), 3+040 (Tiffany Creek Tributary), 3+270 (Tiffany Creek Tributary), 3+700 (Tiffany Creek Tributary and 5+080 (Upper Twenty Mile Creek Tributary). • There will be a loss of riparian vegetation at each crossing. • Culvert extensions will be required at all watercourse crossings, but no HADD is expected as result of the works with the application of mitigation. 	2	<ul style="list-style-type: none"> • Direct impact to fish and fish habitat with this alternative. • Key watercourse crossings include 0+340 (Ancaster Creek), 1+175 (Ancaster Creek Tributary), 1+960 Tiffany Creek Tributary), 2+840 (Tiffany Creek Tributary), 3+040 (Tiffany Creek Tributary), 3+270 (Tiffany Creek Tributary), 3+700 (Tiffany Creek Tributary) and 5+080 (Upper Twenty Mile Creek Tributary). • There will be a loss of riparian vegetation at each crossing. • Culvert extensions will be required at all watercourse crossings, but no HADD is expected as result of the works with the application of mitigation. • This alignment has slightly lower impacts to the watercourses, as there is a slightly narrower footprint. 	3
Terrestrial Habitat/Roadside Vegetation	<ul style="list-style-type: none"> • Moderate impacts to roadside trees and communities in ditches and boulevard. • Key areas include: Garner/Rymal Road – 0+775-1+200, 1+650-1+850, 2+700-3+100, 5+150-5+500. 	2	<ul style="list-style-type: none"> • Moderate impacts to roadside trees and communities in ditches and boulevard. • Key areas include: Garner/Rymal Road – 0+775-1+200, 1+650-1+850, 2+700-3+100, 5+150-5+500. 	2	<ul style="list-style-type: none"> • Lower impacts to roadside trees and communities in ditches and boulevard compared to other alternatives. • Key areas include: Garner/Rymal Road – 0+775-1+200, 1+650-1+850, 2+700-3+100, 5+150-5+500. 	3

EVALUATION FACTOR	ALIGNMENT ALTERNATIVES – GARNER/RYMAL			
	Alternative 1 - 5.0m Continuous Median, 3.5m Blvd.	Alternative 2 - No Continuous Median, 6m Blvd.	Alternative 2A- No Continuous Median, 3.5m Blvd.	
	Score	Score	Score	
Designated Areas	<ul style="list-style-type: none"> Minor impacts to roadside ditch wetland vegetation associated with Tiffany Creek (ESA) headwaters crossing of Garner/Rymal Road. This portion of the ESA has been previously impacted by original construction of the road and entrances for the hydro corridor. 	3	<ul style="list-style-type: none"> Minor impacts to roadside ditch wetland vegetation associated with Tiffany Creek (ESA) headwaters crossing of Garner/Rymal Road. This portion of the ESA has been previously impacted by original construction of the road and entrances for the hydro corridor. 	3
Total Score	7	7	9 Preferred Alternative	
Summary	<ul style="list-style-type: none"> Alternatives 1 and 2 scored the same for each evaluation criteria and had slightly more impacts than Alternative 2A. Alternative 2A is the preferred alternative with respect to Natural Environment, since impacts to watercourses are slightly lower due to the narrower footprint, and there are fewer impacts to roadside trees in ditches and boulevard areas compared to other alternatives. 			
Historical/Cultural Environment				
Archaeological Resources	<ul style="list-style-type: none"> Presence of known archaeological sites adjacent to the study area. Presence of other features indicating archaeological potential. Potential of the proposed road widening to impact identified areas containing archaeological potential. 	2	<ul style="list-style-type: none"> Presence of known archaeological sites adjacent to the study area. Presence of other features indicating archaeological potential. Potential of the proposed road widening to impact identified areas containing archaeological potential. 	2
Built Heritage Features and Cultural Landscapes	<ul style="list-style-type: none"> Alternative 1 presents the most number of direct/ adverse impacts to both built heritage features and to cultural heritage landscapes. It is the least desirable alternative. Removal: Five (5) cultural heritage resources were shown to be impacted 	2	<ul style="list-style-type: none"> Although the work undertaken Alternative 2 also requires removals, it presents slightly fewer adverse impacts to the built heritage resources and to the cultural heritage landscapes than Alternative 1. It is the second choice of the three alternatives. Removal: Five (5) cultural heritage 	2
			<ul style="list-style-type: none"> Alternative 2A is the preferred alternative in terms of presenting fewer direct/ adverse impacts than Alternative 1. This alternative not only presents with reduced impacts (in the two categories of encroachment) it also potentially requires one less 	2

ALIGNMENT ALTERNATIVES – GARNER/RYMAL

EVALUATION FACTOR	ALIGNMENT ALTERNATIVES – GARNER/RYMAL		
	Alternative 1 - 5.0m Continuous Median, 3.5m Blvd.	Alternative 2 - No Continuous Median, 6m Blvd.	Alternative 2A- No Continuous Median, 3.5m Blvd.
			
	Score	Score	Score
Built Heritage Features and Cultural Landscapes (cont'd)	<p>through removal.</p> <ul style="list-style-type: none"> • Encroachment (Proximity): Five (5) cultural heritage resources would be impacted by work being undertaken within proximity of the resource. An additional (1) resource could be subject to removal. • Encroachment (Frontage): Ten (10) cultural heritage resources could be subject to encroachment along the frontage of the property possibly resulting in impacts to mature plantings and an alteration to the integrity of the landscape. A further two (2) may be impacted depending on the extent of the western limits of the study area. • No Impact: Analysis showed that four (4) cultural heritage resources would not be impacted by the work proposed. 	<p>resources were shown to be impacted through removal.</p> <ul style="list-style-type: none"> • Encroachment (Proximity): Six (6) cultural heritage resources would be impacted by work being undertaken within proximity of the resource. Of the total of six (6) resources, four (4) were deemed to be subject to impacts through encroachment (proximity). Of the two remaining cultural heritage resources one (1) presented reduced impacts (than Alternative 1) while the other (1) cultural heritage resource showed greater impacts than those assessed in Alternative 1. • Encroachment (Frontage): Seven (7) cultural heritage resources could be subject to encroachment along the frontage of the property possibly resulting in impacts to mature plantings and an alteration to the integrity of the landscape. Comparing these impacts with those assessed in Alternative 1 shows that one (1) cultural heritage resource was assessed as resulting in greater impacts and two (2) other resources returned impacts that were less than those assessed in Alternative 1. The final two (2) resources may be impacted depending on the extent of the western limits of the study area. 	<p>removal of an identified cultural heritage resource than both Alternatives 1 and 2.</p> <ul style="list-style-type: none"> • Removal: Four (4) cultural heritage resources were shown to be impacted through removal. • Encroachment (Proximity): Seven (7) cultural heritage resources would be impacted by work being undertaken within proximity of the resource. Of the total of seven (7) cultural heritage resources, five (5) were deemed to be subject to impacts through encroachment (proximity). Comparing these impacts to those assessed in Alternative 1, one (1) cultural heritage resource showed reduced impacts and another (1) showed greater impacts than Alternative 1. • Encroachment (Frontage): Seven (7) cultural heritage resources could be subject to encroachment along the frontage of the property possibly resulting in impacts to mature plantings and an alteration to the integrity of the landscape. Three (3) other resources returned impacts that were less than those assessed in Alternative 1. The remaining two (2) resources may be

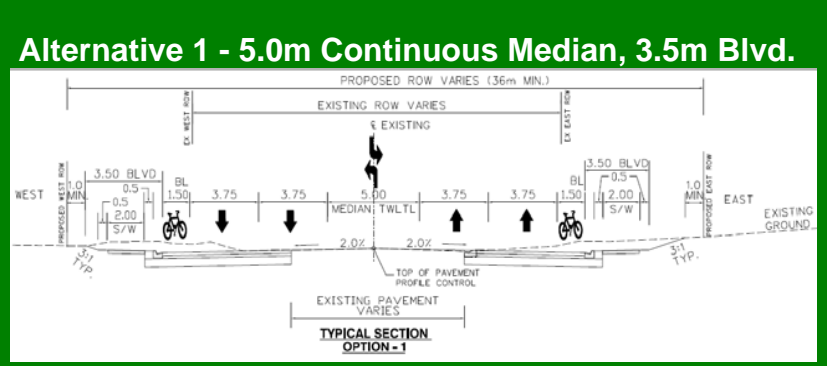
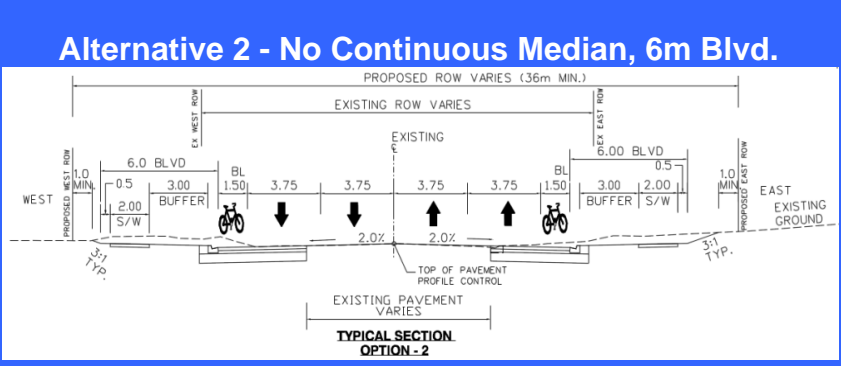
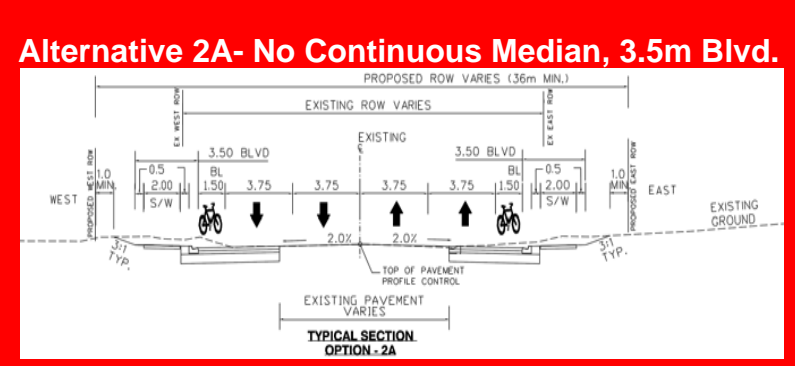
ALIGNMENT ALTERNATIVES – GARNER/RYMAL

EVALUATION FACTOR	Alternative 1 - 5.0m Continuous Median, 3.5m Blvd.			Alternative 2 - No Continuous Median, 6m Blvd.			Alternative 2A- No Continuous Median, 3.5m Blvd.		
	Score		Score	Score		Score	Score		Score
Built Heritage Features and Cultural Landscapes (cont'd)			<ul style="list-style-type: none"> No Impact: Analysis showed that four (4) cultural heritage resources would not be impacted by the work proposed. 			<ul style="list-style-type: none"> impacted depending on the extent of the western limits of the study area No Impact: Analysis showed that four (4) cultural heritage resources would not be impacted by the work proposed. 			
Total Score	4		4	4		4 Preferred Alternative			
Summary	<ul style="list-style-type: none"> All Alternatives impact areas of archaeological potential. Alternative 1 presents the most number of direct/adverse impacts to both built heritage features and to cultural heritage landscapes. It is the least desirable alternative. Alternative 2 also requires removal of cultural heritage features. However, it imposes slightly fewer adverse impacts to the built heritage resources and to the cultural heritage landscapes than Alternative 1. It is the second choice of the three alternatives. Alternative 2A is the preferred alternative in terms of imposing fewer direct/adverse impacts than Alternative 1. This alternative not only results in reduced impacts (in the two categories of encroachment), it also potentially requires one less removal of an identified cultural heritage resource than both Alternatives 1 and 2. 								
Socio-Economic Environment									
Conformity with Planning/ Development Policies	<ul style="list-style-type: none"> This design alternative is compatible with the City's broad based growth management plan (GRIDS) and Official Plan land use designations. 	5	<ul style="list-style-type: none"> This design alternative is compatible with the City's broad based growth management plan (GRIDS) and Official Plan land use designations. 	5	<ul style="list-style-type: none"> This design alternative is compatible with the City's broad based growth management plan (GRIDS) and Official Plan land use designations. 	5			
Existing Adjacent Land Uses	<ul style="list-style-type: none"> Majority (2/3) of the parking lot across the street from the Bowman United Church/Cemetery will be acquired. Approximately 587 m2 of property required. The drilled well in front of the barn at 927 Garner Road East would be displaced with this alternative. Access used on the south side of barn from the east side to 	2	<ul style="list-style-type: none"> Approximately half (1/2) of the parking lot across the street from the Bowman United Church/Cemetery will be acquired. Approximately 455 m2 of property required. Displacement of drilled well in front of the barn at 927 Garner Road could be avoided with this alternative. Access used on the south side of barn from the east side to blow grain into upper level granary could be 	2	<ul style="list-style-type: none"> Approximately half (1/2) of the parking lot across the street from the Bowman United Church/Cemetery will be acquired. Approximately 379 m2 of property required. Displacement of drilled well in front of the barn at 927 Garner Road could be avoided with this alternative. Access used on the south side of barn from 	3			

ALIGNMENT ALTERNATIVES – GARNER/RYMAL

EVALUATION FACTOR	ALIGNMENT ALTERNATIVES – GARNER/RYMAL		
	Alternative 1 - 5.0m Continuous Median, 3.5m Blvd.	Alternative 2 - No Continuous Median, 6m Blvd.	Alternative 2A- No Continuous Median, 3.5m Blvd.
	Score	Score	Score
Existing Adjacent Land Uses (cont'd)	<p>blow grain into upper level granary could be lost, but an alternative access is available via the barn bridge on the east-side.</p> <ul style="list-style-type: none"> • Effects to local businesses - Bennett's Apple and Cider Ltd. (944 and 954 Garner Road East) may lose one or two parking spots in front of their store. The main store sign will need to be relocated southerly onto the site. Requires a complete buyout of commercial property (service station at 523 Garner) for all alternatives. • Requires a total of 5.6 ha of property, which may require a complete buyout of 10 properties. • Avoids impacts to Garners Corners Cemetery and Bowman United Church/Cemetery. 	<p>maintained.</p> <ul style="list-style-type: none"> • Effects to local businesses - Bennett's Apple and Cider Ltd. (944 and 954 Garner Road East) may lose one or two parking spots in front of their store. The main store sign will need to be relocated southerly onto the site. Requires a complete buyout of commercial property (service station at 523 Garner) for all alternatives. • Alternative 2 requires a total of 5.9 ha of property, which may require a complete buyout of 8 properties. • Avoids impacts to Garners Corners Cemetery and Bowman United Church/Cemetery. 	<p>the east side to blow grain into upper level granary would be maintained.</p> <ul style="list-style-type: none"> • Effects to local businesses - Bennett's Apple and Cider Ltd. (944 and 954 Garner Road East) may lose one or two parking spots in front of their store. The main store sign will need to be relocated southerly onto the site. Requires a complete buyout of commercial property (service station at 523 Garner) for all alternatives. • Alternative 2A requires a total of 4.1 ha of property, which may require a complete buyout of 6 properties. • Avoids impacts to Garners Corners Cemetery and Bowman United Church/Cemetery.
Compatibility with Approved Future Land Uses	<ul style="list-style-type: none"> • A number of approved Draft Plans for large land parcels already include dedicated blocks for the roadway expansion. Future approved land use types include: Residential (single family detached, low density residential, medium density residential use and 3-storey retirement home), commercial, neighbourhood parks, and open space). It 	<ul style="list-style-type: none"> • A number of approved Draft Plans for large land parcels already include dedicated blocks for the roadway expansion. Future approved land use types include: Residential (single family detached, low density residential, medium density residential use and 3-storey retirement home), commercial, neighbourhood parks, and open space). It is expected that all future development lands 	<ul style="list-style-type: none"> • A number of approved Draft Plans for large land parcels already include dedicated blocks for the roadway expansion. Future approved land use types include: Residential (single family detached, low density residential, medium density residential use and 3-storey retirement home), commercial, neighbourhood parks, and
	3	3	3

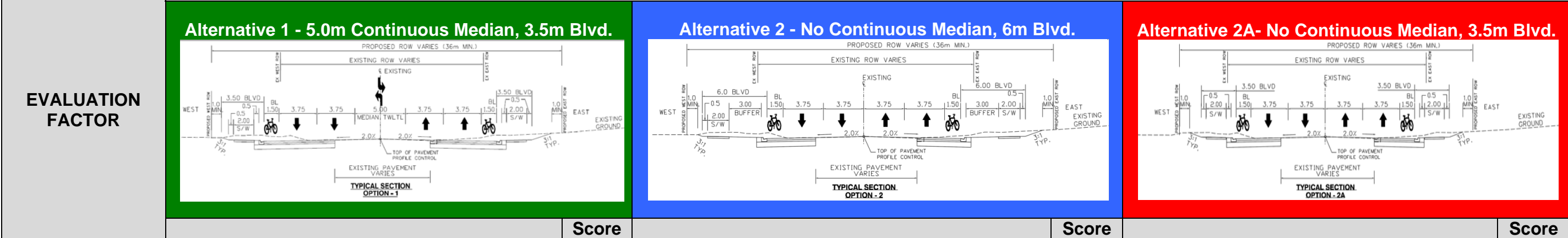
ALIGNMENT ALTERNATIVES – GARNER/RYMAL

EVALUATION FACTOR	ALIGNMENT ALTERNATIVES – GARNER/RYMAL		
	Alternative 1 - 5.0m Continuous Median, 3.5m Blvd.	Alternative 2 - No Continuous Median, 6m Blvd.	Alternative 2A- No Continuous Median, 3.5m Blvd.
			
	Score	Score	Score
Compatibility with Approved Future Land Uses (cont'd)	is expected that all future development lands will be graded to be compatible with the future road widening.	will be graded to be compatible with the future road widening.	open space). It is expected that all future development lands will be graded to be compatible with the future road widening.
Community Access and Linkages	<ul style="list-style-type: none"> This design alternative maintains/enhances pedestrian and cycling movement/connectivity in the Garner/Rymal corridor and provides opportunities for connection to proposed north/south cycling routes (West 5th Street to Upper James Street; Garth Street; Upper Paradise Road; Glancaster; Kitty Murray Drive; Southcote Road; numerous points southerly into the planned Airport Employment Growth District). 	<ul style="list-style-type: none"> This design alternative maintains/enhances pedestrian and cycling movement in the Garner/Rymal corridor and provides opportunities for connection to proposed north/south cycling routes (West 5th Street to Upper James Street; Garth Street; Upper Paradise Road; Glancaster; Kitty Murray Drive; Southcote Road; numerous points southerly into the planned Airport Employment Growth District). Provides highest level of comfort for pedestrians due to buffer between edge of pavement and sidewalk. 	<ul style="list-style-type: none"> This design alternative maintains / enhances pedestrian and cycling movement in the Garner/Rymal corridor and provides opportunities for connection to proposed north/south cycling routes (West 5th Street to Upper James Street; Garth Street; Upper Paradise Road; Glancaster; Kitty Murray Drive; Southcote Road; numerous points southerly into the planned Airport Employment Growth District).
	4	5	4

ALIGNMENT ALTERNATIVES – GARNER/RYMAL

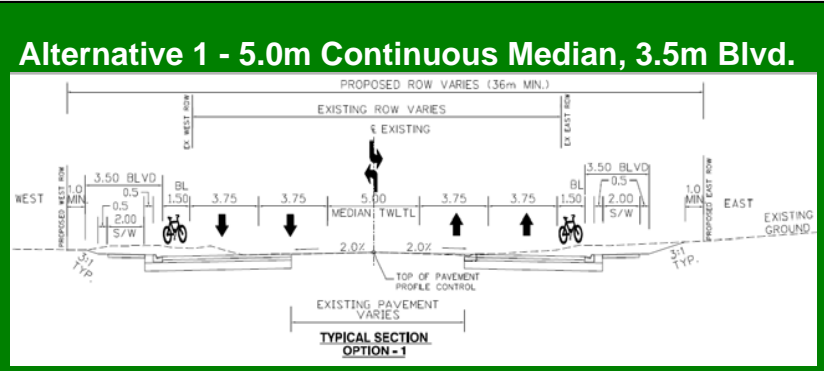
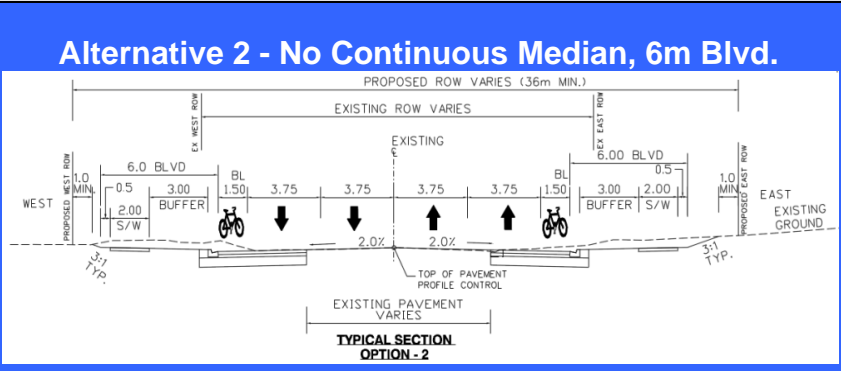
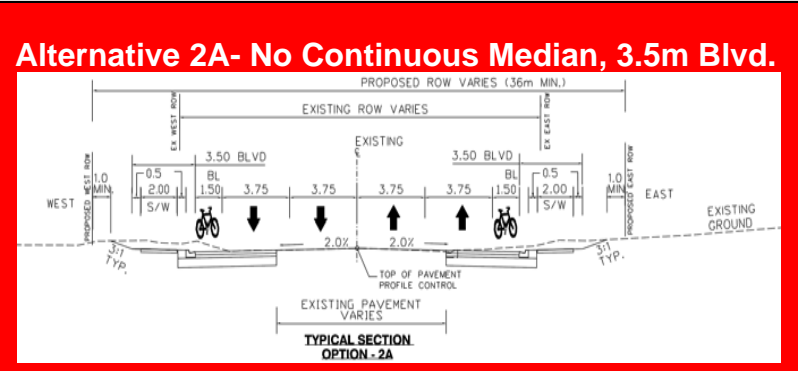
EVALUATION FACTOR	Alternative 1 - 5.0m Continuous Median, 3.5m Blvd.			Alternative 2 - No Continuous Median, 6m Blvd.			Alternative 2A- No Continuous Median, 3.5m Blvd.		
	Score		Score	Score		Score	Score		Score
Noise	<ul style="list-style-type: none"> The impacts due to increasing traffic range from 3 dB to 4 dB. In cases where the future road centerline is offset from the existing road centerline (asymmetrical widening), there will be increases or decreases in the impacts noted above. Moving the centerline away from the sensitive receptors will decrease the impact, while moving the centerline closer will increase the impact. For the sections on Garner Road, it is unlikely that a 5 dB impact will be reached due to asymmetrical widening, as the distance between the receptors and the roadway is large enough that small changes to the location of the centerline will not have a great effect. All three road alignment alternatives share a common centerline; therefore, the acoustic differences between the various alternatives will not be significant. 		3	<ul style="list-style-type: none"> The impacts due to increasing traffic range from 3 dB to 4 dB. In cases where the future road centerline is offset from the existing road centerline (asymmetrical widening), there will be increases or decreases in the impacts noted above. Moving the centerline away from the sensitive receptors will decrease the impact, while moving the centerline closer will increase the impact. For the sections on Garner Road it is unlikely that a 5 dB impact will be reached due to asymmetrical widening, as the distance between the receptors and the roadway is large enough that small changes to the location of the centerline will not have a great effect. All three road alignment alternatives share a common centerline; therefore, the acoustic differences between the various alternatives will not be significant. 		3	<ul style="list-style-type: none"> The impacts due to increasing traffic range from 3 dB to 4 dB. In cases where the future road centerline is offset from the existing road centerline (asymmetrical widening), there will be increases or decreases in the impacts noted above. Moving the centerline away from the sensitive receptors will decrease the impact, while moving the centerline closer will increase the impact. For the sections on Garner Road it is unlikely that a 5 dB impact will be reached due to asymmetrical widening, as the distance between the receptors and the roadway is large enough that small changes to the location of the centerline will not have a great effect. All three road alignment alternatives share a common centerline; therefore, the acoustic differences between the various alternatives will not be significant. 		3
Total Score	18		18	18		18	18		18
Summary	<ul style="list-style-type: none"> Alternative 1 has the most impacts to existing adjacent land uses, including virtual displacement of the Bowman United Church north side parking lot and impacts to the barn at 927 Garner Road East (access restrictions and displacement of well). Alternative 1 requires the most buyout of properties (10 complete buyouts) and the most property requirements of all three alternatives. Alternative 2A is the preferred alternative in regards to socio-economic environment (lowest property requirements and the least impact to existing adjacent land uses). 								

ALIGNMENT ALTERNATIVES – GARNER/RYMAL



Technical Considerations						
Traffic Operations	<ul style="list-style-type: none"> Continuous median lane provides more storage for left turns and access points for entrances and side roads. Continuous median lane may be used for queue jumping. 	5	<ul style="list-style-type: none"> Left-turn storage lanes designed as per the traffic study report dated April 2011. Increasing storage lengths, if required, will have significant traffic operations and staging impacts. 	2	<ul style="list-style-type: none"> Left-turn storage lanes designed as per the traffic study report dated April 2011. Increasing storage lengths, if required, will have significant traffic operations and staging impacts. 	2
Transit Operations	<ul style="list-style-type: none"> Extra lane in each direction improves bus transit operations. Continuous widened cross-section provides for easier future incorporation of alternate transit technologies. 	4	<ul style="list-style-type: none"> Extra lane in each direction improves bus transit operations. 	3	<ul style="list-style-type: none"> Extra lane in each direction improves bus transit operations. 	3
Provincial Highway Operations	<ul style="list-style-type: none"> Minor reconfiguration required at the Highway 6 interchange. 	5	<ul style="list-style-type: none"> Minor reconfiguration required at the Highway 6 interchange. 	5	<ul style="list-style-type: none"> Minor reconfiguration required at the Highway 6 interchange. 	5
Safety	<ul style="list-style-type: none"> Continuous median lane provides more storage for left turns and access points for entrances and side roads. Continuous median lane may be used for queue jumping. 	5	<ul style="list-style-type: none"> Left-turn storage lanes designed as per the traffic study report dated April 2011. Incorporating future intersections/side roads for development will require significant reconstruction and will disrupt traffic. 	2	<ul style="list-style-type: none"> Left-turn storage lanes designed as per the traffic study report dated April 2011. Incorporating future intersections/side roads for development will require significant reconstruction and will disrupt traffic. 	2
Pedestrian/ Cyclist Facilities	<ul style="list-style-type: none"> 1.5 m Bicycle Lane provided on both sides of Garner/Rymal Road between the travelled edge of pavement and the curb. Refer also to Community Access and Linkages. 	5	<ul style="list-style-type: none"> 1.5 m Bicycle Lane provided on both sides of Garner/Rymal Road between the travelled edge of pavement and the curb. Refer also to Community Access and Linkages. 	5	<ul style="list-style-type: none"> 1.5 m Bicycle Lane provided on both sides of Garner/Rymal Road between the travelled edge of pavement and the curb. Refer also to Community Access and Linkages. 	5

ALIGNMENT ALTERNATIVES – GARNER/RYMAL

EVALUATION FACTOR	Alternative 1 - 5.0m Continuous Median, 3.5m Blvd.			Alternative 2 - No Continuous Median, 6m Blvd.			Alternative 2A- No Continuous Median, 3.5m Blvd.		
									
		Score		Score		Score			
Drainage/ Stormwater Management	<ul style="list-style-type: none"> The existing rural ditch cross-section on Garner/Rymal Road will be replaced by an urban cross-section with catch basins and storm sewers within the project limits. From Highway 6 to Glancaster Road, the urban storm system will outlet to existing Tiffany Creek. From Glancaster Road to West 5th Street, the storm sewer system will tie into an existing urban system outletting to Upper Twenty Mile Creek and Upper Ottawa Creek. Construction of the storm sewer system has least impact on traffic staging because of increased overall pavement width. 	4	<ul style="list-style-type: none"> The existing rural ditch cross-section on Garner/Rymal Road will be replaced by an urban cross-section with catch basins and storm sewers within the project limits. From Highway 6 to Glancaster Road, the urban storm system will outlet to existing Tiffany Creek. From Glancaster Road to West 5th Street, the storm sewer system will tie into an existing urban system outletting to Upper Twenty Mile Creek and Upper Ottawa Creek. Construction of the storm sewer system will require additional traffic and construction staging compared to Alternative 1 due to no median. 	2	<ul style="list-style-type: none"> The existing rural ditch cross-section on Garner/Rymal Road will be replaced by an urban cross-section with catch basins and storm sewers within the project limits. From Highway 6 to Glancaster Road, the urban storm system will outlet to existing Tiffany Creek. From Glancaster Road to West 5th Street, the storm sewer system will tie into an existing urban system outletting to Upper Twenty Mile Creek and Upper Ottawa Creek. Construction of the storm sewer system will require additional traffic and construction staging compared to Alternative 1 due to no median. 	2			
Other Municipal Infrastructure/ Utilities	<ul style="list-style-type: none"> Hydro, Bell, Gas and other utilities will require relocation. Extent of relocations is the largest for this alternative. 	2	<ul style="list-style-type: none"> Hydro, Bell, Gas and other utilities will require relocation. Extent of relocations is the least of all alternatives. Wider boulevard can accommodate utilities. 	4	<ul style="list-style-type: none"> Hydro, Bell, Gas and other utilities will require relocation. Extent of relocations is the median of all alternatives. 	3			
Constructability (site-specific design issues)	<ul style="list-style-type: none"> Easiest alternative to construct. 5 m median provides for greater flexibility in shifting traffic lanes to facilitate storm sewer and the widening. Impact on side roads and residential and commercial entrances is the largest of all of the alternatives. 	4	<ul style="list-style-type: none"> More complicated alternative to construct with respect to shifting traffic lanes to facilitate storm sewer and the widening. Fewer impacts on side roads and residential and commercial entrances than Alternative 1. 	2	<ul style="list-style-type: none"> More complicated alternative to construct with respect to shifting traffic lanes to facilitate storm sewer and the widening. Fewer impacts on side roads and residential and commercial entrances than Alternative 1. 	2			

ALIGNMENT ALTERNATIVES – GARNER/RYMAL

EVALUATION FACTOR	Alternative 1 - 5.0m Continuous Median, 3.5m Blvd.		Alternative 2 - No Continuous Median, 6m Blvd.		Alternative 2A- No Continuous Median, 3.5m Blvd.	
		Score		Score		Score
Staging of Implementation to Meet Growth Needs	<ul style="list-style-type: none"> Continuous median provides for easier future incorporation of alternate transit technologies and other infrastructure to meet growth needs. 	5	<ul style="list-style-type: none"> Incorporating future growth/development will require significant reconstruction and will disrupt traffic. 	2	<ul style="list-style-type: none"> Incorporating future growth/development will require significant reconstruction and will disrupt traffic. 	2
Total Score	39 Preferred Alternative		27		26	
Summary	<ul style="list-style-type: none"> Alternative 1 is the preferred alternative since it allows for incorporating future development and could accommodate future plans for Rapid Transit. Alternative 1 is also the easiest to construct. 					
Financial Implications						
Construction Costs	<ul style="list-style-type: none"> Approximately \$26.3M construction costs (this estimate includes grading, drainage, and electrical works). 	2	<ul style="list-style-type: none"> Approximately \$23.5M construction costs (this estimate includes grading, drainage, and electrical works). 	3	<ul style="list-style-type: none"> Approximately \$22.9M construction costs (this estimate includes grading, drainage, and electrical works). 	3
Utility Relocation Costs	<ul style="list-style-type: none"> Approximately \$800,000 for all utility relocation work. 	2	<ul style="list-style-type: none"> Approximately \$800,000 for all utility relocation work. 	2	<ul style="list-style-type: none"> Approximately \$800,000 for all utility relocation work. 	2
Total Score	4		5		5 Preferred Alternative	
Summary	<ul style="list-style-type: none"> Alternative 2A is the preferred alternative from a financial perspective, with the lowest construction costs, mainly resulting from lower earth excavation quantities. 					
COMPREHENSIVE SUMMARY COMMENTS (Total Scores)	PREFERRED ALTERNATIVE 1	71	NOT RECOMMENDED FOR FURTHER STUDY	61	NOT RECOMMENDED FOR FURTHER STUDY	62

Impact Assessment Scoring Scheme

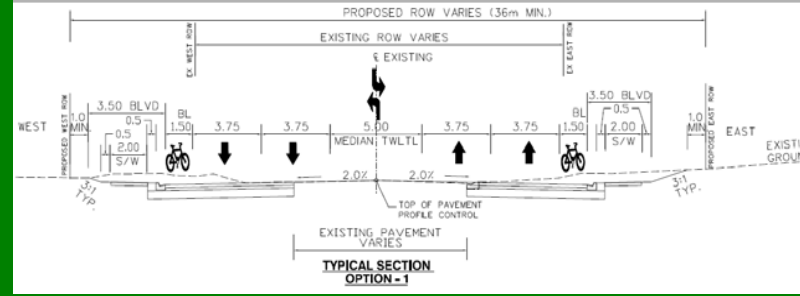
1	Major negative effect / No positive effect	2	Some negative effect/very little positive effect	3	Fair (little negative or positive effect)	4	Very little negative effect/ some positive effect	5	No negative effect/ Major positive effect
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Table 4.4: Comparative Assessment and Evaluation of Alignment Alternatives – Garth Street

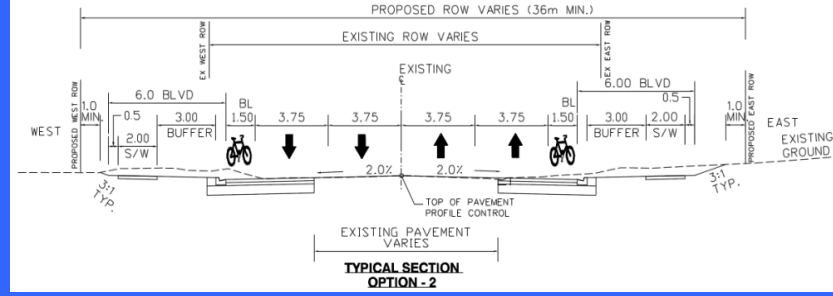
EVALUATION FACTOR	ALIGNMENT ALTERNATIVES – GARTH					
	Alternative 1 - 5.0m Continuous Median, 3.5m Blvd.	Alternative 2 - No Continuous Median, 6m Blvd.	Alternative 2A- No Continuous Median, 3.5m Blvd.			
	Score	Score	Score			
Natural Environment						
Aquatic Habitat	<ul style="list-style-type: none"> Indirect impact to fish and fish habitat of Upper Twenty Mile Creek tributary with this alternative. There will be a loss of some riparian vegetation. 	2	<ul style="list-style-type: none"> Indirect impact to fish and fish habitat of Upper Twenty Mile Creek tributary with this alternative. There will be a loss of some riparian vegetation. 	2	<ul style="list-style-type: none"> Indirect impact to fish and fish habitat of Upper Twenty Mile Creek tributary with this alternative. There will be a loss of some riparian vegetation. 	2
Terrestrial Habitat/Roadside Vegetation	<ul style="list-style-type: none"> Moderate impacts to roadside trees in ditches and boulevard. Key areas include: Garth Street – 0+700-1+000. 	2	<ul style="list-style-type: none"> Moderate impacts to roadside trees in ditches and boulevard. Key areas include: Garth Street – 0+700-1+000. 	2	<ul style="list-style-type: none"> Lower impacts to roadside trees in ditches and boulevard compared to other alternatives. Key areas include: Garth Street – 0+700-1+000. 	3
Designated Areas	<ul style="list-style-type: none"> Minor impacts to Significant woodlot on the east side of Garth Street (~0+100-0+325). Based on the Official Plan, site alterations, including grading and filling, are not permitted within these areas. 	2	<ul style="list-style-type: none"> Minor impacts to Significant woodlot on the east side of Garth St (~0+100-0+325). Based on the Official Plan, site alterations, including grading and filling, are not permitted within these areas. 	2	<ul style="list-style-type: none"> Minor impacts to Significant woodlot on the east side of Garth St (~0+100-0+325), though less impact than other alternatives. Based on the Official Plan, site alterations, including grading and filling, are not permitted within these areas. 	3
Total Score	6	6	7 <i>Preferred Alternative</i>			
Summary	<ul style="list-style-type: none"> Alternatives 1 and 2 scored the same for each evaluation criteria and had slightly more impacts than Alternative 2A. Alternative 2A is the preferred alternative with respect to Natural Environment since there are fewer impacts to roadside trees (in ditches and boulevard) and Significant woodlot areas compared to other alternatives. 					

ALIGNMENT ALTERNATIVES – GARTH

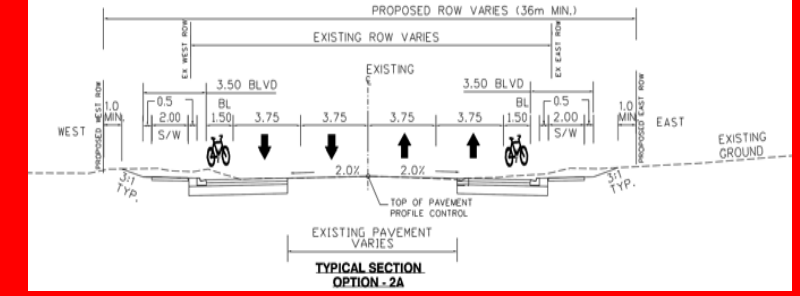
Alternative 1 - 5.0m Continuous Median, 3.5m Blvd.



Alternative 2 - No Continuous Median, 6m Blvd.



Alternative 2A- No Continuous Median, 3.5m Blvd.



EVALUATION FACTOR

Score

Score

Score

Historical/Cultural Environment

Archaeological Resources	<ul style="list-style-type: none"> Potential for the proposed road widening to impact identified areas containing archaeological potential in Significant woodlot. 	2	<ul style="list-style-type: none"> Potential for the proposed road widening to impact identified areas containing archaeological potential in Significant woodlot. 	2	<ul style="list-style-type: none"> Potential for the proposed road widening to impact identified areas containing archaeological potential in Significant woodlot. 	2
Built Heritage Features and Cultural Landscapes	<ul style="list-style-type: none"> No cultural heritage resources were identified on Garth Street and, as such, no impacts are anticipated. 	N/A	<ul style="list-style-type: none"> No cultural heritage resources were identified on Garth Street and, as such, no impacts are anticipated. 	N/A	<ul style="list-style-type: none"> No cultural heritage resources were identified on Garth Street and, as such, no impacts are anticipated. 	N/A
Total Score	2	2	2	2	2	2

Summary • There are no significant differences amongst the alternatives with respect to the Historical/Cultural Environment.

Socio-Economic Environment

Conformity with Planning/ Development Policies	<ul style="list-style-type: none"> This design alternative is compatible with the City's broad based growth management plan (GRIDS) and Official Plan land use designations. 	5	<ul style="list-style-type: none"> This design alternative is compatible with the City's broad based growth management plan (GRIDS) and Official Plan land use designations. 	5	<ul style="list-style-type: none"> This design alternative is compatible with the City's broad based growth management plan (GRIDS) and Official Plan land use designations. 	5
Existing Adjacent Land Uses	<ul style="list-style-type: none"> Requires a total of 0.1 ha of property, and does not require any property buyouts. 	3	<ul style="list-style-type: none"> Requires a total of 0.11 ha of property, and does not require any property buyouts. 	2	<ul style="list-style-type: none"> Requires a total of 0.05 ha of property, and does not require any property buyouts. 	3
Compatibility with Approved Future Land Uses	<ul style="list-style-type: none"> There is a conditionally approved site plan (DA-07-169) for 460 Rymal Road West (northwest corner of Rymal and Garth). The proposal is for a 3-storey retirement home with a total of 114 units and 100 parking spaces (75 above and 25 below). This alternative does not conflict with the development proposal. 	3	<ul style="list-style-type: none"> There is a conditionally approved site plan (DA-07-169) for 460 Rymal Road West (northwest corner of Rymal and Garth). The proposal is for a 3-storey retirement home with a total of 114 units and 100 parking spaces (75 above and 25 below). This alternative does not conflict with the development proposal. 	3	<ul style="list-style-type: none"> There is a conditionally approved site plan (DA-07-169) for 460 Rymal Road West (northwest corner of Rymal and Garth). The proposal is for a 3-storey retirement home with a total of 114 units and 100 parking spaces (75 above and 25 below). This alternative does not conflict with the development proposal. 	3

ALIGNMENT ALTERNATIVES – GARTH

EVALUATION FACTOR	Alternative 1 - 5.0m Continuous Median, 3.5m Blvd.			Alternative 2 - No Continuous Median, 6m Blvd.			Alternative 2A- No Continuous Median, 3.5m Blvd.		
			Score			Score			Score
Community Access and Linkages	<ul style="list-style-type: none"> This alternative maintains/enhances pedestrian and cycling movement in the Garth Street corridor and provides opportunities for connection to the proposed east/west pedestrian and cycling facilities on Garner/Rymal. 		4	<ul style="list-style-type: none"> This alternative maintains/enhances pedestrian and cycling movement in the Garth Street corridor and provides opportunities for connection to the proposed east/west pedestrian and cycling facilities on Garner/Rymal. Provides highest level of comfort for pedestrians due to buffer between edge of pavement and sidewalk. 		5	<ul style="list-style-type: none"> This alternative maintains/enhances pedestrian and cycling movement in the Garth Street corridor and provides opportunities for connection to the proposed east/west pedestrian and cycling facilities on Garner/Rymal. 		4
Noise	<ul style="list-style-type: none"> The impacts due to increasing traffic range from 3 dB to 4 dB. In cases where the future road centerline is offset from the existing road centerline (asymmetrical widening), there will be increases or decreases in the impacts noted above. Moving the centerline away from the sensitive receptors will decrease the impact, while moving the centerline closer will increase the impact. For the sections on Garth Street, it is unlikely that a 5 dB impact will be reached due to asymmetrical widening, as the distance between the receptors and the roadway is large enough that small changes to the location of the centerline will not have a great effect. All three road alignment alternatives share a common centerline; therefore, 		3	<ul style="list-style-type: none"> The impacts due to increasing traffic range from 3 dB to 4 dB. In cases where the future road centerline is offset from the existing road centerline (asymmetrical widening), there will be increases or decreases in the impacts noted above. Moving the centerline away from the sensitive receptors will decrease the impact, while moving the centerline closer will increase the impact. For the sections on Garth Street it is unlikely that a 5 dB impact will be reached due to asymmetrical widening, as the distance between the receptors and the roadway is large enough that small changes to the location of the centerline will not have a great effect. All three road alignment alternatives share a common centerline; therefore, the acoustic differences between the various alternatives 		3	<ul style="list-style-type: none"> The impacts due to increasing traffic range from 3 dB to 4 dB. In cases where the future road centerline is offset from the existing road centerline (asymmetrical widening), there will be increases or decreases in the impacts noted above. Moving the centerline away from the sensitive receptors will decrease the impact, while moving the centerline closer will increase the impact. For the sections on Garth Street it is unlikely that a 5 dB impact will be reached due to asymmetrical widening, as the distance between the receptors and the roadway is large enough that small changes to the location of the centerline will not have a great effect. All three road alignment alternatives share a common centerline; therefore, 		3

ALIGNMENT ALTERNATIVES – GARTH

EVALUATION FACTOR	ALIGNMENT ALTERNATIVES – GARTH					
	Alternative 1 - 5.0m Continuous Median, 3.5m Blvd.	Alternative 2 - No Continuous Median, 6m Blvd.	Alternative 2A- No Continuous Median, 3.5m Blvd.			
	Score	Score	Score			
	the acoustic differences between the various alternatives will not be significant.	will not be significant.	the acoustic differences between the various alternatives will not be significant.			
Total Score	18	18	18			
Summary	<ul style="list-style-type: none"> Alternative 2 requires the most private property of all three alternatives. Alternative 2A is the preferred alternative in regards to socio-economic environment, since this alternative has the least property requirements. 					
Technical Considerations						
Traffic Operations	<ul style="list-style-type: none"> Continuous median lane provides more storage for left turns and access points for entrances and side roads. Continuous median lane may be used for queue jumping. 	5	<ul style="list-style-type: none"> Left-turn storage lanes designed as per the traffic study report dated April 2011. Increasing storage lengths, if required, will have significant traffic operations and staging impacts. 	2	<ul style="list-style-type: none"> Left-turn storage lanes designed as per the traffic study report dated April 2011. Increasing storage lengths, if required, will have significant traffic operations and staging impacts. 	2
Transit Operations	<ul style="list-style-type: none"> Extra lane in each direction improves bus transit operations. Continuous widened cross-section provides for easier future incorporation of alternate transit technologies. 	4	<ul style="list-style-type: none"> Extra lane in each direction improves bus transit operations. 	3	<ul style="list-style-type: none"> Extra lane in each direction improves bus transit operations. 	3
Provincial Highway Operations	<ul style="list-style-type: none"> No impact to provincial highway operations. 	5	<ul style="list-style-type: none"> No impact to provincial highway operations. 	5	<ul style="list-style-type: none"> No impact to provincial highway operations. 	5
Safety	<ul style="list-style-type: none"> Continuous median lane provides more storage for left turns and access points for entrances and side roads. Continuous median lane may be used for queue jumping. 	5	<ul style="list-style-type: none"> Left-turn storage lanes designed as per the traffic study report dated April 2011. Incorporating future intersections/side roads for development will require significant reconstruction and will disrupt traffic. 	2	<ul style="list-style-type: none"> Left-turn storage lanes designed as per the traffic study report dated April 2011. Incorporating future intersections/side roads for development will require significant reconstruction and will disrupt traffic. 	2

ALIGNMENT ALTERNATIVES – GARTH

EVALUATION FACTOR	Alternative 1 - 5.0m Continuous Median, 3.5m Blvd.			Alternative 2 - No Continuous Median, 6m Blvd.			Alternative 2A- No Continuous Median, 3.5m Blvd.		
			Score			Score			Score
Pedestrian/ Cyclist Facilities	<ul style="list-style-type: none"> 1.5 m Bicycle Lane provided on both sides of Garner/Rymal Road between the travelled edge of pavement and the curb. Refer also to Community Access and Linkages. 		5	<ul style="list-style-type: none"> 1.5 m Bicycle Lane provided on both sides of Garner/Rymal Road between the travelled edge of pavement and the curb. Refer also to Community Access and Linkages. 		5	<ul style="list-style-type: none"> 1.5 m Bicycle Lane provided on both sides of Garner/Rymal Road between the travelled edge of pavement and the curb. Refer also to Community Access and Linkages. 		5
Drainage/ Stormwater Management	<ul style="list-style-type: none"> The storm sewer system will tie into an existing urban system outletting to Upper Twenty Mile Creek and Upper Ottawa Creek. Construction of the storm sewer system has least impact on traffic staging because of increased overall pavement width. 		4	<ul style="list-style-type: none"> The storm sewer system will tie into an existing urban system outletting to Upper Twenty Mile Creek and Upper Ottawa Creek. Construction of the storm sewer system will require additional traffic and construction staging compared to Alternative 1 due to no median. 		2	<ul style="list-style-type: none"> The storm sewer system will tie into an existing urban system outletting to Upper Twenty Mile Creek and Upper Ottawa Creek. Construction of the storm sewer system will require additional traffic and construction staging compared to Alternative 1 due to no median. 		2
Other Municipal Infrastructure/ Utilities	<ul style="list-style-type: none"> Hydro, Bell, Gas and other utilities will require relocation. Extent of relocations is the largest for this alternative. Total property required 0.08ha. 		2	<ul style="list-style-type: none"> Hydro, Bell, Gas and other utilities will require relocation. Extent of relocations is the least of all alternatives. Wider boulevard can accommodate utilities. Total property required 0.11ha. 		4	<ul style="list-style-type: none"> Hydro, Bell, Gas and other utilities will require relocation. Extent of relocations is the median of all alternatives. Total property required 0.05ha. 		3
Constructability (site-specific design issues)	<ul style="list-style-type: none"> Easiest alternative to construct. 5 m median provides for greater flexibility in shifting traffic lanes to facilitate storm sewer and the widening. Impact on side roads and residential and commercial entrances is the largest of all of the alternatives. 		4	<ul style="list-style-type: none"> More complicated alternative to construct with respect to shifting traffic lanes to facilitate storm sewer and the widening. Fewer impacts on side roads and residential and commercial entrances than Alternative 1. 		2	<ul style="list-style-type: none"> More complicated alternative to construct with respect to shifting traffic lanes to facilitate storm sewer and the widening. Fewer impacts on side roads and residential and commercial entrances than Alternative 1. 		2

ALIGNMENT ALTERNATIVES – GARTH

EVALUATION FACTOR	Alternative 1 - 5.0m Continuous Median, 3.5m Blvd.		Alternative 2 - No Continuous Median, 6m Blvd.		Alternative 2A- No Continuous Median, 3.5m Blvd.	
		Score		Score		Score
Staging of Implementation to Meet Growth Needs	<ul style="list-style-type: none"> Continuous median provides for easier future incorporation of alternate transit technologies and other infrastructure to meet growth needs. 	5	<ul style="list-style-type: none"> Incorporating future growth/development will require significant reconstruction and will disrupt traffic. 	2	<ul style="list-style-type: none"> Incorporating future growth/development will require significant reconstruction and will disrupt traffic. 	2
Total Score	39 <i>Preferred Alternative</i>		27		26	
Summary	<ul style="list-style-type: none"> Alternative 1 is the preferred alternative since it allows for incorporating future development and is the easiest to construct. 					
Financial Implications						
Construction Costs	<ul style="list-style-type: none"> Approximately \$6.3M construction costs (this estimate includes grading, drainage, and electrical works). 	2	<ul style="list-style-type: none"> Approximately \$5.6M construction costs (this estimate includes grading, drainage, and electrical works). 	3	<ul style="list-style-type: none"> Approximately \$5.6M construction costs (this estimate includes grading, drainage, and electrical works). 	3
Utility Relocation Costs	<ul style="list-style-type: none"> Approximately \$200,000 for all utility relocation work. 	2	<ul style="list-style-type: none"> Approximately \$200,000 for all utility relocation work. 	2	<ul style="list-style-type: none"> Approximately \$200,000 for all utility relocation work. 	2
Total Score	4		5		5 <i>Preferred Alternative</i>	
Summary	<ul style="list-style-type: none"> Alternative 2A is the preferred alternative from a financial perspective, with the lowest construction costs mainly resulting from lower earth excavation quantities. 					
COMPREHENSIVE SUMMARY COMMENTS (Total Scores)	PREFERRED ALTERNATIVE	69	NOT RECOMMENDED FOR FURTHER STUDY	58	NOT RECOMMENDED FOR FURTHER STUDY	58

Impact Assessment Scoring Scheme

1	Major negative effect / No positive effect	2	Some negative effect/very little positive effect	3	Fair (little negative or positive effect)	4	Very little negative effect/ some positive effect	5	No negative effect/ Major positive effect
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4.6 Rationale for Preferred Design

Alternative 1 (4-lane Widening with Two-Way Left-Turn Lane) received the highest overall scores and has been identified as the technically preferred design concept for both the Garner Road/Rymal Road and Garth Street corridors for the following reasons:

- The continuous median lane provides the maximum storage lengths for left turns and access points for entrances and side roads, including the flexibility to accommodate future developments (e.g., Airport Employment Growth District).
- The widened cross-section as a result of the continuous median facilitates bus transit operations, current and anticipated truck traffic and provides for easier future incorporation of alternate transit technologies.
- Provides the necessary room for locating municipal services within the road cross-section and clearances to other utilities and appurtenances.
- Is the easiest alternative to construct, as the 5 m median provides the greatest flexibility to shift traffic lanes to facilitate the road widening and storm sewer installation, with the fewest impacts to traffic operations.
- Provides opportunities for potential streetscaping in median areas and replacement of roadside trees on boulevards.
- Potential property requirements can be reduced through strategic modification of grading requirements.

5.0 DESCRIPTION OF SELECTED DESIGN

5.1 Features of Recommended Roadway Design

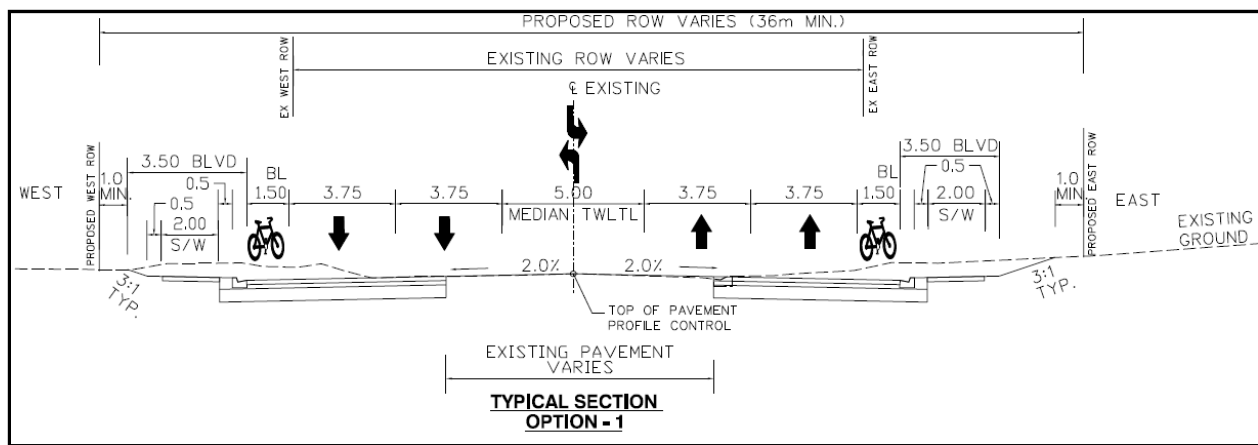
5.1.1 Right-of-Way and Cross-Section Elements

Alternative 1 was selected as the Technical Preferred Alignment (TPA). The preliminary design of the TPA was developed according to the Design Criteria discussed in Section 4.5.1, including the following key design parameters:

- Road Classification - four-lane urban secondary arterial road (36 m right-of-way) with four 3.75 m through lanes; a 5.0 m median to accommodate 3.0 m left-turn lanes with raised median at most intersections; an exclusive 3.5 m right-turn lane; a 1.5 m bike lane; and a 3.5 m boulevard, including 2.0 m side walk on each side and 0.5 m curb and gutter widths
- Design Speed - 70 km/h
- Posted Speed - 60 km/h
- Minimum Stopping Site Distance - 110 m
- Minimum Horizontal Radius - 190 m
- Minimum Vertical Curve (Crest) K - 35
- Minimum Vertical Curve (Sag) K - 30
- Maximum Grade - 4.0%
- Minimum Grade - 0.3%
- Maximum Superelevation: 6.0%

The preliminary design for the TPA is presented in Appendix C, including plan-over-profile drawings, and preliminary property requirements. The proposed Typical Cross-Section is shown in Figure 5.1.

Figure 5.1: Proposed Typical Cross-Section



Horizontal and Vertical Alignment

The existing horizontal and vertical alignments have been maintained, with the widening being symmetrical about the existing centerline, except at one location, where an alignment shift to the north has been implemented to mitigate property constraints at the Bowman Cemetery location.

On Garth Street, the horizontal alignment is improved, eliminating the existing jog at Claudette Gate/Sabrina Boulevard by shifting the alignment approximately 8 m to the east between the jog and Stone Church Road.

The proposed options will extend the existing 2% tangent crossfall from the existing centerline to the curbs and gutters throughout the alignment. Maintaining the existing profile throughout will generally facilitate construction staging and mitigate impacts on entrances and existing properties.

Sight Triangle

Existing sight triangles are located at all major signalized intersections and are sufficient to provide safe sight distance for drivers, cyclists and pedestrians.

Intersection Improvements

The detailed intersection improvement recommendations are described in the Traffic Study Report (Appendix D.1). In summary, the proposed improvements include:

- Provide an exclusive southbound right-turn lane with a minimum storage length of 30 m, and convert the existing shared left-right lane to an exclusive southbound left turn lane at the Highway 403 Off-ramp terminal;
- Provide an exclusive right-turn lane at all the approaches at the Southcote Road/Garner Road East intersection. Provide 20 m and 150 m storage lengths for the eastbound and westbound right-turn lanes, respectively. Provide 40 m and 100 m storage lengths for the northbound and southbound right-turn lanes, respectively. Extend the northbound and southbound left-turn lanes and provide a minimum of 40 m and 175 m storage lengths, respectively. Widen the northbound and southbound approaches to a 4-lane section along Southcote Road. Optimize signal plans with added sub-phasing;
- Provide exclusive left-turn lanes at all the approaches at the Kitty Murray Lane/Garner Road intersection. In addition to that, provide a westbound right-turn lane and a southbound right-turn lane at the subject intersection. The storage length of the eastbound left will be minimum 90 m, and that should be 50 m for the westbound left-turn move. The storage lengths for the northbound and southbound left-turn lanes will be 20 m and 25 m, respectively. The storage length for each of the eastbound and the southbound right-turn lanes should be minimum 50 m;
- Provide an exclusive right-turn lane at all the approaches with a minimum 50 m storage length at the Upper Paradise/Rymal Road West intersection. Optimize signal plans with added sub-phasing;
- Provide an exclusive right-turn lane at all the approaches with a minimum 50 m storage length for the eastbound, westbound and northbound approaches and a 30 m storage length for the southbound approach at the Garth Street/Rymal Road West intersection. Optimize signal plans with added sub-phasing;
- Provide an exclusive right-turn lane at the eastbound and westbound approaches with minimum 30 m and 40 m storage lengths, respectively at the

- West 5th Street/Rymal Road West intersection. Optimize signal plans with added sub-phasing;
- Provide an exclusive right-turn lane at the northbound approach with a 30 m storage length, and at the southbound and westbound approaches with a minimum 50 m storage length at the Stone Church Road/Garth Street intersection. Optimize signal plans with added sub-phasing.

The study area unsignalized intersections will also be provided with necessary auxiliary lanes on the main approaches, as well as on the cross streets/major accesses.

Existing Shoulders

There are no fully paved shoulders within the project limits. The existing shoulders throughout the project limits are gravel, ranging in widths from approximately 2.0 m to 3.0 m. The existing shoulders will be removed by the proposed roadway widening and installation of the boulevards (curb and gutter, buffer zone, and sidewalk).

Existing Sidewalk and Boulevard

There is no existing boulevard on Garner Road, and the existing boulevard on Rymal Road begins near Glanaster Road and continues to the east project limit (West 5th Street). The existing boulevard has either concrete or asphalt sidewalk ranging in width from 1.0 m to 1.7m between Glanaster Road and Garth Street; and a sidewalk width of 1.5 m between Garth Street and West 5th Street.

The west side of Garth Street has a 1.5 m existing sidewalk along the study area and the east side of Garth Street has no existing sidewalk or boulevard.

A 2.0 m sidewalk and a buffer zone will be installed on both sides along Garner Road East/Rymal Road West and Garth Street.

Grading / Slopes

Grading will be required to match existing property grades behind the sidewalk. A proposed 1:3 grading slope will be used to match the property elevation. If existing sidewalks are to be retained, grading will be done from the curb to match existing sidewalks.

Entrance Modifications

The sight distance at each of the entrances and sideroads will be reviewed during Detail Design to ensure that they satisfy the city's minimum requirements. The results of the sight distance review will be documented in chart format and submitted to the City for their review.

All existing sideroads and entrances, including all paved tapers, will be reinstated to match existing conditions during Detail Design.

Road Right-of-Way and Easement Requirements

The City will acquire a 36 m basic right-of-way, with 18 m taken from each side of the centerline. The 36.0 m right-of-way will accommodate most of the properties required for the road widening, with additional property being impacted at locations where there

is an alignment shift or where the grading limit exceeds the 36.0 m requirement. The properties required for the proposed road improvements are also shown on the preliminary design plates in Appendix C.

A total of 5.53 ha, excluding property buyout areas, is required. In addition, a buyout (i.e., acquisition of the entire parcel) of 7 properties on the north side and 3 properties on the south side is required along the Garner Road East/Rymal Road West corridor. It should be noted that the property requirements identified on the design plates are very preliminary in nature. Buyouts requirements have conservatively been applied where the property required encroaches on buildings or other structures, or the amount of property required would leave a remainder parcel of a size or configuration that would render the land nonviable for the current use. During the Detail Design phase, the City will make additional efforts to minimize the need to acquire land from properties abutting the road right-of-way. In particular, alternative design schemes will be examined to limit the number of buyouts required.

Property will not be required from the two cemetery locations (Station 1+140 - Garners Corners Cemetery and Station 2+450 – Bowman Cemetery).

Property/business acquisition required for this project will be undertaken by the City of Hamilton, with the objective being to ensure that individual rights are respected and protected, and to provide fair compensation within the framework of the city's policies and associated legislative instruments governing the acquisition of property for municipal projects. The acquisition process emphasizes negotiation on a willing seller, willing buyer basis and the achievement of a mutually satisfactory agreement between the City and the owner. If necessary, expropriation may be required to acquire the necessary property in a timely and efficient manner.

Temporary easements will be required for the temporary drainage ditches and construction of the entrances to the abutting properties, and these will be confirmed during Detail Design.

Right-of-way and easement requirements will be finalized for the purposes of property acquisition during the Detail Design phase. As indicated above, all mitigating measures will be considered during Detail Design to reduce the impacts to abutting properties.

5.1.2 Pavement Design

SNC-Lavalin's scope of work for the preliminary design does not include the geotechnical study of the Garner Road East/Rymal West corridor and the Garth Street corridor. In order to provide the proper pavement design required to support the projected traffic volumes in 2031, a geotechnical study that includes reviewing all geotechnical reports that have been undertaken for the corridors, recommending supplementary field investigations and providing recommendations on the type and thickness of the road pavement required is recommended. The geotechnical study should be completed in the early stages of the Detail Design phase for the recommended corridor widening.

5.1.3 Drainage and Stormwater Management

The drainage systems for the project were evaluated for the proposed future condition after the road improvements. The analysis included an assessment of potential impacts on the existing cross culverts and storm sewers, as well as impacts on peak flows to the receiving streams. Where the existing drainage system elements were found to be inadequate for the future conditions, improvements to the system have been developed. The potential for water quality impacts due to the road improvements has also been evaluated and mitigation measures have been proposed. The details of these analyses and the recommended measures are given in the Drainage and Stormwater Management Report in Appendix D.2.

Design Criteria and Targets

The design criteria for the roadway are defined in the City of Hamilton design criteria. The road drainage system is to be designed for a five-year minor system capacity, while the major system is to have 100-year capacity. Crossing culverts should have a minimum 25-year capacity with adequate freeboard to prevent flooding of the roadway pavement for the 100-year event. Crossing culverts with larger catchment areas (i.e., >50 ha or so) have also been evaluated for the Regional Storm. Post-development flows are not to exceed pre-development flows at all locations, except the East Tributary of the East Ancaster Creek (culvert C15). Previous study has indicated that peak flow control is not required on this tributary. Similarly, for the catchment areas connected to the Twenty Mile Creek outlet at St. Elizabeth Village East of Garth Street, it has been determined in previous studies and confirmed by the Niagara Peninsula Conservation Authority, that the downstream pond system has been designed to accommodate future development in the upstream catchment area. As a result, peak flow control is not required for the sections of Rymal Road and Garth Street contributing to these ponds.

The water quality target for stormwater management for the receiving watersheds is defined as an enhanced (Level 1) treatment at all locations. However, where this is not possible due to the limited opportunities available for stormwater management within the right-of-way, a “best effort” approach has been applied to maximize the available opportunities.

Proposed Drainage Concept

The proposed road profile will approximate the existing profile throughout the study area. As a result, the future road drainage system will maintain the existing catchment boundaries and outlets. Diversion of flows between catchment areas will be minimized. The future road will feature a standard curb and gutter cross-section with catch basins connected to storm sewers with five year capacity. Existing storm sewers will be utilized and supplemented where needed with additional storm sewer lines. Storm sewer connections to adjacent development areas will be utilized where available. In general, major system outlets will be maintained at existing sag points in the road profile. However, major system flows will be directed to adjacent roadways at intersections, where appropriate.

All of the major crossing culvert outlets will be maintained for the Garner Road section. The existing culvert will be replaced at some locations due to poor condition, insufficient

capacity or insufficient depth to accommodate future road construction. The roadside ditches will generally be reinstated to convey the external drainage areas to the culverts. In some locations, a ditch inlet will be placed at the upstream end of the culvert due to property limitations and revised grading for the road widening.

For the Rymal Road section, most of the culverts capturing external drainage areas are connected to the existing storm sewer system. These connections will be replaced with new ditch inlets connected to a new storm sewer system to provide relief to the existing storm sewer. The future road drainage will be connected directly to the new storm sewers and the contributing area to the culvert inlet will be reduced for the future condition.

Impact Assessment – Downstream Flows

The future road widening will increase the impervious area connected to the local watercourses. At locations where the contributing catchment area is small, the increase in the pavement area may be a significant percentage of the total area, which could lead to increases in peak flows. The impact of the road improvements on peak flows to the downstream watercourses was assessed for the Garner Road culverts. The Rymal Road culverts were not assessed because they will not receive road drainage in the future and the upstream design flows will be reduced. For the Rymal Road and Garth Street sections discharging to the St. Elizabeth ponds, the change in peak inflow rates and volumes to the ponds was evaluated for the future condition with the proposed road improvements. For the remaining areas of Rymal Road and Garth Street, existing and future flows to the existing storm sewer systems were also assessed.

The OTTHYMO model was used to compare existing flows to future flows at the Garner Road culverts. The Soil Conservation Service 24-hour storm distribution was used in the analysis. It has been determined in previous studies that this is the critical storm for drainage design on these watersheds. Pre-development roadway drainage for Garner Road was based on the existing survey data, while the future roadway drainage area was based on the proposed design data. External drainage areas were taken from the hydrologic analysis for the existing condition. The future drainage condition also accounts for the proposed storm sewers on Garner Road and connections to existing storm sewers where those storm sewers have been designed to accommodate some drainage from the Garner Road right-of-way. These connections occur at Raymond Road and Kitty Murray Lane on Garner Road. The available design capacity for Garner Road drainage at these locations was determined from the original design calculations for the downstream sewers.

The results for the Tiffany Creek watershed outlets are summarized in Table 5.1. At the Tiffany Creek culvert itself (culvert C7) the future peak flows with the Garner Road storm sewers connected to the culvert are predicted to be slightly lower than the existing peak flow values. At culverts C8 and C9, future Garner Road drainage will be taken to the existing Raymond Road storm sewer, resulting in significantly reduced flows downstream at these locations. At culvert C12, the future upstream development area will be reduced from about 9.3 ha to about 7.1 ha as a result of a portion of the area being connected to the drainage system to the west, based on the design report for the Bungalows of Ancaster development. This reduction in area will result in an

overall reduction in flow to the downstream watercourse at culvert C12 after the Rymal Road improvements.

At outlet C13, the upstream Bungalows of Ancaster development includes an existing stormwater management pond. The hydrologic model for this pond design was used in assessing the future flow conditions at this outlet, including the full development of the Bungalows of Ancaster and the future Garner Road widening. However, because this is a fairly recent development, the natural pre-development flows to the watercourse south of Garner Road were also estimated for comparison. The future flows to this outlet after the Garner Road improvements were found to be generally lower than the flow rates for all return periods events except the 2-year storm. For the 2-year storm, an increase of about 5.6% is predicted. However the future 2-year flow is estimated to be about two-thirds of the pre-development flow at this location. Therefore, when considering the overall effect of the future development and the stormwater management pond, the flows downstream of culvert C13 will be significantly lower than the pre-development flows.

Future peak flows are predicted to increase significantly at culverts C10 and C11 after the roadway is reconstructed and storm sewers installed. Both of these locations have catchment areas less than 2.0 ha and the future road area is a significant part of the total area in both cases. Although the magnitudes of the flows are small, the downstream watercourses are poorly defined and they are connected to designated wetland areas on Tiffany Creek to the south.

The results of the analysis for the Ancaster Creek watershed are summarized in Table 5.2. The future downstream flows will be significantly reduced at culverts C14, C16, C17 and C18 in the Ancaster Creek watershed because the future Garner Road storm sewers will bypass these culverts to discharge to the principal drainage outlets. This does not constitute a diversion of flows from the existing outlets because these smaller culverts are now connected through roadside ditches to the same outlets. These culverts will be retained in the future design to accommodate external area flows.

At the remaining two outlets in the Ancaster Creek system (culverts C15 and C19), future peak flows will increase as a result of the discharge of the Garner Road storm sewers at these locations. The C15 outlet is on the East Tributary of the East Ancaster Creek and it has been determined that peak flow controls are not required at this location. However, at the C19 outlet on East Ancaster Creek, the peak flow increases may have a detrimental impact on the downstream watercourse.

Table 5.1: Garner Road Tiffany Creek Culverts - Downstream Flows

No.	Sta.	Case	Cchmt Area	Design Event							Reg. Storm	Comments
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	(m ³ /s)		
			(ha)	(m ³ /s)	(m ³ /s)	(m ³ /s)	(m ³ /s)	(m ³ /s)	(m ³ /s)	(m ³ /s)		
C7	3+694	Exist.	147.90	1.058	1.875	2.467	3.281	3.858	4.454	10.506	Future condition includes Garner Rd. storm sewers from Sta. 3+270 to Sta. 3+880	
		Future	149.96	1.057	1.870	2.460	3.270	3.845	4.438	10.436		
C8	3+270	Exist.	1.46	0.061	0.110	0.140	0.180	0.210	0.242	-	Future storm sewers to Raymond Road (Ancaster Meadow Phase1)	
		Future	1.29	0.028	0.051	0.069	0.094	0.112	0.131	-		
C9	3+040	Exist.	0.81	0.045	0.074	0.094	0.122	0.142	0.164	-	Future storm sewers to Raymond Road (Ancaster Meadow Phase1)	
		Future	0.35	0.013	0.023	0.031	0.043	0.051	0.060	-		
C10	2+845	Exist.	1.53	0.075	0.128	0.164	0.214	0.249	0.289	-	Road drainage only after full development of u/s area; divert 115 m of road drainage to Raymond Rd.	
		Future	1.69	0.132	0.199	0.246	0.310	0.350	0.403	-		
		Future Mitigation	0.81	0.079	0.125	0.157	0.202	0.235	0.268	-		
C11	2+620	Exist.	1.73	0.117	0.195	0.247	0.318	0.367	0.419	-	Road drainage only after full development of u/s area	
		Future	1.86	0.159	0.247	0.308	0.388	0.445	0.502	-		
		Future Mitigation	0.67	0.080	0.121	0.145	0.177	0.199	0.222	-		
C12	2+346	Exist.	9.32	0.287	0.502	0.652	0.866	1.018	1.163	1.265	Future u/s area reduced; diversion to Bungalows of Ancaster South SWM pond	
		Future	7.08	0.263	0.446	0.607	0.816	0.964	1.125	0.950		

No.	Sta.	Case	Cchmt Area	Design Event							Comments
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	Reg. Storm	
			(ha)	(m ³ /s)	(m ³ /s)	(m ³ /s)	(m ³ /s)	(m ³ /s)	(m ³ /s)	(m ³ /s)	
C13	1+190	Pre-Dev.	15.42	0.318	0.580	0.781	1.066	1.274	1.487	1.714	Prior to development and SWM pond
		Exist.	14.94	0.193	0.363	0.534	0.787	0.991	1.195	1.534	OK. Q2 less than pre-development Q2.
		Future	15.03	0.204	0.358	0.530	0.779	0.981	1.173	1.529	

Table 5.2: Garner Road Ancaster Creek Culverts - Downstream Flows

No.	Sta.	Case	Cchmt Area (ha)	Design Event							Reg. Storm (m ³ /s)	Comments
				2-yr (m ³ /s)	5-yr (m ³ /s)	10-yr (m ³ /s)	25-yr (m ³ /s)	50-yr (m ³ /s)	100-yr (m ³ /s)			
Outlets to East Ancaster Creek East Tributary												
C14	1+364	Exist.	2.42	0.090	0.160	0.203	0.261	0.301	0.347		Future storm sewers to C15	
		Future	1.52	0.028	0.053	0.073	0.130	0.122	0.144			
C15	1+176	Exist.	23.58	0.375	0.679	0.912	1.240	1.477	1.724	2.737	Future includes diversion to Kitty Murray Lane of local major system and 0.055 m ³ /s to existing storm sewers. Peak flow control not required based on study of East Tributary of Ancaster Creek.	
		Future	24.28	0.475	0.773	0.965	1.258	1.495	1.744	2.805		
C16		Exist.	14.06	0.213	0.383	0.514	0.699	0.832	0.977	1.598	Southcote Rd. south of Garner. Future storm sewers to C15	
		Future	12.85	0.191	0.353	0.476	0.649	0.702	0.907	1.473		
C17	0+851	Exist.	2.69	0.083	0.149	0.192	0.251	0.292	0.338		Future storm sewers to C19	
		Future	2.73	0.040	0.075	0.101	0.140	0.168	0.197			
Outlets to East Ancaster Creek												
C18	0+665	Exist.	2.23	0.089	0.160	0.203	0.262	0.303	0.350	-	Future storm sewers to C19	
		Future	2.28	0.029	0.055	0.075	0.015	0.127	0.150	-		
C19	0+338	Exist.	121.91	1.441	2.895	4.023	5.627	6.798	8.028	14.046	Future condition includes Garner Rd. storm sewer drainage from Sta 0+000 to Sta 1+170 (west of Southcote Rd.)	
		Future	125.35	1.456	2.921	4.054	5.668	6.843	8.081	14.167		
		Future Mitigation	122.25	1.424	2.870	3.984	5.569	6.724	7.942	13.861	Diversion of Q5 and ½ of major system flows to John Frederick Dr. (Ancaster Glen Phase 2)	

The Rymal Road outlet to the Twenty Mile Creek system consists of a 3000 mm x 1800 mm concrete box storm sewer, which discharges to Pond C in the St. Elizabeth Village. This pond system is presently under study by the City of Hamilton (AECOM) to identify existing erosion and flooding problems and to recommend operational improvements and maintenance requirements. A hydrologic model (QUALHYMO) has been prepared for the St. Elizabeth Village study and the model and catchment definition was obtained for use in the present EA study. The QUALHYMO parameter data are comparable to OTTHYMO parameters, allowing the AECOM model to be converted directly to the OTTHYMO format to create an existing condition model for Pond C. The pond rating curve data were taken directly from the AECOM model. The catchment areas containing Rymal Road and Garth Street were identified and the degree of imperviousness in each was increased to represent the proposed road improvements to create the future condition model. The existing and future conditions were analyzed with these models to determine the impact of the proposed road improvements on the St. Elizabeth Village pond system.

The results of the analysis are summarized in Table 5.3. Peak inflows to the pond immediately adjacent to Rymal Road, to which runoff from Rymal Road would flow (Pond C) are predicted to increase in the future from 7.8% to 3.4% for the 2-year to 100-year design events, although the corresponding inflow volumes increased by 2.1% or less. The peak flow discharges from the pond will increase from 4.6% for the 2-year event to a low of 2% for the 5-year event. The estimated total future pond volume used ranges from 0.295 ha-m to 0.86 ha-m, representing percentage increases of 5.0% for the 2-year event to 0.6% for the 100-year event. The largest percentage increase in volume used occurs for the 2-year and 5-year events, even though the relative increase in inflow volumes is about the same for all events. This reflects the design of the outlet control structure to have a greater flow control function for the smaller events.

Based on these results, it would appear that the impact of the future Rymal Road and Garth Street improvements on Pond C in St. Elizabeth Village will not be significant, particularly for the larger storm events. The small increase in the total pond volume for the 100-year event will result in a negligible increase in the maximum water level. Furthermore, the relative impact will be further diminished in the pond system downstream of Pond C. However, water levels corresponding to smaller design events in the 2-year to 5-year range may show a greater increase and may affect considerations for the redesign of the pond outlet control structure and measures for flooding and erosion control currently being considered for the pond system. Peak flow conveyance downstream of Pond C may also be affected by flow increases in the order of 3% to 4%, assuming there is no modification to the pond volume or outlet control structure.

Table 5.3: Impact on St. Elizabeth Pond C

Design Storm	Condition	Peak Inflow (m ³ /s)	Peak Outflow (m ³ /s)	Inflow Volume (mm)	Pond Volume Used (ha-m)
2-yr	Existing	5.164	4.235	24.92	0.281
	Future	5.567	4.430	25.58	0.295
	% Change	7.8	4.6	1.0	5.0
5-yr	Existing	8.596	6.304	39.09	0.608
	Future	9.124	6.429	39.90	0.629
	% Change	6.1	2.0	2.1	3.5
10-yr	Existing	11.362	9.354	48.98	0.744
	Future	11.931	9.645	49.86	0.748
	% Change	5.0	3.1	1.8	0.5
25-yr	Existing	14.702	13.303	62.28	0.805
	Future	15.283	13.797	63.26	0.809
	% Change	4.0	3.7	1.6	0.5
50-yr	Existing	17.137	16.367	71.60	0.831
	Future	17.753	16.981	72.63	0.837
	% Change	3.6	3.8	1.0	0.7
100-yr	Existing	19.552	19.070	81.16	0.855
	Future	20.222	19.713	82.25	0.860
	% Change	3.4	3.4	1.3	0.6

Culvert Improvements

The future design flows were used to analyze potential impacts on the cross culverts that will be retained for the Garner Road section of the project. Design flows were based upon the future road widening and road storm sewer drainage connected to the culverts. In addition to hydraulic capacity, the condition of the existing culvert and physical constraints such as the depth of cover were also considered in the evaluation. Culverts that are in poor condition or are too shallow for construction of the new roadway were recommended for replacement.

The results for the hydraulic analysis of the culverts are shown in Table 5.4. Only culverts C9 and C13 may be retained. All of the smaller culverts (700 mm to 800 mm

diameter CSP's) are recommended for replacement with concrete pipes of equivalent diameter. At the existing 800 mm corrugated steel pipe (CSP) culvert C 15 on the East tributary of East Ancaster Creek, future road overtopping is predicted for the 50 year event. It is recommended that this culvert be replaced with a 1000 mm concrete pipe to provide the 50-year capacity and protection against road overtopping for the Regional Storm. At the Tiffany Creek crossing (culvert C7), the existing culvert has less than a 50-year capacity and the road will overtop by a depth of 0.3 m for the Regional Storm. This culvert is also very shallow, which may interfere with the construction of the new roadway widening. At this location, it is recommended that the existing culvert be replaced by a 2400 mm x 1220 mm concrete open footing box culvert with the invert filled to a depth of about 300 mm with round stone to provide an effective hydraulic opening 900 mm high. To provide additional cover, the invert should be lowered by about 150 mm. At the East Ancaster Creek crossing (culvert C19) the freeboard for the 100-year storm is inadequate and the road overtops for the Regional Storm. This culvert is also too shallow for future road construction. As a result, it is recommended that this culvert be replaced with a 3660 mm x 1220 mm concrete open footing box culvert.

Drainage Improvements

Future peak flows are predicted to increase significantly at culverts C10 and C11 after the roadway is reconstructed and storm sewers installed. Lands on the north side of Garner Road at these locations are part of the Meadowlands Neighbourhood 4 planning area. According to the Master Plan for these lands, the drainage north of Garner Road will be taken to the north. When this development occurs, the remaining drainage area to these outlets will consist entirely of Garner Road storm sewer discharge. Therefore, future flows to these outlets will be reduced after the upstream lands develop. At culvert C10, it is also possible to divert about 100 m of road drainage by connecting the storm sewers from this area to the Raymond Road storm sewer. As a result of these considerations, the ultimate flows to these outlets will be less than the current conditions after full development of the lands north of Garner Road and construction of the Garner Road storm sewers. However, if the Garner Road widening takes place before the upstream development, or only part of the Garner Road frontage is diverted to the north, additional erosion control measures may be required in the stream channels immediately downstream of these outlets.

At the west end of the project at the East Ancaster Creek outlet (culvert C19), peak flow increases can be mitigated by diverting the storm sewers from Garner Road to the north at the future John Frederick Drive in the Ancaster Glen Phase 2 development. This would have the additional benefit of providing water quality treatment for some of the Garner Road drainage in the proposed stormwater management pond in this development. The design data for the Ancaster Glen Phase 2 stormwater management pond were obtained from the Ancaster Glen Phase 2 Functional Servicing Study Addendum Phase 2 Update (MTE Ltd. 2012). To analyze the impact of the additional flows on the Ancaster Glen pond, a hydrologic model was prepared from this data and verified against the results in the report. Additional drainage area representing storm sewer flow diversion from Garner Road was then added to the model with the purpose of determining the impact of the additional drainage area on the Ancaster pond.

The standard for the Garner Road storm sewers is for a 5-year design capacity. However, the Ancaster Glen pond has been designed to control the 2-year flows from the subdivision area. Therefore, four design scenarios were evaluated: diversion of Garner Road flows up to the 2-year level and analyzed for the 2-year and 5-year design storms and diversion of Garner Road flows up to the 5-year level, also analyzed for the 2-year and 5-year design storms. For consistency with the functional design report, the 4-hour Chicago Storm was used.

The results are summarized in Table 5.5. If only the 2-year flows are diverted from Garner Road, the pond volume used for the 2-year event would increase by about 400 m³ (12.9%). For the 5-year event, the total pond volume used would increase by only 191 m³ (4.1%). If the 5-year flow is diverted from Garner Road, the pond volumes increase very little over the 2-year diversion scenario. It would appear that it is feasible to consider the diversion of the Garner Road storm sewers to the Ancaster Glen South pond facility with relatively minor changes to the pond area and outlet control structure. It is recommended that the pond design be reviewed to confirm the feasibility of this revised design.

The diversion of storm sewer flows to John Frederick Drive will reduce flows to the East Ancaster Creek outlet C19. For the future condition, it was also assumed that the major system flows from the North side of Garner Road would be diverted to John Frederick Drive, although this will not affect the pond operation. The result of these measures is that the future flows downstream of culvert C19 will be slightly lower than the existing flows.

Water Quality Treatment

The water quality treatment target for the watersheds study area is enhanced Level 1 treatment, based on the City of Hamilton and conservation authority design criteria. Opportunities for stormwater treatment for road projects are limited by the spatial constraints of the road right-of-way. Ideally, stormwater management for roadways would be incorporated into conventional stormwater treatment for the adjacent development areas. For the Garner Road section of the project, this is proposed for the areas draining to the future Raymond Road storm sewer (Ancaster Meadow Phase 1), and a small section at Kitty Murray Lane connected to the Bungalows of Ancaster stormwater management facility. It is also proposed to direct Garner Road drainage to the Ancaster South stormwater management pond at John Frederick Drive. There is a stormwater management facility currently proposed on the north side of Garner Road near Springbrook Avenue. It may be possible to direct some of the Garner Road drainage to this facility but this has not yet been confirmed.

For the remaining sections of Garner Road, feasible measures are generally restricted to linear storage and infiltration type devices such as bio retention swales and exfiltration pipes or oil grit separators at the storm sewer outlets. Bio retention swales would increase the width of the required road platform by about 4 m which would extend beyond the available space within the proposed 36 m right-of-way. Exfiltration pipes and other infiltration type systems require pre-treatment to remove sediments and are not generally recommended for roadway drainage systems due to maintenance concerns. For these reasons, recommended stormwater treatment method for the Garner Road

drainage areas are not connected to other stormwater management facilities is oil grit separators at the storm sewer outlets.

For the Rymal Road and Garth Street sections in the Twenty Mile Creek watershed, stormwater treatment will be provided by the existing ponds and St. Elizabeth village. For Garth Street North and the East end of Rymal road, the storm sewers will be connected into the existing storm sewer systems of the Upper Ottawa Creek watershed and no additional stormwater management is proposed at these locations.

Table 5.4: Hydraulic Analysis of Centerline Culverts – Future Condition

Culvert ID	Station (sta-m)	Type	Size		Fut. Length (m)	Invert Elevations		U/S Culvert Obvert Elevation (m)	Centerline Road Elevation [1] (m)	Min. Road Elevation [2] (m)	Computed U/S Water Elevation			Culvert Clearance [3]		Freeboard [4]			Comments
			Width (mm)	Height (mm)		U/S (m)	D/S (m)				50 yr (m)	100 yr (m)	Reg. St (m)	50 yr (m)	100 yr (m)	50 yr (m)	100 yr (m)	Reg. St (m)	
C7 Existing	3+695	Conc. Box	1800	900	20.87	228.98	228.90	229.88	230.76	230.63	230.20	230.38	230.93	-0.32	-0.50	0.43	0.25	-0.30	>Q50 capacity; too shallow for road construction - Replace
C7 Proposed	3+695	Conc. Box	2400	1220	40.0	228.83	228.75	230.05	230.76	230.63	229.84	229.97	230.88	0.21	0.08	0.79	0.66	-0.25	Lower invert by 0.15m; fill base with round stone to depth of 0.3m. May connect storm sewers.
C8	3+269	CSP		800	39.0	235.96	235.85	236.76	237.86	237.78	236.21	236.23	n/a	0.55	0.53	1.57	1.55	n/a	Culvert damaged - replace; Storm sewers to Raymond Rd.
C9	3+040	CSP		750	35.0	238.30	238.19	239.05	239.76	239.63	238.47	238.49	n/a	0.58	0.56	1.16	1.14	n/a	Extend Culvert; Storm sewers to Raymond Rd.
C10	2+842	CSP		800	38.0	238.85	238.34	239.65	241.32	241.23	239.11	239.14	n/a	0.54	0.51	2.12	2.09	n/a	Culvert damaged - replace; May connect storm sewers
C11	2+619	CSP		800	38.0	241.42	241.06	242.22	243.30	243.15	242.56	242.58	n/a	-0.34	-0.36	0.59	0.57	n/a	Culvert damaged; replace
C11	2+619	Conc.		800	38.0	241.42	241.06	242.22	243.30	243.15	242.55	242.57	n/a	-0.33	-0.35	0.60	0.58	n/a	May connect connect storm sewers.
C12 Existing	2+345	CSP		800	15.4	242.80	242.31	243.60	245.00	244.91	243.70	243.95	n/a	-0.10	-0.35	1.21	0.96	n/a	d/s ditch eliminated by widening; small driveway culvert d/s.
C12 Proposed	2+345	Conc.		800	35.0	242.80	242.31	243.60	245.00	244.91	243.67	243.76	n/a	-0.07	-0.16	1.24	1.15	n/a	<Q50 Capacity. Relocate 20m east; May connect connect storm sewers.
C13	1+960	CSP		1,000	38.0	244.00	243.98	245.00	246.70	246.51	245.57	245.65	n/a	-0.57	-0.65	0.94	0.86	n/a	Pipes are new; Capacity <Q25 but freeboard is adequate. Extend culverts.
	1+960	CSP		600	38.0	244.00	243.98	244.60	246.70	246.51	245.57	245.65	n/a	-0.97	-1.05	0.94	0.86	n/a	
C14	1+364	CSP		700	36.8	247.92	247.77	248.62	249.25	249.25	248.29	248.33	n/a	0.33	0.29	0.96	0.92	n/a	Capacity OK. Cover < 0.5m. Replace at lower elevation with DI u/s. Storm sewers to C15.
C15 Existing	1+176	CSP		800	44.8	245.65	245.38	246.45	248.52	248.52	248.51	248.53	n/a	-2.06	-2.08	0.01	-0.01	n/a	Road may overtop for Q50. Inadequate capacity. Replace
C15 Proposed	1+176	Conc.		1,000	44.8	245.65	245.38	246.65	248.65	248.65	246.75	246.89	247.60	-0.10	-0.24	1.90	1.76	1.05	Q50 Capacity + Storm sewer connections; No overtopping for Reg. Storm.
C16	1+203 rt	CSP		600	19.25	246.62	246.54	247.22	248.59	248.59	248.08	248.09	n/a	-0.86	-0.87	0.51	0.50	n/a	Culvert located on Southcote Rd. Culvert damaged. Replace.
C16 Proposed	1+203 rt	Conc.		800	19.25	246.62	246.54	247.42	248.59	248.59	247.31	247.48	n/a	0.11	-0.06	1.28	1.11	n/a	Q50 capacity
C17	0+850	CSP		800	33.6	246.01	245.79	246.81	247.86	247.86	246.40	246.44	n/a	0.41	0.37	1.46	1.42	n/a	Culvert damaged; too shallow for future road construction. Replace at lower elevation with DI upstream.
C18	0+665	CSP		700	24.33	245.41	245.21	246.11	247.10	247.10	245.77	245.80	n/a	0.34	0.31	1.33	1.30	n/a	Culvert damaged; too shallow for future road construction. Replace at lower elevation with DI upstream.
C19	0+338	CSPA	2,440	1,750	42.0	239.83	239.23	241.58	242.02	241.98	241.65	241.86	242.11	-0.07	-0.28	0.33	0.12	-0.13	Too shallow for future road construction; Freeboard inadequate. Replace.
C19 Proposed	0+338	Conc. Box	3,600	1,220	42.0	239.83	239.23	241.05	242.02	241.98	241.00	241.13	241.62	0.05	-0.08	0.98	0.85	0.36	Q50 capacity (including storm sewers); No overtopping for Reg. Storm.

Notes:
 [1] Distance from water elevation to culvert obvert.
 [2] Distance from water elevation to minimum road EOP elevation.
 [3] Centerline Road elevation adjacent to culvert
 [4] Minimum road elevation for freeboard calculation.

Table 5.5: Ancaster Glen South Pond Analysis

Case	Description		Q2-yr			Q5-yr		
	Design Storm	Diversion Flow to John Frederick Rd. (m ³ /s)	Pond Inflow (m ³ /s)	Pond Outflow (m ³ /s)	Total Storage Volume (ha-m)	Pond Inflow (m ³ /s)	Pond Outflow (m ³ /s)	Total Storage Volume (ha-m)
MTE Study (2012)	Chicago 4hr	-	1.37	0.038	0.3014	-	-	-
EA Study Model Verification	Chicago 4hr	-	1.38	0.038	0.3004	2.08	1.20	0.4621
Flow Diversion Option 1	Chicago 4hr	Q2 = 0.294	1.61	0.040	0.3404 (+13.4%)	2.35	0.177	0.4812 (+4.1%)
Flow Diversion Option 2	Chicago 4hr	Q5 = 0.434	1.61	0.040	0.3404 (+13.4%)	2.48	0.181	0.4825 (+4.4%)

Proposed Drainage and Stormwater Management Plan

The recommended future drainage improvements for Garner Road, Rymal Road and Garth Street include new crossing culverts and storm sewers on Garner Road, new storm sewers and storm relief sewers on Rymal Road, and ditch inlets at a number of locations to accommodate flows from external areas. The details of the proposed drainage systems are shown on the road design plates and summarized in Table 5.6.

Most of the crossing culverts are recommended for replacement due to poor condition, lack of hydraulic capacity or insufficient depth for the new road construction. Larger replacement culverts are recommended at the East Ancaster Creek outlet (culvert C19), the East Ancaster Creek East Tributary outlet (culvert C 15) and the Tiffany Creek outlet (culvert C7).

The existing storm sewers have been utilized throughout. However, additional storm sewer capacity will be added to the section of Rymal Road discharging to the Twenty Mile Creek outlet at the St. Elizabeth Village Pond C. This will provide hydraulic relief to the existing Rymal Road storm sewer and reduce the flooding on Upper Paradise Road.

Water quality treatment will be provided in the adjacent subdivisions where possible. This is proposed at Raymond Road, Kitty Murray Lane, and John Frederick Drive. On the remaining sections of Garner Road, oil grit separators (OGS) will be utilized at the storm sewer outlets. For the Rymal Road and Garth Street sections in the Twenty Mile Creek watershed, stormwater treatment will be provided by the existing ponds at St.

Elizabeth Village. For Garth Street north and the east end of Rymal Road, the storm sewers will be connected into the existing storm sewer systems of the Upper Ottawa Creek watershed and no additional stormwater management is proposed at these locations.

Table 5.6: Drainage and Stormwater Management Plan Summary

Outlet	Road Segment	Culvert	Minor System	Major System	SWM Treatment	Comments
Ancaster Creek Watershed						
C19 (Sta. 0+388) Ancaster Creek East Branch	Sta 0+734 to 0+388	Replace existing 2440mm x 1750mm CSPA with twin 1800m x 900m Open Footing Box Structure	Connect storm sewer to new culvert	To existing outlet to East Ancaster Creek at C19 (Sta 0+388)	OGS	<ul style="list-style-type: none"> • Culvert replacement due to lack of cover for new road. • Provide freeboard for 100-yr design.
C18 (Sta. 0+665)	n/a	Replace existing 700mm CSP with 800mm CP with u/s DI	No minor system connection	To existing outlet at C19 (Sta 0+388)	n/a	<ul style="list-style-type: none"> • Existing culvert is damaged. • Drains upstream external area only. • Deepen culvert to provide adequate clearance for new road structure.

Outlet	Road Segment	Culvert	Minor System	Major System	SWM Treatment	Comments
Future John Frederick Drive (0+734)	Sta 1+170 to 0+734	n/a	Connect storm sewers to future storm sewer on John Frederick Dr.	North side major system to John Frederick Dr.; south side to C19 (Sta 0+388)	Connection to Ancaster Glen SWM Pond 2	<ul style="list-style-type: none"> • Review design of Ancaster Glen Pond 2 with the proposed Garner Rd. drainage connection. • Estimated maximum additional volume is 210 m³ for the 5-year design
C17 (Sta. 0+850)	n/a	Replace existing 800mm CSP with 800mm CP with u/s DI	No minor system connection	To existing outlet at C19 (Sta 0+388)	n/a	<ul style="list-style-type: none"> • Existing culvert is damaged. • Drains upstream external area only. • Deepen culvert to provide adequate clearance for new road structure.

Outlet	Road Segment	Culvert	Minor System	Major System	SWM Treatment	Comments
C15 (Sta. 1+176) Ancaster Creek East Branch - East Tributary	Sta 1+760 to 1+176	Replace existing 800mm CSP with 1000mm CP	Connect storm sewer to new culvert. Connect north side road drainage from Sta 1+760 to Sta 1+614 to existing Kitty Murray Lane storm sewer	Outlet to Kitty Murray Lane/ Smith Road (Sta 1+614) and C15 (Sta 1+176)	OGS	<ul style="list-style-type: none"> • Culvert replacement due to insufficient capacity • Provide freeboard for 100-yr design. • Diversion of storm sewer flow to Kitty Murray Lane up to design allowance of 55 L/s. • Local peak flow increases but quantity control is not required on this watercourse, per Garner Neighbourhood Master Drainage Plan. • Provide erosion control in d/s watercourse.

Outlet	Road Segment	Culvert	Minor System	Major System	SWM Treatment	Comments
C14 (Sta 1+364)	n/a	Replace existing 700mm CSP with 800mm CP with u/s DI	No minor system connection	To existing outlet at C15 (Sta 1+176)	n/a	<ul style="list-style-type: none"> • Drains upstream external area only. • Deepen culvert to provide adequate clearance for new road structure.
Tiffany Creek Watershed						
C13 (Sta 1+960)	Sta 1+760 to 1+960	Existing 1000mm + 600mm culverts are adequate	Connect storm sewer to new culvert	To existing outlet at C13 (Sta 1+960)	OGS	<ul style="list-style-type: none"> • D/s of existing Bungalows of Ancaster SWM pond
C12 (Sta 2+346)	Sta 1+960 to 2+425	Replace existing 800mm CSP with 800mm CP located 24m east at Sta 2+370	Connect storm sewers to new culvert	To existing outlet at Sta 2+360	2 OGS (east and west)	<ul style="list-style-type: none"> • Future upstream area reduced due to partial diversion to Bungalows of Ancaster SWM pond. • Remaining area assumed to be equivalent to pre-development conditions.
C11 (Sta 2+620)	Sta 2+425 to 2+620	Replace existing 800mm CSP with 800mm CP	Connect storm sewer to new culvert	To existing outlet at Sta 2+620	OGS	<ul style="list-style-type: none"> • Culvert damaged. • Provide erosion control in d/s watercourse.

Outlet	Road Segment	Culvert	Minor System	Major System	SWM Treatment	Comments
C10 (Sta 2+842)	Sta 2+620 to 2+870	Replace existing 800mm CSP with 800mm CP	<ul style="list-style-type: none"> • Convey Road drainage from Sta 2+750 to 2+870 to Raymond Road outlet • Connect storm sewer to new culvert 	To existing outlet at Sta 2+870	OGS	<ul style="list-style-type: none"> • Culvert damage. • Provide erosion control in d/s watercourse.
C9 (Sta 3+040)	n/a	Extend existing 750mm CSP culvert	No minor system connection	To Raymond Road.	To Ancaster Meadow Phase 1 SWM	<ul style="list-style-type: none"> • The existing Raymond Road storm sewer design includes drainage from Garner Rd.
Raymond Road (Sta 3+125)	Sta 2+750 to 3+265	Existing 600mm storm sewer	Connect Garner Road storm sewers from west of C10 to C8	To Raymond Road	To Ancaster Meadow Phase 1 SWM	<ul style="list-style-type: none"> • Garner Rd. drainage to the existing Raymond Road storm sewer up to the design allowance of 0.37 m³/s.
C8 (Sta 3+270)	n/a	Replace existing 800mm CSP with 800mm CP	No minor system connection	To Tiffany Creek C7 (Sta 3+694)	OGS at C7 outlet	<ul style="list-style-type: none"> • The existing Raymond Road storm sewer design includes drainage from Garner Road.

Outlet	Road Segment	Culvert	Minor System	Major System	SWM Treatment	Comments
C7 (Sta 3+270)	Sta 3+265 to 3+880	Replace existing 1800mm x 900mm structure with 2400mm x 1200mm Conc. Open Footing Box Structure	Connect storm sewer to new culvert	To existing Tiffany Creek C7 outlet (Sta 3+694)	2 OGS (east and west)	<ul style="list-style-type: none"> Existing culvert may be too shallow for road widening and reconstruction. Lower invert by 0.15 m. Fill bottom with round stone to provide a minimum conveyance depth of 900 mm.
Twenty Mile Creek Watershed						
Garth Street storm sewers (Sta 4+990)	Sta 0+480 to 0+000	Use existing storm sewers	Connect all of the new road drainage to the existing storm sewers	To existing outlet at St. Elizabeth Village Pond C (Rymal Sta 5+078)	Treatment in existing St. Elizabeth Village pond system	<ul style="list-style-type: none"> Existing storm sewers are adequate for the future road widening.

Outlet	Road Segment	Culvert	Minor System	Major System	SWM Treatment	Comments
Rymal Road West storm sewers (Sta 5+348)	Sta 3+880 to 5+535	New storm sewers for Rymal Road drainage	Connect all of Rymal Road drainage and external areas to the new storm sewers. Cross over existing Rymal Road Box storm sewer	To existing outlet at St. Elizabeth Village Pond C (Sta 5+078)	Treatment in existing St. Elizabeth Village pond system	<ul style="list-style-type: none"> • Pick up Q100 from external area connections. • New storm sewer provides relief to the existing Rymal Road box storm sewer. • Possible over-sizing to provide additional relief – to be addressed in preliminary design.
C6 (Sta 4+230)	Sta 3+880 to 4+253	Replace existing 1500mm CSP with a Ditch Inlet and 600mm CP	Connect to new Rymal Road storm sewer	To existing outlet at St. Elizabeth Village Pond C (Sta 5+078)	Treatment in existing St. Elizabeth Village pond system	<ul style="list-style-type: none"> • External drainage area only. • Pre-development area reduced by construction of Upper Paradise Storm sewer south of Rymal Road. • Design for Q100 external area flow.

Outlet	Road Segment	Culvert	Minor System	Major System	SWM Treatment	Comments
C5 (Sta 4+500)	Sta 4+253 to 4+565	Replace existing 1200mm CSP with a Ditch Inlet and 600mm CP	Connect to new Rymal Road storm sewer	To existing outlet at St. Elizabeth Village Pond C (Sta 5+078)	Treatment in existing St. Elizabeth Village pond system	<ul style="list-style-type: none"> • External drainage area only. • Design for Q100 external area flow.
C4 (Sta 4+903)	Sta 4+565 to 4+990	Replace existing 1200mm CSP with a Ditch Inlet and 600mm CP	Connect to new Rymal Road storm sewer	To existing outlet at St. Elizabeth Village Pond C (Sta 5+078)	Treatment in existing St. Elizabeth Village pond system.	<ul style="list-style-type: none"> • External drainage area only. • Design for Q100 external area flow.
C3 Sta 5+078)	n/a	Extend existing 920mm x 920mm conc. Box Culvert	No minor system connection	To existing outlet at St. Elizabeth Village Pond C (Sta 5+078)	Treatment in existing St. Elizabeth Village pond system.	<ul style="list-style-type: none"> • External drainage area only. • Design for Q100 external area flow.
C2 (Sta 5+348)	n/a	Replace existing 450mm CSP with a Ditch Inlet and 450mm Conc. pipe	Connect to new Rymal Road storm sewer	To existing outlet at St. Elizabeth Village Pond C (Sta 5+078)	Treatment in existing St. Elizabeth Village pond system.	<ul style="list-style-type: none"> • External drainage area only. • Design for Q100 external area flow.

Outlet	Road Segment	Culvert	Minor System	Major System	SWM Treatment	Comments
Upper Ottawa Creek Watershed						
Garth Street storm sewers (Sta 1+020)	Sta 0+480 to 1+020	Use existing storm sewers	Connect all of the new road drainage to the existing storm sewers	To existing Garth Street outlet at Stone Church Road	Treatment in existing d/s storm sewer system	<ul style="list-style-type: none"> Existing storm sewers are adequate for the 5-year design flow and future road widening. Relief storm sewer may be required for Q100 from sag at 0+900 to outlet – to be addressed in preliminary design.
Rymal Road East (Sta 6+225)	Sta 5+535 to 6+225	Use existing storm sewers	Connect to existing storm sewers.	To existing outlet west on Rymal Road	Treatment in existing d/s storm sewer system	
C1 (Sta 6+093)	n/a	Replace existing 450mm CSP with a Ditch Inlet and 450mm Conc. pipe	Connect to new Rymal Road storm sewer	To existing outlet west on Rymal Road		<ul style="list-style-type: none"> External drainage area only. Design for Q100 external area flow.

5.1.4 Municipal Services and Utilities

The existing municipal services and utilities identified under Section 3.2.3 are within the road corridors and can be accommodated within the City's 36 m road allowance. The existing services and utilities will be retained in their existing location if they are not in conflict with the proposed road widening. The exact location of these existing services and utilities and any new services have to be confirmed with the stakeholders during

Detail Design phase so as to identify any relocation requirements prior to the road widening.

Initial investigation indicates that the following services and utilities will require either relocation or adjustment.

Hydro/Bell/Cable

The proposed road widening requires relocation of the majority of the hydro poles, which will trigger the relocation of Bell and Cable aerial lines that are attached to the same hydro poles. It is quite likely that the associated buried cables, if any, will also require relocation.

Gas Mains/Sanitary Sewers/Watermains

These underground utilities may need adjustment and/or relocation, the need for which will be determined during the Detail Design phase.

Storm Sewers

For the details on the storm sewers required for the road widening, please see Section 5.1.3. On Garner Road, new storm sewers are required throughout. A few locations on Rymal Road will also require new storm sewers. However, for most of Rymal Road and all of Garth Street, the existing storm sewers will be used and supplemented with relief pipes in locations where the existing sewers are not adequate for the future roadway. A conceptual design of the storm sewer pipe sizes and layout has been prepared at this time. The invert elevations and the exact location of the new storm sewers will be refined during the Detail Design phase in conjunction with the identification of any utility conflicts.

5.1.5 Illumination

There is no existing lighting on the section of Garner Road East in the study area, except at the signalized intersections, while street lighting is provided on the existing section of Rymal Road West. There is also no lighting on Garth Street from Rymal Road West to Stone Church Road, except at the Garth Street and Stone Church Road intersection.

For the urbanized cross-section, street lighting is likely to be required. It is recommended that the illumination requirement for the Garner Road East and Garth Street, based on the illumination warrants, should be determined during the Detail Design phase.

5.2 Potential Environmental Effects, Proposed Mitigation and Commitments to Further Work

The following sections of the ESR present a description of the potential environmental condition changes associated with the Preliminary Design scheme; the proposed environmental protection/mitigation measures to reduce or eliminate potential adverse effects; and commitments to additional investigations (including monitoring) and consultation.

5.2.1 Fish and Fish Habitat

Work in and around water features containing fish and fish habitat have the potential to result in changes that prevent the physical, biological or chemical attributes of fish habitat from providing food, reproduction, cover and movement corridors, or any change in fish habitat that reduces its capacity to support one or more of the life processes of fish. The proposed Garner/Rymal Road and Garth Street improvements may have the potential to adversely affect the aquatic environment and surface water quality.

There are four (4) subwatersheds located within the study area and there is a total of nine (9) stream crossings along Garner Road and Garth Street. The works for the proposed road widening include the replacement and/or extension of culverts, which will involve work within the watercourses, which will directly affect fish habitat. The works may also include activities near the watercourses, such as earth excavation/grading, excess material storage, equipment maintenance activities and wastewater management. All of these activities have the potential to impact fish by altering/removing their physical habitat (i.e., channel bed substrates, riparian vegetation, in-stream cover, etc.). Potential effects also include impairment of water quality and direct fish kills or destruction of habitat due to the inadvertent delivery of deleterious or toxic materials to the watercourse (e.g., chemical spills or sediment laden stormwater runoff), resulting in short term population decline.

In summary, potential effects to fish and fish habitat that are applicable to the proposed works include:

- Alteration/loss to riparian vegetation (potential loss of allochthonous inputs (food supply/sources) – leaf matter, terrestrial insects);
- Discharge of sediment to a watercourse from earth/spoil stockpiles, grading and excavation activities associated with the roadway improvements and associated culvert works, resulting in the impairment of water quality and/or physical damage to habitat;
- Release of fuel, oil, grease contaminants from mobile equipment, resulting in unacceptable contaminant concentrations in receiving watercourses;
- Displacement/stranding/mortality of fish during construction from the use of mobile equipment (pumps, backhoe, etc.); and
- Change to sensitive life stages/process (i.e., spawning) if in-water works are not timed appropriately.

Recommended environmental design and construction mitigation measures to avoid and/or minimize potential impacts to the aquatic environment and surface water for consideration in future phases of the project include:

- Design and install native woody riparian vegetation and groundcover to pre-construction conditions or better.
- Design and implement erosion and sediment controls to prevent erosion of exposed soils and migration of sediment to the watercourse.
- Implement timing restrictions (as determined by MNR) for any in-water work to protect sensitive life stages of fish. In-stream works in warmwater systems are permitted from July 1 to March 31 (Upper Ottawa Creek and Upper

- Twenty Mile Creek, Tiffany Creek). In-stream works in coldwater systems are permitted from July 1 to September 15 (Ancaster Creek).
- Isolate in-water work areas (work “in the dry”) during construction through temporary flow passage systems (e.g., by-pass pumping/fluming, cofferdam diversion channel) to maintain flow around the work zone at all times.
 - Store, handle and dispose of all excess materials in a manner that prevents their entry to the watercourse.
 - Operate, maintain and store all equipment and materials (e.g., fuel, lubricates) in a manner that prevents the entry of any deleterious substances to the watercourse.
 - Design and implement erosion and sediment control measures such as straw bale flow checks, silt fence, and temporary rock flow checks to prevent erosion of exposed soils and delivery of sediment to watercourses.
 - Stabilize and re-vegetate exposed soils immediately following construction.
 - Conduct work in a continuous fashion to minimize the duration of potential impacts and limit the area of disturbance to a minimum.
 - Design drainage and stormwater management systems to mimic overland drainage patterns and control the quality/quantity of runoff to watercourse features.
 - Store, handle and dispose of all excess/waste materials during site preparation, construction and operations in a manner that prevents their entry into watercourses.
 - Place temporary stockpiles of material a minimum of 30 m away from the watercourse and ensure that material is stabilized to prevent sediment laden runoff from entering watercourses.
 - Prepare a spill/emergency response plan for construction and operations.
 - Manage dewatering and concrete effluent, where applicable, from excavations and structural works to prevent release of contaminated water to receiving watercourses.
 - Direct dewatering effluent to temporary settling basins, filter bags and energy discharge diffusers, as required.
 - Capture and transport concrete effluent off-site for disposal.
 - Equipment re-fuelling and washing will take place no closer than 30 m from any watercourse to prevent water contamination due to accidental fuel spills and delivery of other contaminated runoff to watercourses.
 - Prohibit/limit construction access to watercourse/watercourse banks.

Scale of Negative Effects and Net Residual Effects

Remaining residual effects after the application of mitigation measures were assessed in terms of the resulting Scale of Negative Effect (extent, duration, and intensity) in the context of the fish habitat being affected (i.e., the sensitivity of fish and fish habitat). The Department of Fisheries and Oceans (DFO) Risk Management Framework, which incorporates the above two factors (i.e., Scale of Negative Effect and Sensitivity of Fish/Fish Habitat), was used to characterize the level of risk (high or low) that any residual effects after the application of mitigation pose to fish/fish habitat, and thus the

likelihood of a negative effect to fish habitat occurring as a result of the proposed works. Results from this assessment were then used to help determine whether the works will result in a low or high risk to fish habitat, as defined under the *Fisheries Act*.

The conservation authorities with jurisdiction in the study area (Hamilton Conservation Authority (HCA) and Niagara Peninsula Conservation Authority (NPCA)), have a Level 2 agreement in place with DFO. In accordance with the agreement and DFO's Risk Management Framework, HCA and NPCA will complete an aquatic effects assessment to determine potential impacts of the proposed work on fish and fish habitat during the Detail Design phase for the project. This process includes an assessment to determine the level of risk (high or low) that any residual effects after the application of mitigation pose to fish/fish habitat, and thus the likelihood of requiring a Fisheries Act Authorization for the proposed works.

From the preliminary assessment completed as part of this study it is expected the proposed work associated with the proposed road extension will be characterized as "Low Risk" by the conservation authorities and, as such, will not require an Authorization under the *Fisheries Act*, provided that the appropriate mitigation measures are applied. In conclusion, from the assessment conducted, no significant residual effects to surface water resources are anticipated from the project with implementation of the identified mitigation.

Monitoring

An environmental monitoring plan to assess the mitigation measures for protection of aquatic and surface water resources will be prepared, if needed, in future phases of the project.

Monitoring during construction is anticipated to focus on:

- Routine inspections of temporary erosion and sediment control measures to ensure that they are operating effectively to prevent any release of sediment laden runoff to watercourses.
- Monitoring of treatment systems for any dewatering and/or concrete effluent to avoid any release of contaminated water to receiving watercourses.
- Compliance monitoring of best management practices related to refuelling and excess materials storage and handling.

5.2.2 Vegetation Communities and Wildlife

Vegetation Communities

The majority of the vegetation communities within the study area are significantly degraded by historic residential/commercial development, or agricultural uses. Impacts to these communities from the implementation of Option 1 for the widening of Garner/Rymal Road and Garth Street will primarily be to roadside vegetation consisting of cultural meadow or thicket communities at the roadside, small meadow marsh communities associated with roadside ditches and watercourses, as well as manicured lawns and street trees. Principal areas of impacts to street trees will be along the existing boulevard and road edges on Rymal Road east of Glanaster Road and along the west side of Garth Street, as well as trees (including several large specimens) along

the rural residential properties and the Redeemer University College frontage on Garner Road between Kitty Murray Lane and Glanaster Road. The only remnant natural community directly affected by the proposed widening is the locally significant deciduous forest edge along the east side of Garth Street, where it is anticipated approximately 0.26 hectares of this vegetation unit will be removed as a result of the proposed works.

The following design and construction mitigation measure will be investigated./ implemented to minimize the effects of the new Garner/Rymal Rd and Garth Street alignments on the natural and/or semi-natural vegetative assemblies found within the project area.

- Minimize encroachment on, or avoid remnant woodlots and large healthy trees where possible. Individual specimens to be saved will be marked on the ground before construction takes place.
- Trees and areas to be preserved within and adjacent to the right-of-way will be identified in a Tree Protection Plan during Detail Design and protected with snow fence defining Tree Protection Zone(s) during construction.
- Designated staging, refuelling areas.
- Siltation control in areas where sedimentation could potentially affect vegetation not scheduled for removal.
- Stormwater management to minimize adverse effects to runoff water quality, and provide some peak flow controls, which will minimize impacts to nearby natural features.
- The movement of construction machinery will be limited to within the boundaries of the right-of-way and operated in a manner that minimizes damage to adjacent vegetation.
- Approval will be obtained, and compensation/reimbursement will be provided, as required, for displacement of publicly owned roadside trees on public property, in compliance with City of Hamilton's Public Tree Removal Policy, the Forest Management Plan (Reforestation Policy) and By-Law 06-151 (Public Trees By-Law), as amended.
- Roots and branches, if damaged, will be treated using approved horticultural methods.
- Tree management, as needed, to remove any potentially hazardous trees along new wooded edges, and maintain forest health and balance.
- Trees felled will be dropped to fall within the right-of-way to avoid damage to the remaining vegetation, where practicable.
- Retain dead standing trees for use by wildlife, where possible and there is no resultant safety hazard.
- Wherever possible, construction activities will be restricted within the dripline of all trees not scheduled for removal;
- No rare or endangered species have been identified within the study area. Specimens of rare or otherwise significant species, if observed, would be transplanted in nearby compatible habitat, where practical. The survival rate

- of any relocated rare and endangered species will also be monitored periodically.
- Inclusion of hard and soft landscaping in the corridor, including planting of additional street trees, where opportunities present themselves.
 - Where practicable, use only native species for landscaping efforts along the right-of-way.
 - Provide dense edge plantings in areas of fresh forest edge exposure to protect from drying winds, sun exposure (desiccation and spread of invasive sun-tolerant plant species), and salt spray. These plantings may constitute an exception to the native species mandate, since non-native conifers may provide better screening/protection than native options.
 - Return right-of-way to pre-construction conditions, where possible.

Monitoring

Environmental site inspections will be required during key construction periods and at key locations to ensure environmental protection/re-vegetation measures are implemented and working and any required remedial action is undertaken. If species at risk are identified within the influence zone of construction activities, MNR will be contacted to determine how specimens of such species should be treated.

Plantings of woody and herbaceous vegetation will be checked periodically for a period of one year to ensure an acceptable survival rate.

Wildlife

The impacts on wildlife, wildlife habitat resulting from this project are generally considered to be of minor significance; however, habitat loss will result along the preferred alignment. The following environmental protection measures designed to reduce or minimize vegetation removals/wildlife habitat will be considered on a site-specific basis during the Detail Design phase:

- Reduce grading requirements to the minimum extent possible;
- Work zones will be isolated using construction fencing, barrier fencing and silt fencing to avoid further encroachment on wildlife habitat;
- Prepare restoration, enhancement and streetscape plans to offset vegetation/habitat losses in order to achieve a net gain in vegetation/habitat area, attributes and functions;
- Prepare edge management plans for areas where encroachment on vegetation communities/habitat will occur;
- Engage in good housekeeping practices related to materials storage/stockpiling and equipment fuelling/ maintenance, during construction.

The Migratory Birds Convention Act (MBCA) prohibits the killing, capturing, injuring, taking or disturbing of migratory birds (including eggs) or the damaging, destroying, removing or disturbing of nests. To meet the requirements of the MBCA, no vegetation removals should occur during the nesting season. The critical nesting period for the study area is May 1 to July 31. This timing restriction will also protect the birds listed under the Fish and Wildlife Conservation Act.

To protect bird species, the following measures are proposed:

- Implement timing constraints so that no vegetation or buildings deemed to be suitable for migratory bird/avian SAR habitat will be removed during the bird breeding season (May 1 to July 31)¹⁴;
- If construction is scheduled to occur during the aforementioned restricted period, conduct a nest search of vegetation or buildings deemed to be suitable for migratory bird habitat; and
- Conduct a general site visit prior to May 1 in the first year of construction, if required, to inspect the structures scheduled for alteration or removal. If nesting is likely, the Contractor must install bird nesting preventative measures before May 1. The measures must remain in place until July 31. The Contractor will be responsible for installing and maintaining these measures during the bird breeding season.

The City of Hamilton will comply with the requirements of the Migratory Birds Convention Act with regard to the nesting season and, as a result, the proposed widening is not expected to have significant adverse effects on avian wildlife species/populations.

Monitoring

Monitoring of the migratory bird prevention measures will occur during the critical breeding/nesting period (May 1 – July 31) to ensure that the measures are effective in restricting nesting on structures scheduled for removal or alteration; thus, eliminating the potential for incidental take.

If any wildlife species, particularly nesting birds, are encountered during construction, a qualified biologist will be contacted immediately to identify the species encountered and ensure that the appropriate agencies are notified and arrangements are made with respect to the required action to be taken to minimize impacts to the species.

5.2.3 Hydrogeology

Along Garner Road, the Dundas re-entrant valley fringes upon the study area. The water table condition is depressed in the Dundas re-entrant valley owing to the drainage into this feature to the north. Thus, water table measurements tend to be lower than 5m below ground surface and water wells are constructed several metres below this depth. Based on the conceptual design of the preferred corridor; the excavation for the storm sewer would be above this depth and, therefore, the construction is unlikely to have a pronounced effect on the underlying resource(s).

Along Rymal Road, where municipal servicing is supplied, it is concluded that the proposed corridor construction will have a negligible impact on adjacent serviced properties. The glaciolacustrine plain is a low permeability feature and will limit the lateral extent of the construction influence. Construction during the summer season

¹⁴ Explanation for the Core Nesting Periods Table (Bird Conservation Region 13).
Environment Canada, Canadian Wildlife Service (Ontario Region), July 2012.

would very much limit such influences due to the enhanced unsaturated zone expected during the dry season.

SLI has determined that, based on the preliminary grading a property requirements identified to date, a well located at 927 Garner Road (east of Springbrook Avenue on the north side of Garner Road) is so close to the right-of-way that it will require decommissioning. During the January 16, 2012 on-site meeting with the owner of this property, the owner provided details on the well use and construction. Reportedly, this well, is used only for agricultural purposes and is 30.5 m (100 feet) deep. The owner also reported that the water quality and quantity of the well are fine and it naturally recharges periodically. The stratigraphic profile is reported to consist of 9.1 m of overburden overlying 9.1 m of till/soft stone, overlying 9.1 m of black quicksand, which overlies 3.1 m of rock interpreted to be the limestone bedrock. A review of the MOE Water Well Records for Lot 51, Concession 3 in the former Ancaster Township failed to identify this well description within the database. On occasion, wells registered with the MOE are misfiled in terms of the correct lot and concession. A precursory search of adjacent lots and concessions also failed to identify this well. The closest well that could be found was Water No.: 68-2139, which was 10.7 m (35 feet) deep and possibly represents the house well described in the site meeting.

Regardless, the decommissioning of the agricultural well on this property would represent a nominal effort when performed by a licensed well contractor. If necessary, the well could be replaced with a similar well installation on the north side of the barn structure present on this property. It is expected that, if constructed, such a replacement well would provide an equivalent resource, having been constructed to the bedrock contact. There should be no negative consequences to this replacement program, if needed. Similarly, the same is anticipated for any other private wells that might require replacement, since the bedrock aquifer represents a good confined aquifer system that should not be vulnerable to the transportation improvements identified in this Class EA investigation.

5.2.4 Land Use

The City of Hamilton's 'Truck Route Master Plan' study identified the Garner Road/Rymal Road corridor as a designated truck route, with the Garth Street corridor expected to operate as a part-time truck route following the progressive urbanization of the corridor. The proposed base design involves widening the Garner/Rymal Road and Garth Street corridors within the study area from 2 to 4 lanes and adding a two-way left-turn lane for safer and more efficient local accessibility. The proposed design is compatible with the UHOP, RHOP and GRIDS cited in Section 3.4.1 of this ESR.

The preferred option maintains and enhances both options for pedestrian access and cycling connectivity. Utilities such as Hydro, Bell, gas and others will likely require relocation with this option (refer to Section 5.1.4). The continuous median lane provides the flexibility for easier future incorporation of Alternate Transit Technologies and other infrastructure to meet growth needs. In this regard, the City of Hamilton is anticipating to move forward with implementation of the 'S' Line Light Rail Transit project along the corridor in future. To minimize taxpayer costs associated with relocating utilities and widening structures at watercourse crossings, the City is securing property for the 36 m

wide right-of-way of and relocating or constructing these elements to accommodate the preferred cross-section as part of this EA.

Garner/Rymal Road

The preferred alignment includes acquiring 5.6 ha of property, including the full buyout of ten properties. As noted in Section 5.1.1, the property requirements identified on the design plates are very preliminary in nature and future design investigations will include an examination of alternatives that minimize the need to acquire land from properties abutting the road right-of-way. In particular, an attempt will be made to limit the number of buyouts required.

Although the preferred option will avoid impacts to Garners Corners Cemetery and the Bowman United Church/Cemetery, notably two-thirds of the parking lot across the road from the Bowman United Church/Cemetery will also be acquired.

Garth Street

The preferred alignment includes acquiring 0.1 ha of property; no full buyouts are required.

Local Businesses

Concerns expressed by a local business, Bennett's Apple and Cider Limited, included consideration for movement of traffic for the delivery of supplies and produce, such as apples, bakery supplies, jugs for cider, etc. and also for tour/school buses. Construction will be properly staged and, in consultation with Bennett's Apple and Cider, to prevent/minimize potential disruptions to business operations. Bennett's Apple and Cider also has peak seasonal considerations, particularly during the fall (harvest and Thanksgiving) and Christmas periods. Early spring would be a more optimal time period for construction. The proposed design will require the main sign to be re-located to a more southerly part of their property. Likely one or two parking spots from the property may be affected by the road design.

The agricultural barn operation on the property at 927 Garner Road East is used for cash crops, such as corn beans and wheat and would be directly affected by the proposed design. The current access to the granary on the south side of the barn would be lost; however there is an alternative access to the granary via the barn bridge on the east-side. The well located in front of the barn is currently used for agricultural purposes and it will be displaced. Refer to Section 5.2.3 Hydrogeology for further details on impacts and mitigation measures proposed for this well.

The service station at 523 Garner Road East is one of the properties that would require a full buyout, since the pumps and main entrance are within the proposed road footprint.

Compatible Future Land Use

The improvements in the Garner/Rymal Road corridor include 1.5 m bike lanes on both sides of the corridor. Inclusion of this amenity provides opportunities for connections to the following north/south cycling routes:

- West 5th Street to Upper James Street;
- Garth Street;

- Upper Paradise Road;
- Glancaster Road;
- Kitty Murray Lane;
- Southcote Road; and
- Southerly points planned for the Airport Employment Growth District.

Future land use types approved by the City of Hamilton, and which would benefit from the improved mobility and access provided by the proposed road improvements, include low and medium density residential use, primarily detached, single family homes and a three-story retirement home; open spaces, such as neighbourhood parks; and designated commercial use.

5.2.5 Noise

Existing noise levels measured at four strategic locations in the study area range from 60 to 68 dBA (A-weighted decibels) during the daytime period and 50 to 62 dBA during the night time period. Based on the alternatives developed, seven (7) sensitive receptors (referred to as noise sensitive areas), including locations matching or in close proximity to those where measurements were taken, were identified and assessed using the Ministry of Transportation’s “Environmental Guide for Noise” (the protocol). The protocol compares the future daytime (0700h-2300h) equivalent sound levels (16hr L_{eq}) under the various scenarios at a point 10 years after the hypothetical completion of the project. The comparison is between the sound levels that would be present with the project in place (the “with project” scenario) and the sound levels that would be present assuming the project did not proceed (the “no project” scenario). If the difference between these two scenarios is 5 dB (decibels) or greater, the economic, technical, and administrative feasibility of noise control needs to be investigated.

The detailed results of the assessment are presented in the Noise Impact Assessment report in Appendix D.5. Figures 2 to 8 in Appendix A of the Noise Impact Assessment report show the locations of the points of reception (PORs) – two on Garner Road; three on Rymal Road; and two on Garth Street.

Table 5.7 summarizes the sound level increases that can be expected as a result of the implementing the technically preferred alternative (TPA) design concept.

Table 5.7: TPA Sound Levels and Impacts Summary

POR	No Project Sound Level (dBA 16-hr L_{eq})	With Project Sound Level (dBA 16-hr L_{eq})	Impact (dB)
1	62	65	3
2	62	64	2
3	62	64	2
4	58	59	1
5	64	65	1
6	58	63	5
7	59	60	1

For the most part, the widening of Garner Road, Rymal Road and Garth Street will not generate significant (5 dB) impacts. This is to be expected, since the centreline of these roadways, except Garth Street, will not shift noticeably as a result of the widening. In the absence of a shift in the centreline or other major roadway changes, traffic volumes would need to increase by a factor of 3 before a 5 dB impact occurs. In most cases, the traffic volumes only double as a result of a widening from 2 to 4 lanes, resulting in a 3 dB impact.

The exception to the above are the receptors located on the east side of Garth Street (1455 Garth Street - Condominium WCC #40). On Garth Street, a widening along the centreline is not possible. As a result, the centreline will be shifted approximately 8 m to the east and closer to these receptors. Coupled with the increase in traffic volumes, shifting the centreline of the roadway to the east will result in a 5 dB impact at the group of receptors represented by POR 6. As a result of this impact, noise control measures need to be considered for their economic, technical, and administrative feasibility. In this case, the effectiveness of a noise attenuation barrier was investigated.

Two options for installation of noise attenuation barriers along the road corridor property line at this location have been developed for achieving the required insertion loss for all or most of the residential units adversely affected.

Figures 5.2 and 5.3 show the 2.0 m and 2.4 m high noise barrier options, and Table 5.8 presents the sound levels at the outdoor living areas of the townhouses based on the two barrier heights/lengths.

Figure 5.2: Garth Street: 2.0 m High Noise Barrier Option

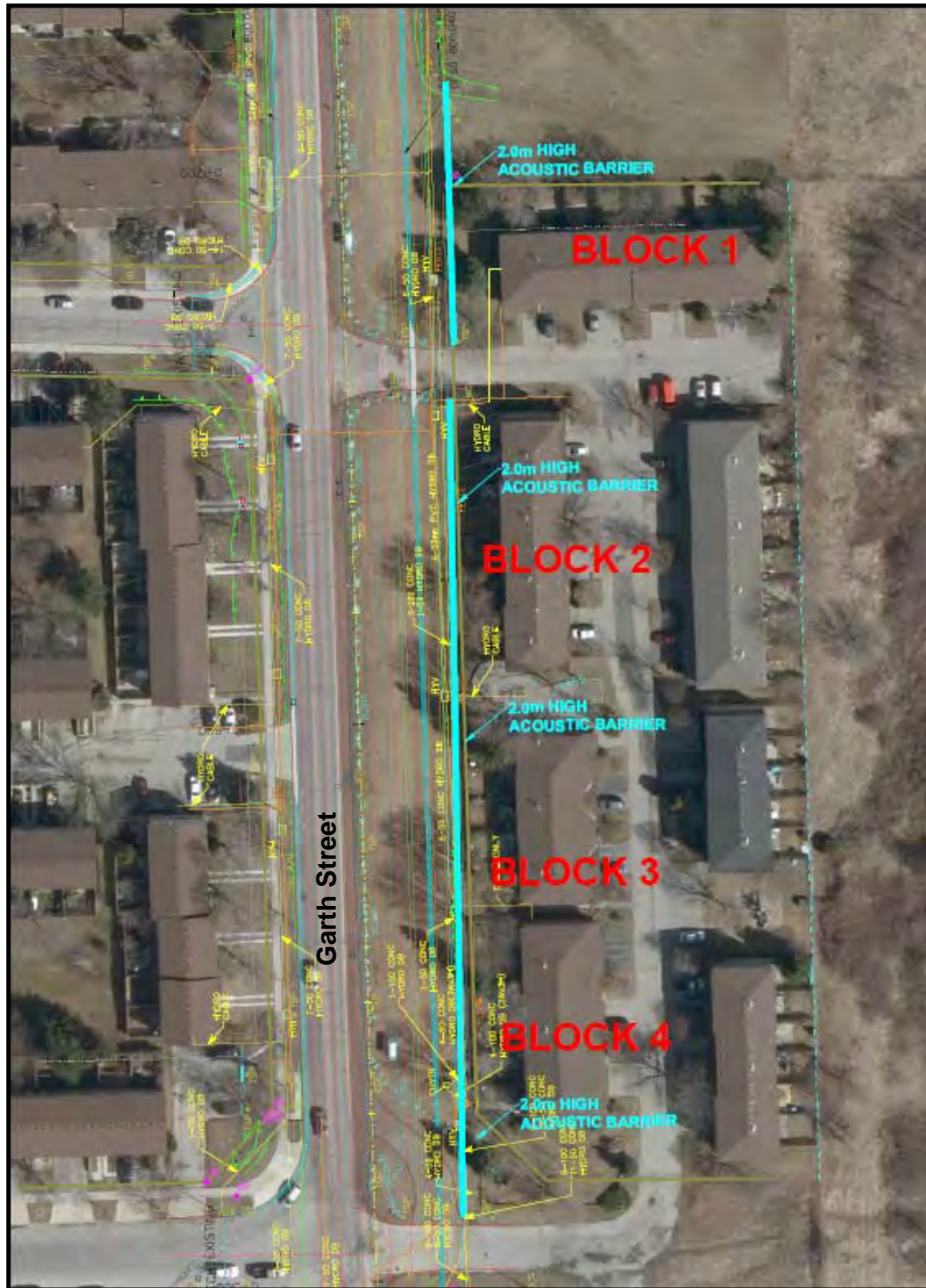


Table 5.8: POR 6 Barrier Recommendations

Block	2.0 M High Barrier		2.4 M High Barrier	
	Sound Level (dBA 16h Leq)	Length (m)	Sound Level (dBA 16h Leq)	Length (m)
1	58	50	58	40
2 (north)	59	60	58	60
2 (south)	57		55	
3	57	34	55	34
4	58	55	58	45

Achieving a 5 dB reduction at Block 2 using a 2.0 m high barrier is not possible for the units at the northern limit of that Block. Retaining the opening in the barrier needed to permit access into and out of the townhouse complex results in only a 4 dB reduction in the sound levels. It is also not possible to return the barrier along the side yards of these dwellings, as it is not city-owned property. It is possible to achieve a 5 dB reduction by increasing the height of the barrier to 2.4 m while continuing to maintain an opening for traffic to pass into and out of the complex. However, this will require increasing the height of the barriers for units in the townhouse blocks that do not themselves need the height to achieve a 5 dB reduction. Nevertheless, there will be a greater benefit in the form of an increased reduction in sound levels for these dwellings at the cost of a taller barrier. Further, the length of barrier required for the northern portion of Block 1 and the southern portion of Block 4 could be reduced by approximately 10 m with the use of a higher barrier. If obtaining a 5 dB reduction at all affected units of the townhouse complex is critical, it is recommended that a 2.4 m high barrier be constructed.

During construction, all construction equipment used will adhere to the source-based guidelines as published by MOE in its publication *NPC-115* "Construction Equipment." The City of Hamilton's noise By-law (No. 11-285) restricts construction activity from 7 p.m. one day to 7 a.m. the next day. If construction activity is expected to occur outside of these prescribed periods, a by-law exemption will be required.

5.2.6 Built Heritage Features

Road improvements have the potential to affect cultural heritage resources in a variety of ways. Impacts can include: direct impacts that result in the loss of resources through demolition, or the displacement of resources through relocation; and indirect impacts that result in the disruption of resources by introducing physical, visual, audible or atmospheric elements that are not in keeping with the resources and/or their setting. Potential impacts on identified cultural heritage resources were identified based on the proximity of a resource to the proposed undertaking.

There are no non-designated properties of heritage interest in the vicinity of the study area within the City of Hamilton limits, under Part IV or Part V of the *Ontario Heritage Act*. However, a total of nine cultural heritage landscapes and sixteen built heritage resources were identified within the study area, thoroughfares, residences and farm complexes that date back to the nineteenth century. Identified cultural heritage resources are historically, architecturally, and contextually associated with nineteenth century and early to mid-twentieth century land use patterns and urban development.

Garner/Rymal Road

The selected option has the highest number of direct/adverse impacts to both built heritage features and to cultural heritage landscapes. These are outlined in Table 5.9 below, full details of the impacts to cultural heritage can be found in Appendix D.6.

Table 5.9: Analysis of Impacts on Identified Cultural Heritage Resources

Feature	Description of Potential Impacts	Recommendations
BUILT HERITAGE RESOURCES		
<u>BHR-1</u> Residence 378 Garner Road East	<ul style="list-style-type: none"> • Frontage encroachment to this 2½-storey brick, gabled nineteenth century residence identified during field sits on a slight rise above the road. • No impacts to the home. • Possible impacts to the plants on the property. • Good legibility of the landscape retained. 	<ul style="list-style-type: none"> • For threats through encroachment, all work undertaken will be planned to avoid impacts through noise and/or vibrations, especially when in close proximity to the resource. • Where possible, mature plantings (particularly those marking property lines or other boundary lines) should be avoided as much as possible. • In instances where the work is carried out in close proximity to a resource, implement appropriate mitigation strategies, including but not limited to protective measures, such as the use temporary fencing.
<u>BHR-2</u> Residence 443 Garner Road East	<ul style="list-style-type: none"> • Proximity encroachment to this dwelling. It consists of a small scale, single storey house dating to the early twentieth-century. • Impacts to the plants on the property. • Some legibility of the landscape retained. 	
<u>BHR-3</u> Residence 453 Garner Road East	<ul style="list-style-type: none"> • Proximity encroachment to these resources. • No impacts to the home. • Impacts to the plants on the property. • Some legibility of the landscape retained. 	
<u>BHR-4</u> Residence 459 Garner Road East	<ul style="list-style-type: none"> • Proximity encroachment to this single story residence typical of the early twentieth century. • Impacts to the plants on the frontage of the property. • Some legibility of the landscape 	

Feature	Description of Potential Impacts	Recommendations
<p>BHR-5 Residence 581 Garner Road East</p>	<p>retained.</p> <ul style="list-style-type: none"> • Removal will be required; direct impact to the commercial enterprise known as Bud's Pool and Spa. Dwelling is no longer used as a residence, remodelled considerably but dates back to the nineteenth century. • No impact to the landscape; isolated from the surroundings. 	<ul style="list-style-type: none"> • No further recommendations.
<p>BHR-6 Residence 681 Garner Road East</p>	<ul style="list-style-type: none"> • Proximity encroachment to this early twentieth century 1½ -storey house and detachable garage. • No impacts to the home. • Impacts to the plants on the property. • Good legibility of the landscape retained. 	<ul style="list-style-type: none"> • For threats through encroachment, all work undertaken will be planned to avoid impacts through noise and/or vibrations, especially when in close proximity to the resource.
<p>BHR-7 Residence 716 Garner Road East</p>	<ul style="list-style-type: none"> • Frontage encroachment to this large-scale, mid-nineteenth century residence. • No impacts to the home. • Impacts to the plants on the property • Good legibility of the landscape retained. 	<ul style="list-style-type: none"> • Where possible, mature plantings (particularly those marking property lines or other boundary lines) should be avoided as much as possible. • In instances where the work is carried out in close proximity to a resource, implement appropriate mitigation strategies, including but not limited to protective measures, such as the use temporary fencing.
<p>BHR-8 Residence 792 Garner Road East</p>	<ul style="list-style-type: none"> • Removal will be required, direct impact to the small single-storey stucco residence and a single-story garage. • Impact to plants on the property. • Notable reduction of legibility of the landscape. 	<ul style="list-style-type: none"> • No further recommendations.
<p>BHR-9 Residence 819 Garner Road East</p>	<ul style="list-style-type: none"> • Frontage encroachment, possible removal, direct impact to resource through disruption/demolition to the 2-storey brick house with a gambrel roof. • Impact to plants on the property. • Notable reduction of legibility of the 	<ul style="list-style-type: none"> • No further recommendations, if removal is required. • For threats through encroachment, all work undertaken will be planned

Feature	Description of Potential Impacts	Recommendations
	<p>landscape.</p>	<p>to avoid impacts through noise and/or vibrations, especially when in close proximity to the resource.</p> <ul style="list-style-type: none"> • Where possible, mature plantings (particularly those marking property lines or other boundary lines) should be avoided as much as possible. • In instances where the work is carried out in close proximity to a resource, implement appropriate mitigation strategies, including but not limited to protective measures, such as the use temporary fencing.
<p><u>BHR-10</u> Residence 1009 Garner Road East</p>	<ul style="list-style-type: none"> • Frontage encroachment to this small scale 1½ storey early twentieth century structure. • No impacts to the home. • Some impacts to the plants on the property. • Good legibility of the landscape retained. 	<ul style="list-style-type: none"> • For threats through encroachment, all work undertaken will be planned to avoid impacts through noise and/or vibrations, especially when in close proximity to the resource. • Where possible, mature plantings (particularly those marking property lines or other boundary lines) should be avoided as much as possible. • In instances where the work is carried out in close proximity to a resource, implement appropriate mitigation strategies, including but not limited to protective measures, such as the use temporary fencing.

Feature	Description of Potential Impacts	Recommendations
<p><u>BHR-11</u> Residence 975 Garner Road East</p>	<ul style="list-style-type: none"> • Frontage encroachment to this small scale, 1½-storey twentieth century brick structure. • No impacts to the home. • Some impacts to the plants on the property. • Good legibility of the landscape retained. 	<ul style="list-style-type: none"> • For threats through encroachment, all work undertaken will be planned to avoid impacts through noise and/or vibrations, especially when in close proximity to the resource. • Where possible, mature plantings (particularly those marking property lines or other boundary lines) should be avoided as much as possible.
<p><u>BHR-12</u> Residence 1021 Garner Road East</p>	<ul style="list-style-type: none"> • Frontage encroachment to this 1½-storey stone structure with a modern garage. • No impacts to the home. • Some impacts to the plants on the property. • Good legibility of the landscape retained. 	<ul style="list-style-type: none"> • In instances where the work is carried out in close proximity to a resource appropriate mitigation strategies measures including but not limited protective measures, such as the use temporary fencing.
<p><u>BHR-13</u> Residence 1157 Garner Road East</p>	<ul style="list-style-type: none"> • Frontage encroachment to this small, 1½-storey gabled house may be late nineteenth or early twentieth century. • No impacts to the home. • No impacts to the plants on the property. • Good legibility of the landscape retained. 	
<p><u>BHR-14</u> Residence 723 Rymal Road West</p>	<ul style="list-style-type: none"> • No Impact, work diverted to the south side of right-of-way to avoid impact. 	<ul style="list-style-type: none"> • No further recommendations.
<p><u>BHR-15</u> Public Building 634 Rymal Road West</p>	<ul style="list-style-type: none"> • Proximity encroachment to this early twentieth century 1½-storey house and detachable garage. • No impacts to the building. • Impacts to the plants on the property. • Notable reduction in legibility of the landscape (especially across the frontage and early circulation route.). 	<ul style="list-style-type: none"> • For threats through encroachment, all work undertaken will be planned to avoid impacts through noise and/or vibrations, especially when in close proximity to the resource. • Where possible, mature plantings (particularly those marking property lines or other boundary lines) should be avoided as much as possible.

Feature	Description of Potential Impacts	Recommendations
		<ul style="list-style-type: none"> In instances where the work is carried out in close proximity to a resource, implement appropriate mitigation strategies, including but not limited to protective measures, such as the use temporary fencing.
<p>BHR-16 Residence 1268 West 5th Street</p>	<ul style="list-style-type: none"> Removal will be required, direct impact to the 1½-storey structure dating to the nineteenth century. Impact to plants on the property. Notable reduction of legibility of the landscape. 	<ul style="list-style-type: none"> No further recommendations.
CULTURAL HERITAGE LANDSCAPES		
<p>CHL-1 Farm Complex 389 Garner Road East</p>	<ul style="list-style-type: none"> Frontage encroachment to this property with a 2½-storey brick farmhouse with gabled roof, two large barns, concrete silo, a drive shed and small frame outbuilding and farm yard. No impacts to the home. Some impacts to the plants on the property. Good legibility of the landscape retained. 	<ul style="list-style-type: none"> For threats through encroachment, all work undertaken will be planned to avoid impacts through noise and/or vibrations, especially when in close proximity to the resource. Where possible, mature plantings (particularly those marking property lines or other boundary lines) should be avoided as much as possible.
<p>CHL-2 Farm Complex 474 Garner Road East</p>	<ul style="list-style-type: none"> Frontage encroachment to this property with nineteenth century brick house, large barn and small frame outbuilding set well back, and screened from the road. No impacts to the home. Some impacts to the plants and trees on the property, especially an old apple tree. Good legibility of the landscape retained. 	<ul style="list-style-type: none"> In instances where the work is carried out in close proximity to a resource, implement appropriate mitigation strategies, including but not limited to protective measures, such as the use temporary fencing.

Feature	Description of Potential Impacts	Recommendations
<p>CHL-3 Cemetery Southcote at Garner Road East</p>	<ul style="list-style-type: none"> • No Impact, work diverted to the south side of right-of-way to avoid impact. 	<ul style="list-style-type: none"> • No further recommendations.
<p>CHL-4 Farm Complex 701 Garner Road East</p>	<ul style="list-style-type: none"> • Removal will be required, direct impact to the 2-storey gabled roof house and detached garage. • Impact to plants on the property. • Notable reduction of legibility of the landscape. 	<ul style="list-style-type: none"> • No further recommendations.
<p>CHL-5 Church and Cemetery 880 Garner Road East</p>	<ul style="list-style-type: none"> • No Impact, work diverted to the north side right of way to avoid impact. 	<ul style="list-style-type: none"> • No further recommendations.
<p>CHL-6 Farm Complex 910 Garner Road East</p>	<ul style="list-style-type: none"> • Frontage encroachment on to the 2-storey farm house and small outbuilding. • No impacts to the home. • Some impacts to the plants on the property (limited to small area on the east). • Good legibility of the landscape retained. 	<ul style="list-style-type: none"> • For threats through encroachment, all work undertaken will be planned to avoid impacts through noise and/or vibrations, especially when in close proximity to the resource. • Where possible, mature plantings (particularly those marking property lines or other boundary lines) should be avoided as much as possible. • In instances where the work is carried out in close proximity to a resource, implement appropriate mitigation strategies, including but not limited to protective measures, such as the use temporary fencing.

Feature	Description of Potential Impacts	Recommendations
<p>CHL-7 Farm Complex 927 Garner Road East</p>	<ul style="list-style-type: none"> • Removal will be required, direct impact to the 2 story large scale nineteenth century brick house, three red, gable roofed barns and detached garage. • Impact to plants on the property. • Notable reduction of legibility of the landscape. 	<ul style="list-style-type: none"> • No further recommendations.
<p>CHL-8 Industrial-Commercial Complex 944 Garner Road East</p>	<ul style="list-style-type: none"> • No Impact, work diverted to the north side of right-of-way to avoid impact to Bennett's Apple & Cider, picks up to the east. • May be limited impact to plants. • Fair legibility of the landscape is retained. 	<ul style="list-style-type: none"> • No further recommendations.
<p>CHL-9 Farm Complex 944 Garner Road East</p>	<ul style="list-style-type: none"> • Frontage encroachment on to the 2-storey nineteenth century brick house, small barns and small outbuildings. • No impacts to the home/barns. • Some impacts to the plants on the property (limited to small area on the east). • Good legibility of the landscape retained. 	<ul style="list-style-type: none"> • For threats through encroachment, all work undertaken will be planned to avoid impacts through noise and/or vibrations, especially when in close proximity to the resource. • Where possible, mature plantings (particularly those marking property lines or other boundary lines) should be avoided as much as possible. • In instances where the work is carried out in close proximity to a resource, implement appropriate mitigation strategies, including but not limited to protective measures, such as the use temporary fencing.

Garth Street

No cultural heritage resources were identified on Garth Street and, as such, no impacts are anticipated.

Recommendations

Based on the results of background data collection, a field review, and impact assessment, the following recommendations have been developed:

1. Road construction should be suitably planned in a manner that avoids any identified, above ground, cultural heritage resource.
2. BHR-9, if subject to removal, should have the work carefully planned to avoid it if possible.
3. Similar additional design review could be considered for CHL-4 and CHL-7. In all instances where cultural heritage resources have been identified, road improvement activities should be planned to avoid impacts to those resources. This may include completing a heritage impact assessment or documentation report, or employing suitable measures, such as landscaping, buffering or other forms of mitigation, where appropriate.

In this regard, provincial guidelines should be consulted for advice and further heritage assessment work should be undertaken, as necessary.

5.2.7 Archaeological Resources

The archaeological and historical context was analyzed to help determine the archaeological potential of the study area¹⁵. The Garner Road/Rymal Road and Garth Street study area meets the following criteria used for determining archaeological potential:

- Previously identified archaeological sites (i.e., AhGx-333, AhGx-540);
- Water sources: primary, secondary, or ancient water sources (i.e., Ancaster Creek, Tiffany Creek, Twenty Mile Creek);
- Areas of early Euro-Canadian settlement (i.e., churches, cemeteries, pioneer homesteads);
- Early historical transportation route (i.e., Garner Road, Rymal Road, Garth Street); and
- Property designated under the *Ontario Heritage Act* or listed on a municipal register (i.e., 581 and 701 Garner Road).

These criteria characterize the study corridor as having potential for the identification of Aboriginal and Euro-Canadian archaeological sites.

¹⁵ Stage 1 Archaeological Assessment (Background Research and Property Inspection) Garner Road/Rymal Road and Garth Street Widening Class EA, City of Hamilton, Ontario, Page 10.

Property Inspection

Road construction disturbance may be found to extend beyond the typical disturbed road right-of-way area, and this generally includes additional grading, cutting and filling, additional drainage ditching, watercourse alteration or channelization, servicing, removals, intensive landscaping, and heavy construction traffic. Areas beyond the typically disturbed right-of-way generally require archaeological assessment in order to determine archaeological potential relative to the type or scale of disturbances that may have occurred in these zones.

Due to the extent of previous disturbance, the Garner Road, Rymal Road, and Garth Street rights-of-way do not exhibit archaeological site potential. No further archaeological assessment is required on these lands (refer to Figures 6 to 11: areas marked in yellow, Appendix D.7).

Beyond the disturbed right-of-way, a number of areas have remained undisturbed and they exhibit archaeological site potential due to their proximity to primary water sources and historic transportation routes. These areas include agricultural fields, open lots, woodlots, front lawns of residential properties that have experienced minor landscaping, and the land surrounding 19th century homesteads. Should road improvements encroach upon undisturbed land with archaeological potential beyond the disturbed right-of-way, a Stage 2 archaeological assessment should be conducted (refer to Figures 6 to 11: areas marked in green, Appendix D.7).

Two cemeteries are situated adjacent to the study corridor. At the Garners Corners Cemetery, if road improvements impact land beyond the ditch along Garner Road or land immediately adjacent to Southcote Road, a cemetery investigation will be necessary in order to determine the presence and extent of burial features adjacent to and within the proposed disturbance area. Similarly, at the Bowman Cemetery, if road improvements impact land beyond the disturbed right-of-way at the west portion of the cemetery, a cemetery investigation will also be necessary in order to determine the presence and extent of burial features adjacent to and within the proposed disturbance area. The installation of a sidewalk adjacent to the east portion of the cemetery has, in all probability, disturbed the land between the right-of-way and the sidewalk.

Conclusions and Recommendations

Based on the results of the Stage 1 Archaeological Assessment, including a property inspection, ASI offers the following conclusions recommendations associated with the proposed roadway improvements:

1. The existing Garner Road, Rymal Road, and Garth Street rights-of-way do not retain archaeological site potential due to previous ground disturbances. Therefore, additional archaeological assessment is not required along this portion of the study corridor;
2. If construction extends beyond the disturbed rights-of-way, a Stage 2 Archaeological Assessment is recommended on any lands along the study corridor where there is potential for archaeological sites, in accordance with the Draft Standards and Guidelines for Consultant Archaeologists (MCL, 2009); and

3. Prior to any land-disturbing activities adjacent to Garner's Corners Cemetery or Bowman Cemetery, a Cemetery Investigation should be conducted. This work will be done in accordance with the Draft Standards and Guidelines for Consultant Archaeologists (MCL, 2009), in order to confirm the presence or absence of unmarked graves within the right-of-way. This work will involve the removal of the topsoil with a Gradall followed by the shovel shining of the exposed surfaces and subsequent inspection for grave shafts.

Advice on Compliance with Legislation

ASI also advises compliance with the following legislation:

- This report is submitted to the Minister of Tourism and Culture as a condition of licensing in accordance with Part VI of the Ontario Heritage Act, RSO 1990, c 0.18. The report is reviewed to ensure that the licensed consultant archaeologist has met the terms and conditions of their archaeological licence, and that the archaeological fieldwork and report recommendations ensure the conservation, preservation and protection of the cultural heritage of Ontario;
- Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48 (1) of the Ontario Heritage Act. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with sec. 48 (1) of the Ontario Heritage Act;
- The Cemeteries Act requires that any person discovering human remains must immediately notify the police or coroner and the Registrar of Cemeteries, Ministry of Small Business and Consumer Services; and
- The documentation related to this archaeological assessment will be curated by Archaeological Services Inc. until such a time that arrangements for their ultimate transfer to Her Majesty the Queen in right of Ontario, or other public institution, can be made to the satisfaction of the project owner(s), the Ontario Ministry of Tourism and Culture, and any other legitimate interest groups.

5.3 Summary of Project Mitigation and Monitoring Requirements

Table 5.10 summarizes the environmental factor-specific issues, potential impacts, proposed mitigation measures, and net effects of implementing the proposed Garner/Rymal Road and Garth Street Improvements, as well as proposed monitoring and future additional/contingency investigations.

Table 5.10: Summary of Potential Environmental Impacts, Proposed Mitigation Measures and Commitments to Further Work

Factor	Environmental Issue/Concern	Potential Construction/Operations Impact/Effect	Mitigation Measures/Net Effect	Monitoring/Future Work/Contingency
NATURAL ENVIRONMENT				
Fish and Fish Habitat	Serious harm to fish habitat	<p>Discharge of sediment to a drainage/watercourse from earth/spoil stockpiles, grading and excavation activities, resulting in the impairment of water quality and/or physical damage to habitat.</p> <p>Release of fuel, oil, grease contaminants from mobile equipment, resulting in unacceptable contaminant concentrations in the receiving watercourse/waterbody.</p>	Design and implement an appropriate Erosion and Sediment Control Plan (ESCP) for both the construction and operations phases to prevent erosion of exposed soils and delivery of sediment to the drainages contributing baseflow to all of the watercourses in the study area in accordance with HCA's and NPCA's best practice requirements, including:	Routine inspections of temporary erosion and sediment control measures to ensure they are operating effectively to prevent any release of sediment-laden runoff to any of the watercourses within the study area.

Factor	Environmental Issue/Concern	Potential Construction/Operations Impact/Effect	Mitigation Measures/Net Effect	Monitoring/Future Work/Contingency
Fish and Fish Habitat (Cont'd)		<p>Change to sensitive life stages/process (i.e., spawning) if near-water works are not timed appropriately.</p>	<ul style="list-style-type: none"> • Limiting the size and duration of disturbed areas; • Identification of, and appropriate phasing of work in, critical and non-critical management areas; • Appropriate seasonal controls, including winter shutdown protection, as required; • Strategic use of vegetation buffers between work areas and natural areas. • If required, implement timing restrictions during construction for near-water work to protect sensitive life stages of fish, as identified by MNR (warmwater – in-stream work permitted from July 1 to March 31 and coldwater – in-stream work permitted from July 1 to September 15). 	<p>Monitoring of treatment systems for any dewatering and/or concrete effluent to avoid any release of contaminated water to receiving watercourses.</p> <p>Compliance monitoring of best management practices related to refuelling and excess materials storage and handling.</p> <p>Prepare a spill/emergency response plan for construction and operations.</p>

Factor	Environmental Issue/Concern	Potential Construction/Operations Impact/Effect	Mitigation Measures/Net Effect	Monitoring/Future Work/Contingency
Fish and Fish Habitat (Cont'd)			<ul style="list-style-type: none"> • Store, handle and dispose of all excess materials in a manner that prevents their entry to drainages/watercourses. <p>Operate, maintain and store all equipment and materials (e.g., fuel, lubricants) in a manner that prevents the entry of any deleterious substances to drainages/watercourses.</p> <p>Design permanent drainage and stormwater management systems to mimic overland drainage patterns and control/maintain runoff quality/quantity contribution to watercourse features.</p> <p>Capture and transport concrete effluent off-site for disposal.</p> <p>Prohibit/limit construction access to watercourses/watercourse banks.</p>	

Factor	Environmental Issue/Concern	Potential Construction/Operations Impact/Effect	Mitigation Measures/Net Effect	Monitoring/Future Work/Contingency
Terrestrial Ecosystems Vegetation Communities	<p>Loss of street trees and vegetation from cultural/remnant natural areas resulting from road widening</p>	<p>Loss of approximately 0.26 ha of Significant Woodlot along Garth Street.</p> <p>Minor loss of cultural/manicured and roadside ditch communities.</p> <p>Impacts to street trees, including large specimens.</p>	<p>Minimize encroachment on remnant woodlots and large healthy trees.</p> <p>Trees and areas to be preserved within and adjacent to the ROW will be identified in a Tree Protection Plan and protected with approved fencing/hoarding defining Tree Protection Zone(s)</p> <p>Compensate, as required, for displacement of publicly owned roadside trees on public property, in compliance with City of Hamilton’s Public Tree Removal Policy, the Forest Management Plan (Reforestation Policy) and By-Law 06-151 (Public Trees By-Law), as amended.</p> <p>Inclusion of hard and soft landscaping in the corridor, including planting of additional street trees, where opportunities present themselves</p>	<p>Environmental site inspections/monitoring during construction and post-construction periods to ensure environmental protection/re-vegetation measures are implemented and working and any required remedial action is undertaken.</p> <p>Plantings of woody and herbaceous vegetation will be checked periodically for a period of one year to ensure an acceptable survival rate.</p>

Factor	Environmental Issue/Concern	Potential Construction/Operations Impact/Effect	Mitigation Measures/Net Effect	Monitoring/Future Work/Contingency
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Terrestrial Ecosystems Vegetation Communities (Cont'd)</p>			<p>Movement of construction machinery will be limited to the boundaries of the ROW and operated in a manner that minimizes damage to adjacent trees.</p> <p>Roots and branches, if damaged, will be treated using approved horticultural methods</p> <p>Wherever possible, construction activities will be restricted within the dripline of all trees not required for removal.</p> <p>Utilize native species for identified restoration areas.</p> <p>Return ROW to pre-construction or better condition.</p>	

Factor	Environmental Issue/Concern	Potential Construction/Operations Impact/Effect	Mitigation Measures/Net Effect	Monitoring/Future Work/Contingency
Wildlife	Wildlife habitat and communities (short term/ construction)	Displacement wildlife and wildlife habitat; barrier effects on wildlife passage; wildlife/ vehicle conflicts;	<p>Reduce grading requirements to the minimum extent possible;</p> <p>Work zones will be isolated using construction fencing, barrier fencing and silt fencing to avoid further encroachment to wildlife habitat;</p> <p>Prepare restoration, enhancement and streetscape plans to offset vegetation/habitat losses in order to achieve a net gain in vegetation/habitat area, attributes and functions;</p> <p>Prepare edge management plans for areas where encroachment on vegetation communities/habitat will occur;</p> <p>Good housekeeping practices related to materials storage (pocket)/stockpiling, equipment fuelling/maintenance, etc. will be implemented during construction.</p>	<p>Environmental site inspections during construction to ensure environmental mitigation measures are implemented and working and any required remedial action is undertaken.</p> <p>Implement timing constraints so that no vegetation or buildings deemed to be suitable for migratory bird habitat will be removed during the bird breeding season (May 1 to July 31).</p> <p>Additional breeding bird surveys may be required.</p>

Factor	Environmental Issue/Concern	Potential Construction/Operations Impact/Effect	Mitigation Measures/Net Effect	Monitoring/Future Work/Contingency
Wildlife (Cont'd)			Implement timing constraints so that no vegetation or buildings deemed to be suitable for migratory bird habitat will be removed during the bird breeding season (May 1 to July 31).	
Hydrogeology	Local Dewatering (short term / construction)	Localized lowering of water table condition to facilitate construction activities.	<p>Garner Road Corridor Potential for ground water influence by construction is considered to be remote. Water table condition is anticipated to be greater than 5 m below ground level.</p> <p>In the conceptual design of the preferred corridor; the excavation of the storm sewage alignment would be above this depth and therefore the construction is unlikely to have a pronounced effect on the underlying resource(s).</p> <p>Summer time work program when water table condition is lowest would be ideal.</p>	If dewatering in excess of 50,000 L/day is to occur then Permit To Take Water application will be required along with an appropriate dewatering plan.

Factor	Environmental Issue/Concern	Potential Construction/Operations Impact/Effect	Mitigation Measures/Net Effect	Monitoring/Future Work/Contingency
Hydrogeology (Cont'd)			<p>Rymal Road Corridor Where municipal servicing is supplied; it is concluded that the proposed corridor construction will have a negligible impact on adjacent serviced properties.</p> <p>The low permeability soils along Rymal Road will limit the lateral extent of the construction influence unless extremely localized.</p> <p>Construction during the summer season would very much limit such influences due to the enhanced unsaturated zone expected during the dry season.</p>	
	Private water well influence	Private water well disturbance	One private agricultural well at 927 Garner Road may exist at or near the ROW. Abandonment and replacement of the well could be required.	

Factor	Environmental Issue/Concern	Potential Construction/Operations Impact/Effect	Mitigation Measures/Net Effect	Monitoring/Future Work/Contingency
Hydrogeology (Cont'd)			<p>Well construction at depth is common in the general vicinity, such that an equivalent supply could be constructed to replace the existing well.</p> <p>All other wells are constructed such that proposed construction activities should have negligible influence on existing resources.</p>	<p>If required, properly abandon existing well and replace with equivalent supply.</p> <p>Precautionary approach would call for pre-construction baseline monitoring of any private water well within 500 m of constructed ROW.</p>
	Private septic influence	Encroachment of construction into private septic tile field	No evidence exists to suggest this issue is a concern.	Precautionary approach would call for pre-construction baseline monitoring of any private servicing within 500 m of constructed ROW.

Factor	Environmental Issue/Concern	Potential Construction/Operations Impact/Effect	Mitigation Measures/Net Effect	Monitoring/Future Work/Contingency
SOCIO-ECONOMIC ENVIRONMENT				
Land Use	Local Businesses	<p>Construction may disrupt the operations of local businesses.</p> <p>Bennett's Apple and Cider Ltd. (944 and 954 Garner Road East) may lose one or two parking spots in front of their store. The main store sign will need to be relocated southerly onto the site.</p> <p>The drilled well in front of the barn at 927 Garner Road East would be displaced with the preferred design.</p> <p>Access used on the south side of barn from the east side to blow grain into upper level granary could be lost, but an alternative access is available via the barn bridge on the east side.</p>	<p>Bennett's Apple & Cider has peak seasonal considerations, during the fall (harvests and Thanksgiving) and Christmas. Early spring would be a more optimal time period for construction.</p> <p>If the agricultural barn operation at 927 Garner Road East can be retained, access via barn bridge on the east side.</p>	<p>Construction will be properly staged, in consultation with Bennett's Apple & Cider, to prevent/minimize potential disruptions to business operations.</p>

Factor	Environmental Issue/Concern	Potential Construction/Operations Impact/Effect	Mitigation Measures/Net Effect	Monitoring/Future Work/Contingency
Land Use (Cont'd)	Existing Land Use	<p>Requires a complete buyout of commercial property (service station at 523 Garner).</p> <p>Majority (2/3) of the parking lot across the road from the Bowman United Church/Cemetery will be acquired. Approximately 587 m² of property required.</p> <p>Requires a total of 5.61 ha of property, which may require a complete buyout of 10 properties.</p> <p>On Garth Street, a total of 0.1 ha of property is required with no property buyouts.</p>	<p>Property/business acquisition required for this project will be undertaken by the City of Hamilton, with the objective being to ensure that individual rights are respected and protected, and to provide fair compensation within the framework of the city's policies and associated legislative instruments governing the acquisition of property for municipal projects. The acquisition process emphasizes negotiation on a willing seller, willing buyer basis and the achievement of a mutually satisfactory agreement between the City and the owner.</p> <p>Right-of-way and easement requirements will be finalized for the purposes of property acquisition during the Detail Design phase. All mitigating measures should be considered during Detail Design to reduce the impacts to abutting properties.</p>	Temporary easements will be required for the temporary drainage ditches and construction of the entrances to the abutting properties, and these will be confirmed during Detail Design.

Factor	Environmental Issue/Concern	Potential Construction/Operations Impact/Effect	Mitigation Measures/Net Effect	Monitoring/Future Work/Contingency
Noise	Increases in ambient sound levels at adjacent noise sensitive receptors (residences)	<p>The preferred alignment along Garner/Rymal Road does not itself generate a significant (5 dBA) impact at any of the receptors evaluated.</p> <p>The receptors located on the east side of Garth Street (1455 Garth Street - Condominium WCC #40) result in a 5dB impact (POR 6).</p>	<p>Noise control measures are not warranted for Garner/Rymal Road.</p> <p>Noise control measures need to be considered for their economic, technical, and administrative feasibility for POR 6 (1455 Garth Street - Condominium WCC #40).</p>	<p>During construction, all construction equipment used will adhere to the source-based guidelines as published by MOE in its publication NPC-115 "Construction Equipment." The City of Hamilton's noise By-law (No. 11-285) restricts construction activity from 7 p.m. one day to 7 a.m. the next day. If construction activity is expected to occur outside of these prescribed periods, a by-law exemption will be required.</p>
CULTURAL ENVIRONMENT				
Built Heritage and Cultural Landscapes (cont'd)	Impacts to Built Heritage Resources and Cultural Heritage Landscapes (CHL)	<ul style="list-style-type: none"> Removal: Five (5) cultural heritage resources were shown to be impacted through removal. 	<p>No further recommendations, if removal is required.</p> <p>For threats through encroachment, all work undertaken will be planned to avoid impacts through noise and/or vibrations, especially when in close proximity to the resource.</p>	<p>BHR 9, if subject to removal, should have the work carefully planned to avoid it if possible.</p>

Factor	Environmental Issue/Concern	Potential Construction/Operations Impact/Effect	Mitigation Measures/Net Effect	Monitoring/Future Work/Contingency
Archaeological Resources	<p>Areas with potential for identification of Aboriginal and Euro-Canadian archaeological resources</p>	<p>The existing Garner Road, Rymal Road, and Garth Street ROWs do not retain archaeological site potential due to previous ground disturbances. Therefore, additional archaeological assessment is not required along this portion of the study corridor.</p>	<p>If construction extends beyond the disturbed rights-of-ways, a Stage 2 Archaeological Assessment is recommended on any lands along the study corridor where there is potential for archaeological sites, in accordance with the Draft Standards and Guidelines for Consultant Archaeologists (MCL, 2009).</p> <p>Prior to any land-disturbing activities adjacent to Garners Corners Cemetery or Bowman Cemetery, a Cemetery Investigation should be conducted. This work will be done in accordance with the Draft Standards and Guidelines for Consultant Archaeologists (MCL, 2009), in order to confirm the presence or absence of unmarked graves within the R.O.W. This work will involve the removal of the topsoil with a Gradall followed by the shovel shining of the exposed surfaces and subsequent inspection for grave shafts.</p>	<p>Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48 (1) of the Ontario Heritage Act.</p> <p>The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with sec. 48 (1) of the Ontario Heritage Act.</p> <p>The Cemeteries Act requires that any person discovering human remains must immediately notify the police or coroner and the Registrar of Cemeteries, Ministry of Small Business and Consumer Services.</p>

Factor	Environmental Issue/Concern	Potential Construction/Operations Impact/Effect	Mitigation Measures/Net Effect	Monitoring/Future Work/Contingency
ENGINEERING				
Transportation Network	Property access	The existing driveways of some properties along the road corridors may require regrading as a result of the road widening and access to the property will be impacted during construction.	<p>During the Detail Design phase, the exact impact on existing driveways will be confirmed. Easements may be required for regrading of the affected driveways and the City will negotiate with the property owner to obtain the easement for construction work prior to calling for tender for the road widening.</p> <p>Should site conditions restrict the construction of the existing driveway in the original location, an alternative driveway will be proposed based on agreements reached with the property owner.</p>	<p>During the Detail Design phase, the necessary operational constraints will be included in the tender documents to ensure that the property owners affected by the driveway regrading are given sufficient notice of the work.</p> <p>Should site conditions and/or construction methods require the provision of a temporary access to the property during regrading of the driveway, the Contractor will negotiate this directly with the property owners during construction.</p>

Factor	Environmental Issue/Concern	Potential Construction/Operations Impact/Effect	Mitigation Measures/Net Effect	Monitoring/Future Work/Contingency
Transportation Network (cont'd)		<p>From the preliminary design, the existing sight triangle at the road intersections within the proposed right-of-way is sufficient to provide safe sight distance for both the drivers and the pedestrians. It is not anticipated that this will be reduced during construction.</p>	<p>The Contractor will ensure that pedestrians and drivers are safe during construction by providing an alternative location for pedestrian to cross the road safely and temporary construction signs will be provided to warn drivers to reduce their speed when turning at the intersection, if required.</p>	<p>During the Detail Design phase, the adequacy of the existing sight triangles will be reconfirmed and provided in the detail design.</p> <p>The City will ensure that the development along the existing road corridors will not have structures or trees which will restrict the sight line of pedestrians and drivers.</p>

Factor	Environmental Issue/Concern	Potential Construction/Operations Impact/Effect	Mitigation Measures/Net Effect	Monitoring/Future Work/Contingency
Drainage and Stormwater Management	<p>Impairment of water quality in Ancaster Creek, Tiffany Creek and Twenty Mile Creek tributaries</p> <p>Increased runoff and erosion potential</p> <p>Increased concentration of flow and peak flows to watercourses and minor tributaries</p> <p>Potential for increased flooding in downstream storm sewer systems of the Upper Ottawa Creek watershed.</p>	<p>Discharge of stormwater runoff from storm sewer outlets to watercourses and minor tributaries</p>	<p>Collection of roadway runoff in storm sewers directed to stormwater treatment facilities in adjacent subdivisions at three locations on Garner Road.</p> <p>Oil grit separators at all other storm sewer outlets on Garner Road.</p> <p>New storm relief sewers on Rymal Road discharging to Pond C at St. Elizabeth Village.</p> <p>Temporary erosion and sediment controls will be implemented to reduce the risk of sedimentation delivery to excessive erosion of drainage channels during construction.</p>	<p>Explore possibility of future storm sewer connections from Garner Road to the adjacent subdivisions to the north and at the Springbrook Neighbourhood in particular.</p> <p>Consider possibility of major system relief storm sewers at the sag locations on Garth Street south of Stone Church Road.</p> <p>Review the operational and maintenance requirements at Pond C at St. Elizabeth Village with respect to potential impacts from increased runoff from Rymal Road.</p> <p>Monitor potential erosion issues downstream of culverts C10 and C11 where there may be peak flow increases due to Garner Road storm sewer discharges.</p>

Factor	Environmental Issue/Concern	Potential Construction/Operations Impact/Effect	Mitigation Measures/Net Effect	Monitoring/Future Work/Contingency
Municipal Services and Utilities	Need for relocation of existing services.	Relocation of some existing services will be required.	<p>During the Detail Design phase, all utility companies servicing the area will be contacted to confirm their existing installations and the planned expansion of their services. Should their existing installations conflict with the proposed corridor widening, they will be located within the future right-of-way of the road.</p> <p>The proposed relocation work will be undertaken prior to the road widening and, therefore, will have minimal impacts to the existing service delivery.</p> <p>Owners of existing residential, commercial and business properties will be notified in advance by the City if utility relocation will occur. Alternative service/ access arrangements will be provided to the owner.</p> <p>Adequate protection will be in place to ensure site safety at all times to protect the public and the owners from the construction sites.</p>	<p>Conduct additional engineering surveys and contact utility owners further to ascertain the existence and nature of their plant, and feasibility of relocation. Additional test-pits will be undertaken to confirm the exact location and depth of installation under the existing ground, if required.</p> <p>Monitor and address service disruptions (complaint protocol).</p> <p>A monitoring plan will be in place to ensure safety as a first priority for the public and employees.</p>
	Impacts to municipal and private services	Service interruptions during construction		

6.0 PROJECT IMPLEMENTATION

This section of the ESR describes the City of Hamilton's current thinking on how and when the Garner Road East, Rymal Road West and Garth Street improvements will move forward to implementation.

In addition, general commitments to environmental compliance and effects monitoring are described.

To inform and provide direction to Detail Design investigations, the Project Team's understanding of approvals, permits, authorizations and clearances that must be obtained prior to construction are also identified. This includes the process for amending the Environmental Study Report, if required, in accordance with the Municipal Class EA process.

6.1 Construction Staging

With respect to the general staging of the improvements within the Garner Road East/Rymal Road West corridor, based on current and forecast traffic demands, it is expected that work will proceed from east to west, commencing at the West 5th Street intersection, and will be separated into manageable contracts over the length of the corridor. Work on the Garth Street corridor can be incorporated in a single contract.

On a local/contract scale, the proposed road widening and drainage improvements of the Garner Road East, Rymal Road West and Garth Street can be undertaken in two main construction stages, as described below. The traffic staging design should follow the Ministry of Transportation's Ontario Traffic Manual, Temporary Conditions, during Detail Design.

Pre-Construction

The existing roadway corridors consist of a basic 2 x 3.6 m traffic lanes cross-section, with one lane in each direction. Therefore, in order to maintain the existing traffic flow during construction, it is necessary to widen one side of the road (north side on Garner Road East/Rymal Road West and west side of Garth Street) to provide a temporary road with two temporary 3.0 m wide traffic lanes for the main Stage 1 construction. The temporary widening on one side during pre-construction can be undertaken behind temporary concrete barriers.

Stage 1 Construction

Shift the temporary concrete barriers in the pre-construction stage to the centre of the existing road and shift the traffic on the south side of Garner Road East/Rymal Road West to the north side and the east side of Garth Street to the west side. This will enable the construction of the storm drainage system and the widening of the south side of Garner Road East/Rymal Road West and the east side of Garth Street behind temporary concrete barriers.

Stage 2 Construction

The second stage of construction will begin after road widening and drainage installation are done on the southern half of Garner Road East/Rymal Road West and the eastern half of Garth Street.

Shift the temporary concrete barriers to the newly constructed roadway and shift the traffic to the newly completed half of the roadway (i.e., to the southern half of Garner Road East/Rymal Road West and the eastern half of Garth Street).

Complete the storm drainage system and the road widening on the north side of Garner Road East/Rymal Road West and the west side of Garth Road.

Post-Construction

Once Stage 2 Construction is completed, the surface course for the road pavement and the final pavement markings will be placed in this stage by temporary road closure of section of the road in accordance with the Ontario Traffic Manual, Temporary Conditions. The temporary concrete barriers will be removed and the traffic will be directed to the newly widened roadway with the permanent traffic signals in operation.

The requirement for temporary signals (and type of signals) during the Stage 1 and Stage 2 construction will be determined during the Detail Design phase. Temporary illumination will be required at all locations where temporary traffic signals are required. The requirements for temporary traffic signals/illumination or alternative staging and detour options will be reviewed further during Detail Design.

6.2 Monitoring

As part of the City of Hamilton's continuing commitment to environmental stewardship, comprehensive construction and post-construction monitoring programs will be instituted on this undertaking. The programs will assess the effectiveness of environmental mitigation, enhancement and compensation measures implemented to limit the net effects of the project, as well as the degree of compliance with environmental protection measures committed to during the construction period.

6.2.1 Environmental Inspection During Construction

The City of Hamilton will retain the services of a qualified Contract Administrator to oversee all aspects of construction at the field level, including supervision of all activities conducted by the Contractor selected by the City to construct the project. The Contract Administrator will be the City's representative during construction and will be present on-site during all construction activities. All instructions to the Contractor will be issued by the Contract Administrator.

From an environmental perspective, the Contract Administrator will be responsible for retaining the appropriate specialists to ensure that all construction activities are carried out in conformity with applicable environmental legislation, regulations and industry standards, and are consistent with provisions in the Contract Documents, which will reflect the commitments contained in this ESR and those developed during the Detail Design phase of the project. The Contract Administrator will also ensure that the conditions of approval specified in site-specific permits, approvals and authorizations

secured from regulatory agencies for this project are adhered to, including documentation, reporting and on-site retention of such permits, as required.

Environmental compliance will be achieved through the establishment of an environmental monitoring approach that includes the use of an Environmental Inspector operating under the direction of the Contract Administrator. The project will be subject to periodic on-site environmental inspection to ensure that the execution of the environmental component of the work is occurring as planned and to deal with any environmental problems that may develop during construction. The periodic on-site inspection will be supplemented by the support of environmental specialists retained by the Contract Administrator, as required, to assure the proper implementation of site-specific mitigation or remediation measures (e.g., erosion and sediment control, monitoring of earthworks for discovery of archaeological resources).

In addition, the effectiveness of the environmental protection measures will be assessed to ensure that:

- Environmental protection measures required in the pre-construction (site preparation) phase are implemented and monitored during the construction activities (e.g., inspection for nesting migratory birds, protection of roadside trees and other vegetation);
- Individual mitigation measures are providing the expected control and/or protection (e.g., dust and noise control);
- Composite control and/or protection provided by the mitigating measures is adequate (e.g., Erosion and Sediment Control Plan; winter shutdown protection of exposed areas);
- Deficiencies (poor installation; ineffectiveness) are corrected in an effective and timely manner; and
- Additional/enhanced mitigating measures are provided, as required, for any unanticipated environmental problems that may develop during construction, and appropriate contingency and emergency response plans are in place and being followed (e.g., spills control; discovery of archaeological artifacts/human remains or vegetation/wildlife Species at Risk; impacts to potable water wells). In addition, the City will develop and implement a strategic program to survey potentially affected potable water wells in proximity to the proposed works prior to and during construction, and will provide an alternate water supply to offset adverse effects demonstrated to be attributable to the project in response to related concerns expressed by well owners.

To assist the Environmental Inspector and standardize the environmental inspection duties, a verification/checklist will be developed, listing all mitigation measures and commitments to be undertaken to ensure compliance with such commitments and associated requirements. Any concerns and required action will be detailed in a standard inspection report form and signed off on as the concerns are addressed or the additional work is completed.

The Environmental Inspector will have the mandate to verify that all environmental protection and mitigation/compensation measures are implemented. On behalf of the Contract Administrator, the Environmental Inspector will have the authority to direct the

construction crews, through the use of field orders, to interrupt specific project activities if the proper protection measures are not in place. In the event that an environmental protection measure could be modified to better protect the environment (public and workers included), the inspector will have the authority to notify the Contract Administrator. Any such proposed interruptions or notifications will be recorded by the Environmental Inspector and promptly reported to the Contract Administrator and the City's Project Manager. The inspector will give immediate notification to the Contract Administrator if, in his/her opinion, the Contractor fails to take appropriate action.

The Environmental Inspector will also monitor areas outside of the road corridor (or site) that have been identified as potentially sensitive to either direct or indirect impacts of the roadway construction (e.g., private properties and downstream reaches of Ancaster Creek, Tiffany Creek and Upper Twenty Mile Creek).

6.2.2 Environmental Effects Monitoring

Environmental monitoring after construction is completed normally involves follow-up inspection/assessment of significant or special mitigation measures, and may include scientific monitoring. In the period immediately following construction the following inspection/monitoring will occur:

- Stability of new earthworks;
- Removal of all debris and excess materials as part of final site clean-up. Surplus excavated material (provided it is free of contaminated soils) will be reused during construction or transported to an environmentally suitable location.

In addition, any environmental issues and problems that have developed or remain unresolved after construction will be identified and addressed at onsite meetings with appropriate staff from the City and affected stakeholders (e.g., property owners, regulatory agencies), depending on the nature, extent and significance of the issue or problem.

For this project, the following longer term post-construction monitoring requirements have been established or are anticipated:

- Function of stormwater management controls/treatments;
- Health and effectiveness of landscaping/screening components and/or salt management plans, and the health of retained individual roadside trees and vegetation communities;
- Success of ecological restoration plantings at watercourse crossings;
- Long term impacts to potable water wells, as required; and
- Intersection operations.

6.3 Approvals Required Prior to Construction

The City of Hamilton will obtain the necessary permits and approvals for the construction, operation and maintenance of the Garner Road/Rymal Road and Garth Street improvements project. This section of the report identifies both project-specific permits and approvals that are known to be required at this time, and those that are typically required for this type of project.

6.3.1 Municipal

The following municipal permits and approvals may be required for the construction of this project:

- City Council endorsement.
- Portions of the study area are located within lands regulated by the Hamilton Conservation Authority's Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation 162/06 under Ontario Regulation 97/04 of the *Conservation Authorities Act*. These lands are associated with the headwater areas of Ancaster Creek, Tiffany Creek and the Red Hill Creel. A permit from the HCA will be required for any works proposed within these regulated areas. It is noted that this project will be phased in sections over a period of time. As such, a permit for each phase will be required. HCA has advised the City that it will consider the work on a contract basis, rather than a regulated area basis (i.e., one permit/contract regardless of how many regulated areas are within the contract limits).
- Portions of the study area are located within lands regulated by the Niagara Peninsula Conservation Authority's Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation 155/06 under Ontario Regulation 97/04 of the *Conservation Authorities Act*. These lands are associated with the headwater areas of Upper Twenty Mile Creek. A permit from the HCA may be required for any works proposed within these regulated areas. NPCA has advised the City to assume a 50 m buffer around the watercourse and NPCA will determine whether a permit is required after a review of the Preliminary Design proposals.
- In accordance with City of Hamilton By-Law 06-026, approval for Installation, Connection and Use of Sewers and Drains, including for stormwater management facilities.
- Exemptions from City of Hamilton By-Law 11-285 (Noise Control By-Law) for construction activities that must be conducted outside the hours of operation.

6.3.2 Provincial

The following provincial permits and approvals may be required for the construction of the project:

- *Ontario Water Resources Act* Permit to Take Water (PTTW) from the Ministry of the Environment (MOE), under Ontario Regulation 387/04, if dewatering for services or foundations exceeds 50,000 litres per day. It is not expected that the PTTW requirement related to dewatering or diversion of flow from watercourses via mechanical means (pumping) will be required.
- Environmental Compliance Approvals from MOE for new/relocated sewers and stormwater management outfalls, and sewer use for discharge of dewatering effluent (in compliance with s. 53 of the *Ontario Water Resources Act* and relevant MOE guidelines).
- Excess waste generated on-site that requires off-site removal should be in accordance with Ontario Regulation 347 under the *Environmental Protection*

- Act*, which includes provisions for the transportation and processing of hazardous and non-hazardous waste.
- Ministry of Tourism, Culture and Sport agreement on any documentation of additional archaeological investigations required to clear the corridor from further concern for this project. Accordingly, further archaeological will be conducted and the associated report(s) will be submitted to MTCS for review and acceptance, as required¹⁶ prior to any ground disturbance.
 - Where removal of potentially contaminated soil must take place, soils will be tested for those chemicals that may have been used or dumped within the area, and will be handled in accordance with Part XV.I of the *Environmental Protection Act* and Ontario Regulation 153/04, Records of Site Condition. Similarly, the quality of all fill material brought on site will meet the Ontario Regulation 153/04 requirements for the respective property use.
 - Approval from the Ministry of Transportation of Ontario for work in the Highway 6 Interchange area.

6.3.3 Federal

With the enactment of the Canadian Environmental Assessment Act, 2012, there are currently no identified federal environmental assessment or other approvals that the City must obtain for the project. As design progresses, the City of Hamilton will continue to monitor the project for potential federal requirements.

6.3.4 Environmental Study Report Amending Procedure

The Municipal Class Environmental Assessment process includes an addendum process for proponents to make changes to a project after completion of the Environmental Study Report review stage (Phase 4).

Modifications to the design and implementation of the Garner Road/Rymal Road and Garth Street improvements proposed in this Environmental Project Report may occur due to unforeseen circumstances, including: changes in environmental conditions in the corridor that may affect anticipated project impacts and means of mitigating adverse effects; technological advancements; and funding availability. This may result in the project being inconsistent or non-compliant with commitments made in the ESR. Significant modifications to the project proposals or changes in the environmental setting that occur after the filing of the ESR will require preparation of an addendum to the ESR.

Changes to the project may also be required if there is a significant lapse of time between the filing of the ESR and the start of construction, since the proposed project and related environmental mitigation measures may no longer be valid or appropriate.

¹⁶ Effective November 13, 2012, MTCS rolled out a new process for reviewing reports. Those projects considered “low risk” (i.e., projects documented in Stage 1 reports where Stage 2 has been recommended, or Stage 2 reports where fieldwork did not identify any archaeological material; thus, there will be no impacts to cultural resources) will now not undergo any technical review. They will simply be entered into the report register.

If the period of time from the end of the public review period following filing of the ESR in the public record, or MOE's denial of a Part II Order request, to the proposed commencement of construction exceeds ten (10) years, the City will be required to review the planning and design process and current environmental setting to ensure that the project and mitigation measures are still valid/appropriate. The review will also be documented in an addendum to the ESR.

The ESR Addendum will document the circumstances necessitating the changes to the project proposals, the environmental implications of the changes, and proposals to mitigate any associated negative effects. The Addendum will be filed with the ESR in the public record, and the same notification and review process and public right to request a Part II Order as described in Section 2.1.1 of this ESR will apply. Where an ESR Addendum is issued, only the project elements in the Addendum (the proposed changes to the recommended undertaking) are open for review.



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