Beaver Creek Road and Conservation Dr. Upgrades and Extension of Municipal Services Class Environmental Assessment

Final Report

Prepared for:
City of Waterloo

Prepared by:
Stantec Consulting Ltd.

1656 40041

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Sign-off Sheet

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INTRODUCTION AND PROBLEM STATEMENT

The City of Waterloo (City) retained Stantec Consulting Ltd. (Stantec) in Fall 2014 to undertake a study to review and implement infrastructure upgrades required to service growth and support development in the north-west area of the City. The Study Area is approximately 405 ha and is located in the north-west area of Waterloo. The area is bound to the north by the City of Waterloo boundary, to the east by low-density residential development and the Laurel Creek Conservation Area, to the south by low density residential and Greenfield areas, and to the west by Wilmot Line. The Study Area includes the proposed development area referred to as Beaver Creek Meadows (BCM). BCM represents a significant portion of the lands that were considered developable within the Study Area for the purposes of this study.

The objective is to provide transportation upgrades, address stormwater management needs within road right-of-ways, and extend municipal water and sanitary servicing along a portion of Beaver Creek Road and Conservation Drive to accommodate development, while taking into consideration the potential impacts of natural, socio-economic, cultural and built heritage environments within the study limits and in the surrounding local community. This study is being completed in accordance with the Municipal Class Environmental Assessment (Class EA) and includes a review of the existing conditions, identification of potential alternatives, and evaluation of alternatives through an environmentally sound process. Evaluation criteria were developed to capture environmental, social, technical, and economic issues relevant to this project, weighted equally across each category. There were multiple points of public consultation, including letters to stakeholders and three (3) Public Consultation Centres (PCCs). The result of this study will be to confirm the preferred alternatives and sizing requirements for transportation, water servicing, and sanitary servicing upgrades. The preferred solutions must provide sustainable, efficient, and cost effective servicing to support the proposed growth within the Study Area.

ENVIRONMENTAL STUDY REPORT

The Class EA is a formal planning process approved under the Ontario Environmental Assessment Act. The Class EA provides the framework for municipalities to plan, design and construct municipal infrastructure projects incorporating public input and consultation and ensuring full public awareness of municipal project decisions.

This Environmental Study Report (ESR) documents the planning process as set out in the Municipal Engineers Association (MEA) guidelines for Municipal Class Environmental Assessment studies and follows a Schedule ‘C’ project process.

The process included the identification of the problems and/or opportunities, documentation of the existing social and natural environment within the study area, identification of possible solutions, evaluation of alternatives, and selection of a preferred

solution. As part of the recommendation for the preferred solutions, mitigation measures and monitoring requirements are also identified for the implementation of upgrades.

This report documents the process followed, the findings of various studies and analyses, and the inputs provided from the public and agencies which lead to the final recommendations. The intent of this document is to provide a traceable process with a clear rationale and the ability to replicate the process and findings while under scrutiny.

BACKGROUND AND RELATED STUDIES

There are a number of related studies which were evaluated and incorporated into this Study, including the Beaver Creek Meadows (BCM) District Plan (The Planning Partnership, ongoing), North Waterloo Scoped Subwatershed Study (Ecoplans, MHBC and Stantec, 2013), and various City or Region of Waterloo (Region) studies and master plans related to local water, sanitary, and transportation servicing. Studies which were initiated as part of this project to complete the Study Area inventory included the Draft Natural Heritage Evaluation (December 1, 2014), Stage 1 Archaeological Assessment (October 2, 2015), and Cultural Heritage Evaluation Report (CHER) (June 2, 2015).

Existing land uses within the Study Area include a church, go-kart track, seasonal trailer park, Grand River Conservation Authority Nature Centre, farms, rural residential properties, and the Erbsville area. Roads within the Study Area are generally rural in nature, and existing land uses primarily have private water and sanitary servicing.

Future development within the area is planned to be a mix of low density residential, mixed use medium density, and open space, and natural systems. Based on the average population density in the BCM District Plan, the future population for the entire Study Area is projected to be 9,794 persons and jobs.

For additional details on supporting studies, refer to Sections 1.2 and 3.0.

ALTERNATIVE SOLUTIONS

A range of alternative solutions were proposed for the water servicing, sanitary servicing, stormwater management, and transportation infrastructure upgrades within the Beaver Creek Road and Conservation Drive Corridor in the Study Area. Alternative solutions were generated considering the design criteria relevant to each discipline and considering public and stakeholder input obtained at PCC 1 and 2. As part of the Class EA process, each discipline considered the “Do Nothing” alternative to provide a baseline against which the other project alternatives were measured. Alternatives were evaluated based on environmental, social, technical, and economic issues relevant to this project, weighted equally across each category. Preferred solutions were presented at the third Public Consultation Centre held in October 2015.

An overview of the identification and evaluation of alternative solutions is detailed in Section 4.0.

PREFERRED DESIGN ALTERNATIVES

The preferred servicing alternatives for each of the water, sanitary, stormwater and transportation infrastructure upgrades are outlined below and are detailed in Section 5.0 of the report.

Water Servicing

New watermains are recommended within the Study Area to service future growth and provide additional looping in the existing distribution system. All watermains are within the existing road right-of-way and are consistent with long-term planning for the distribution system. The recommended infrastructure includes the following:

- Installing a 300 mm watermain along Conservation Drive between Beaver Creek Road and Erbsville Road
- Installing a 300 mm connection along Conservation Drive between existing watermains near the intersection with Rideau River Street
- Installing a 300 mm watermain along Beaver Creek Road between Laurelwood Drive and Conservation Drive
- Installing a 300 mm connection along Erbsville Road from Regal Place to Conservation Drive

Additional analysis is recommended during detailed design to confirm the proposed infrastructure sizing for the above noted watermains based on the outcome of the Staging and Implementation Plan for Consolidating Pressure Zones in North-Central Waterloo (Stantec, ongoing). Adjustments to the pumping station (i.e., pumping controls or replacement of pump/impeller, etc.) or building design modifications to reduce the recommended fire flow for proposed development could also be considered should larger watermain diameters result in negative water quality impacts and/or significant capital cost increase. In addition, detailed staging is to be evaluated at time of development specific to proposed phasing to ensure adequate flows are available throughout each development stage.

The opinion of probable cost associated with the preferred water servicing upgrades is $2,680,000, and the final cost will be further refined as part of the detailed design phase.

Sanitary Servicing

As outlined in Section 4.2.6, sanitary servicing Alternative 2 is the preferred option. Alternative 2 includes servicing areas west of Erbsville Road with a gravity sewer starting at Snowcrest Place. Gravity sewers would convey flow from the western portion of Study Area to a new sewage pumping station (100 L/s) west of Beaver Creek and south of Conservation Drive (referred to as the Conservation Drive Pump Station (PS)). A forcemain would then carry flows along Conservation Drive under Beaver Creek on Conservation Drive (by trenchless methods) and discharge into a gravity sewer west of

Beaver Creek Road. Flows are then conveyed by gravity to a second new pump station (180 L/s) on Beaver Creek Road (referred to as the Beaver Creek Road PS). From Beaver Creek Road PS, a forcemain would be constructed to convey flows south to Beaver Creek Road to an existing gravity sewer.

Alternative 2 results in less impact on existing residents, reduced installation costs and dewatering requirements due to shallower gravity sewer installations, and reduced impact and/or potential impact on environmentally sensitive areas.

The opinion of probable cost for the preferred sanitary servicing design is $12,520,000, and the final cost will be further refined as part of the detailed design phase.

Stormwater Servicing

As outlined in Section 4.3.6, stormwater servicing Alternative 3 is the preferred option. Alternative 3 includes directing flows from stormwater management (SWM) facilities adjacent to Beaver Creek Road within proposed development areas to a storm sewer under the road right-of-way. This sewer will outlet to a ditch alongside the road and convey flows to the Laurel Creek Reservoir.

Alternative 3 has a standard approval process, simplified construction methodologies, low capital costs, standard maintenance requirements, and minimizes the impact to existing aquatic habitat.

In addition, Alternative 3 provides an opportunity to allow separation between the pedestrian/ cycling trail and Beaver Creek Road. A minor revision to the road cross section would place the ditch immediately adjacent to the road, and the trail could be located east of the ditch if that is a desirable configuration.

The opinion of probable cost for the preferred stormwater servicing design concept is $433,000, and the final cost will be further refined as part of the detailed design phase.

Transportation

As outlined in Section 4.4.7, the preferred transportation solution is Alternative 4. Alternative 4 includes a 20 m right-of-way with 11 m pavement width, on-street bicycle lanes, boulevard sidewalk and multi-use trail for both Beaver Creek Road and Conservation Drive.

An overall summary of the key outcomes of preferred design concept include:

- Provides much needed safety improvements within the study limits through increased clear zone distances to utility poles and improving vertical sight lines
- Reduces the potential number of injury collisions in the corridor as compared to the Do-Nothing Alternative

- Provides operational improvements at existing intersections for both current and future traffic demands

- Allows for the addition of future local side street intersections. The addition and final location of local side street intersections will be largely driven by future development. Single-lane roundabouts may be considered at these locations depending on the traffic needs

- Consideration for traffic calming measures such as narrowed travels lanes, curb extensions, pavement colorization/warning markers, and location specific signage/radar speed signs

- Increases active transportation and in particular room within the roadway corridor for future transit needs

- Provides continuous on-street cycling lanes along both sides of Conservation Drive and a continuous link through a mix of on-street cycling lanes, sidewalk and/or multi-use trail on Beaver Creek Road; neither of these currently exist within the current Study Area

- It is recognized that while the preferred design concept would have the least number (23) of properties impacted, it would require the greatest area (1.88 hectares excluding temporary easements and utility easements) of property to be acquired, mainly due to the roundabout which will directly impact an existing residential structure

The opinion of probable cost for the preferred transportation alternative is $8,487,000, and the final cost will be further refined as part of the detailed design phase.

CONSTRUCTION, SCHEDULE AND COST

The estimated total project cost for the preferred design servicing alternatives is approximately $24,120,000, excluding HST. The final cost will be further refined as part of the detailed design phase and will depend on costs for relocation of utilities and property acquisition.

It is anticipated that construction of the improvements will commence in 2016, pending detailed design, property acquisitions, and utility relocations.

ENVIRONMENTAL IMPACTS AND MITIGATING MEASURES

Mitigation measures for implementing the preferred alternatives to minimize impacts to natural and cultural heritage features are summarized and provided in further detail in Section 6.0. This information is to be used in preparing the final detailed design plans, construction timing, agency approvals and on-going monitoring to ensure that the features identified within this Study are protected, maintained, restored and enhanced (where applicable) through the implementation of the preferred alternatives. It can be noted that

during detailed design, the appropriate environmental oversight agencies, cultural and heritage oversight agencies, utilities, and stakeholders will be coordinated with to confirm potential impacts and recommended mitigation measures, as well as obtain the necessary approvals and permits.

Natural Environment

Recommended measures to minimize and mitigate the potentially adverse environmental impacts associated with the planning, design and construction of the proposed preferred alternatives include actions for activities related to tree removal, sediment and erosion control measures, and dewatering. Guidance on the timing and planning of construction is provided to mitigate potential impacts to wetlands, woodlots, potentially significant wildlife, such as turtle nesting and Blandings Turtle migration, and aquatic habitats.

Archaeological and Cultural Heritage Resources

Preferred servicing alternatives and upgrades have the potential to directly affect archaeological and cultural heritage resources. The recommended follow-up and mitigation measures to mitigate potentially adverse archaeological and cultural heritage impacts associated with the planning, design, and construction of the proposed preferred alternatives include a Stage 2 Archaeological Assessment along the study area corridor and Heritage Impact Assessment (HIA) for the identified heritage resources. These studies will specifically recommend mitigation measures.

STUDY COMPLETION AND CLOSING STATEMENTS

The accompanying study and report are the result of a combined effort and input from various study team members, staff members of the City of Waterloo, developer representatives, agencies, and various members of the public.

The ESR will be placed on the public record for a 30 day review period and following the review period, assuming there are no requests for a Part II Order, the study will be deemed completed. Completion of the study will permit the proponent to proceed with the detailed design and construction of the proposed works.

Abbreviations

AODA	Accessibility of Ontarians with Disabilities Act
ANSI	Areas of Natural and Scientific Interest
BCM	Beaver Creek Meadows
CA	Conservation Area
CHER	Cultural Heritage Evaluation Report
CHVI	cultural heritage value or interest
City	City of Waterloo
Class EA	Municipal Class Environmental Assessment
COSSARO	Committee on the Status of Species at Risk in Ontario
DGSSMS	Region of Waterloo and Area Municipalities Design Guidelines and Supplemental Specifications for Municipal Services
E&S	Erosion and sediment
ESA	Endangered Species Act
ESL	Environmentally Significant Landscape
ESPAs	Environmentally Sensitive Policy Areas
ESR	Environmental Study Report
HIA	Heritage Impact Assessment
GAWSER	Guelph All-Weather Storm-Event Runoff
GRCA	Grand River Conservation Authority
LOS	Level of service
MNR and MNRF	Ontario Ministry of Natural Resources (and Forestry)
MOE and MOECC	Ontario Ministry of Environment (and Climate Change)
MTCS	Ministry of Tourism, Culture and Sport
MUT	Multi-Use Trail
NWSSS	North Waterloo Scoped Subwatershed Study
p+j/ha	Persons and jobs/hectare
PCC	Public Consultation Centre
PS	Pump Station
PSWs	Provincially Significant Wetlands

Abbreviations

Region	Region of Waterloo
ROW	Right of way
SWH	Significant Wildlife Habitat
SWM	Stormwater Management
Stantec	Stantec Consulting Ltd.
TAC	Transportation Association of Canada
TBD	To be determined
TSS	Total Suspended Solids
WNH	Waterloo North Hydro

1.0 INTRODUCTION

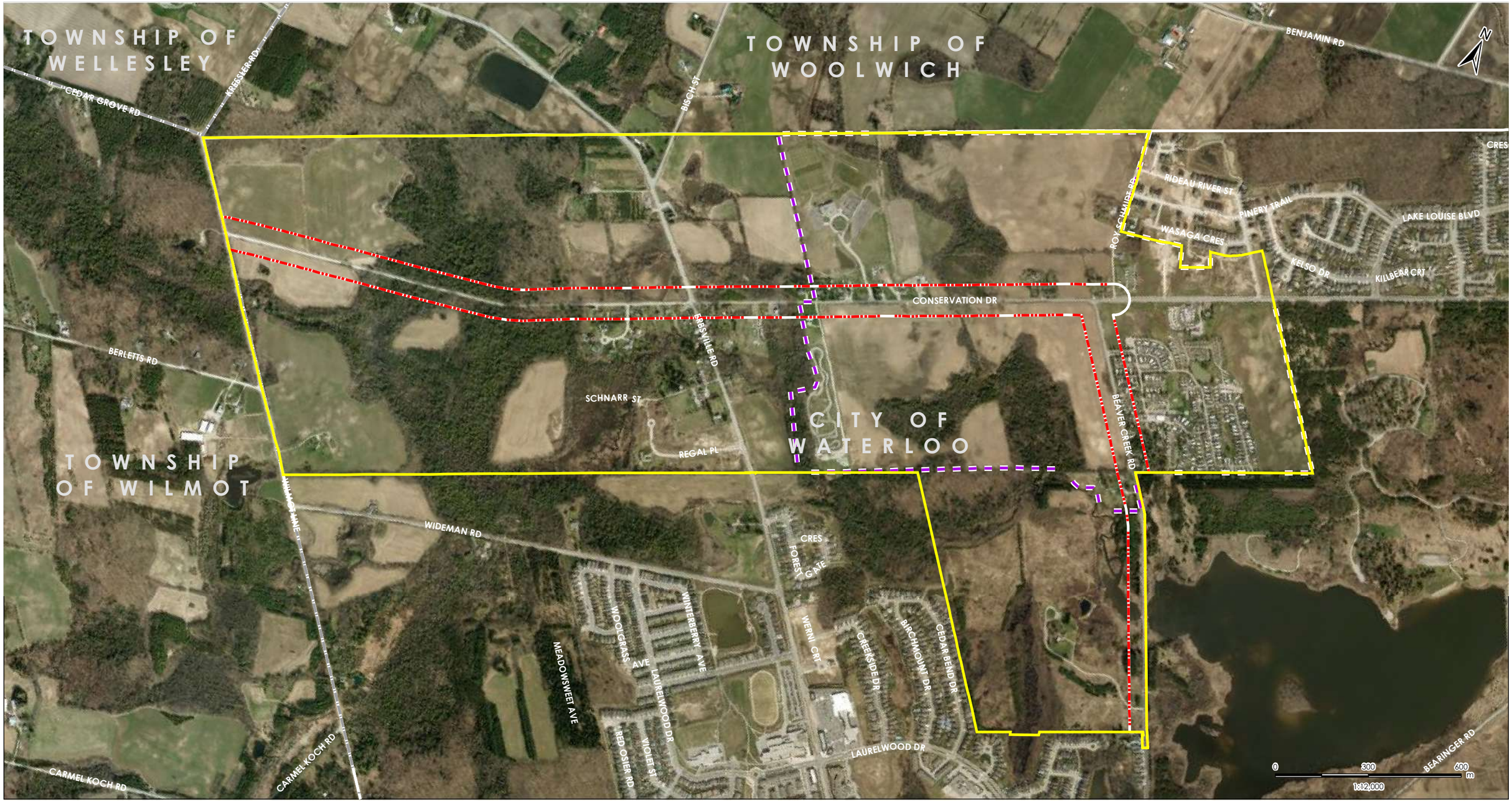
The City of Waterloo (City) retained Stantec Consulting Ltd. (Stantec) to undertake a study to review and implement infrastructure upgrades required to service growth and support development in the north-west area of the City. The objective is to provide transportation upgrades, address stormwater management needs within road right-of-ways, and extend municipal water and sanitary servicing along a portion of Beaver Creek Road and Conservation Drive. This study is being completed in accordance with the Municipal Class Environmental Assessment (Class EA) (October 2000, as amended in 2007 & 2011) and includes a review of the existing conditions, identification of potential alternatives, and evaluation of alternatives through an environmentally sound process. The result of this study will be to confirm the preferred alternatives and sizing/capacity requirements for transportation, water servicing, and sanitary servicing upgrades.

1.1 LOCATION AND STUDY AREA

The Study Area is approximately 405 ha and is located in the north-west area of Waterloo, as shown in Figure 1-1 (please note a print error was made on the Public Consultation Centre presentation boards for the size of the Study Area). The area is bound to the north by the City of Waterloo boundary, to the east by low-density residential development and the Laurel Creek Conservation Area, to the south by low density residential and Greenfield areas, and to the west by Wilmot Line. The Study Area includes the proposed development area referred to as Beaver Creek Meadows (BCM), as shown on Figure 1-1. BCM represents a significant portion of the lands that were considered developable within the Study Area for the purposes of this study.

Existing land uses within the Study Area include a church, go-kart track, seasonal trailer park, Grand River Conservation Authority Nature Centre, farms, rural residential properties, and the Erbsville area. Roads within the Study Area are generally rural in nature, and existing land uses primarily have private water and sanitary servicing.

Consideration for the entire Study Area is important to determine the infrastructure needs to service proposed growth; however, the focus of this project is primarily infrastructure upgrades along the Beaver Creek Road and Conservation Drive corridor (refer to Figure 1-1). Proposed sanitary pump station locations are the only infrastructure upgrades outside of the focus area based on technical requirements. Local servicing and transportation routes within proposed developments are not within the scope of this study.



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Revised: 2014-09-09 By: seanes

September 2014
165640041

Stantec

Legend

- Study Area Boundary
- Focus of the Class EA
- Beaver Creek Meadows District Plan

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2014.
3. 2010 orthoimagery © First Base Solutions, 2014.

Client/Project

City of Waterloo
Beaver Creek Road & Conservation Drive
Extension and Sewage Pumping Stations

Figure No.

1-1

Title

Location Map of Study Area

1.2 RELEVANT AND CONCURRENT STUDIES

This project was completed in parallel to the Beaver Creek Meadows (BCM) District Plan (The Planning Partnership, ongoing). As noted previously, BCM represents a significant portion of developable land within the Study Area. Outcomes of the BCM District Plan were used to confirm sizing/capacity requirements for proposed infrastructure upgrades (Refer to Appendix B for BCM District Plan Draft Report dated June 2015).

In addition to the BCM District Plan, several existing studies have been completed that are relevant to the Study Area. These studies have provided background information for the Class EA and include:

- North Waterloo Scoped Subwatershed Study (Ecoplans, MHBC and Stantec, 2013)
- Beaver Creek Sewage Pumping Station Class EA (Paragon, 1992)
- West Side Trunk Sanitary Sewers South Branch Class EA Schedule B (Planning and Engineering Initiatives, Proctor and Redfern, and Paragon, 1996)
- Waterloo Sanitary Servicing Master Plan (Stantec, ongoing)
- Balancing Environmental Protection and Transportation Considerations in the Laurel Creek Headwaters Environmentally Sensitive Landscape (Dougan & Associates, ongoing)
- City of Waterloo Transportation Master Plan (IBI Group, 2011)
- Region of Waterloo Transportation Master Plan (AECOM, 2011)
- Region of Waterloo Cycling Master Plan (ESG International Inc., Marshall Macklin Monaghan Ltd., Paradigm, 2004)
- Walk Cycle Waterloo Region Active Transportation Master Plan (Region of Waterloo, 2014)
- West Waterloo Integrated Multi-Modal Transportation Study (City of Waterloo, ongoing)
- Tri-City Water Distribution Master Plan Final Report (AECOM, 2009)
- Water Supply and Distribution Operations Master Plan Final Report (Stantec, 2015)

2.0 CLASS ENVIRONMENTAL ASSESSMENT (EA)

2.1 OVERVIEW OF THE PROCESS

This project is being completed in accordance with the Class EA process. The Class EA process, which is presented in Figure 2-1, has the following phases:

- Phase 1: Problem identification and justification for the undertaking
- Phase 2: Identification of alternative solutions, evaluation of alternatives, and selection of preferred solutions
- Phase 3: Identification of alternative methods to implement the preferred solution, with consideration given to environmental effects and methods of mitigation
- Phase 4: Preparation of an Environmental Study Report (ESR) to document the rationale for the project and the study process
- Phase 5: Implementation of the preferred solution to monitor during the construction phase to ensure adherence to environmental provisions and provide specifications with regard to the concerns raised during the planning and design process

Municipal Class EA Planning and Design Process

Municipal Engineers Association, June 2000, amended in 2007 and 2011

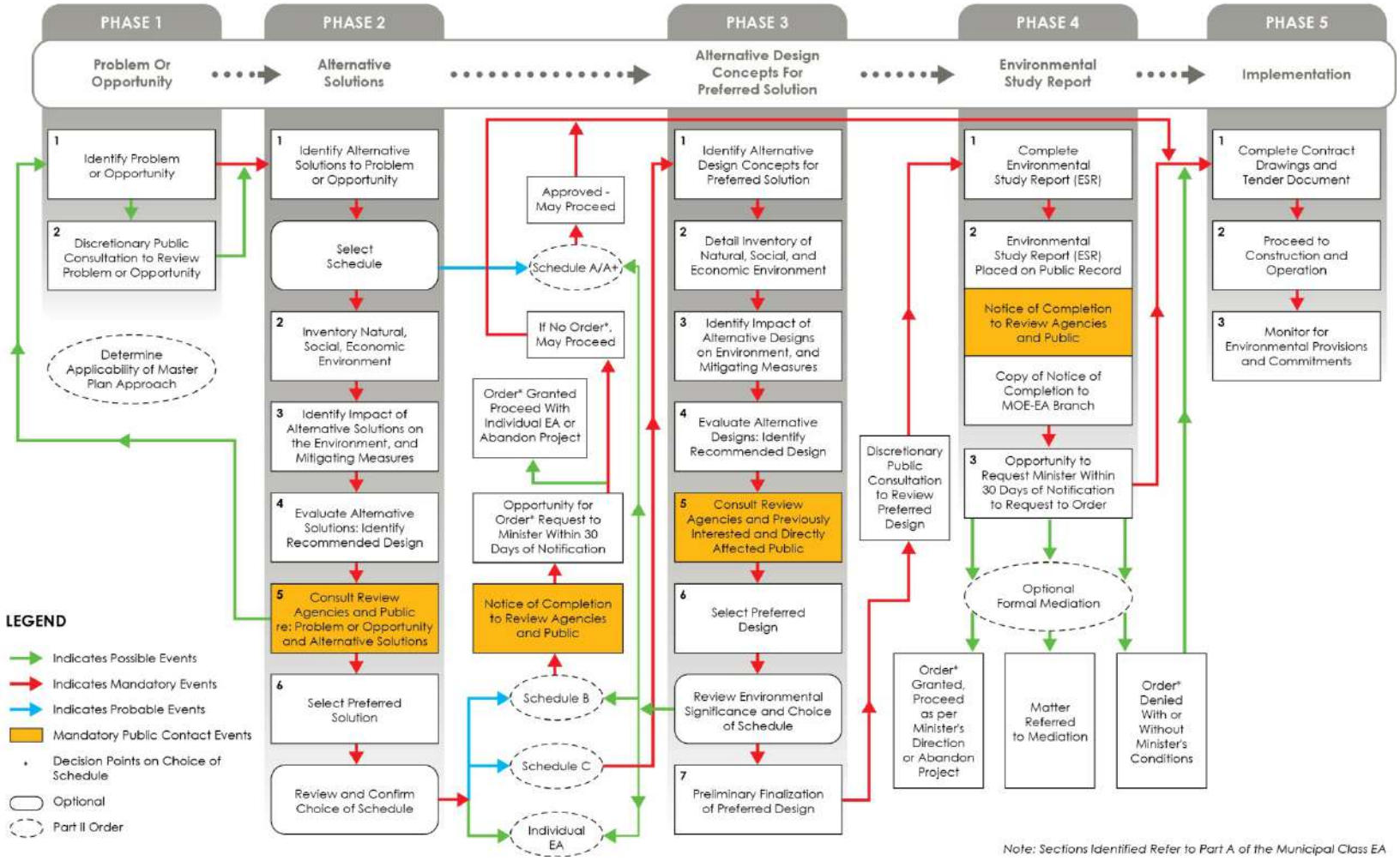


Figure 2-1: Municipal Class EA Planning Process – Flow Chart

The Class EA process has four levels of evaluation: Schedule A, Schedule A+, Schedule B, and Schedule C. Schedule A projects are considered exempt from the Class EA process, while Schedule A+ projects are pre-approved, however the public must be advised prior to project implementation. Schedule B projects are those which have a potential for adverse environmental impacts, requiring completion of Phases 1 and 2 including consultation. Schedule B projects are approved subject to agency screening after completion of Phases 1 and 2 and filing of a Project File. Schedule C projects require the completion of all four phases of the Class EA, including the filing of an ESR documenting the findings. Schedule C projects have the potential for significant environmental impacts and must follow all four phases of the Class EA, including filing an ESR documenting the findings.

This project is being completed as a Schedule C project. If concerns are raised during the 30-day public review period that cannot be resolved through discussions with the proponent (City), a “Part II Order” request may be submitted to the Minister of the Environment by any objector. For Schedule C projects, a written request must be submitted to the Minister within a minimum 30 calendar day review period commencing once the proponent has issued the Notice of Study Completion and filed the ESR on the public record. Requests made or received after the minimum 30 calendar day review period will not be considered. Part II Order requests can be submitted to:

Minister of the Environment and Climate Change
77 Wellesley Street West
Ferguson Block, 11th Floor, Toronto, ON M7A 2T5
Fax: 416-314-8452

Copy to:

Director, Environmental Approvals Branch
Ministry of the Environment and Climate Change
135 St. Clair Avenue West, 1st Floor
Toronto, ON M4V 1P5

In the event that there are no Part II Orders on the project, or the Minister denies a Part II Order request (with or without conditions), then the proponent (City) will have complied with Section 13 (3) (a) of the Environmental Assessment Act and will have the right to proceed to design and construction of the recommended preferred design concept (Phase 5 of the Class EA process).

2.2 PROJECT RATIONALE AND PROBLEM STATEMENT

The City is completing a Schedule C Municipal Class EA Study to determine preferred infrastructure upgrades to service growth and support development in the north-west area of the City. Currently, roads within the Study Area are generally rural in nature, and existing land uses primarily have private water and sanitary servicing. This study is intended to identify upgrades and confirm sizing requirements for the following:

- Roadway upgrades to Beaver Creek Road and Conservation Drive
- Sewage pumping station(s) and forcemain requirements for sanitary servicing
- Extension requirements of existing collector gravity sewers and watermain networks
- Storm sewers and stormwater management needs within the road rights-of-way

The preferred solutions must provide sustainable, efficient, and cost effective servicing to support the proposed growth within the Study Area.

2.3 PROJECT SCHEDULE

The following Figure 2-2 presents the key project milestones during the Beaver Creek Road and Conservation Drive Upgrades and Extension of Municipal Services Class EA study.

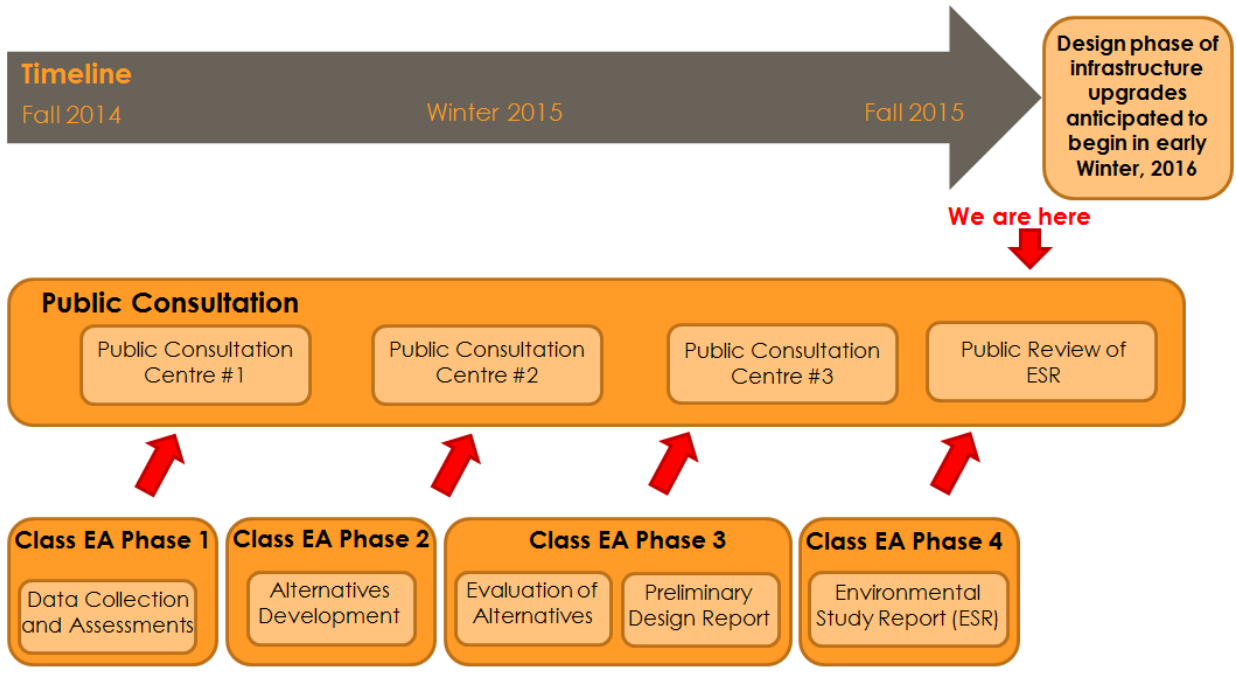


Figure 2-2: Summary of Project Schedule

2.4 PUBLIC CONSULTATION

Public consultation was conducted as part of this project to gain input from the interested public, residents, and stakeholders who may be impacted by the implementation of the infrastructure upgrades. The following sections summarize the various means of communication used to inform and solicit input from the affected public. Information was also posted on the City website (http://www.waterloo.ca/en/living/conservation-drive-beaver-creek-road-ea.asp).

2.4.1 Project Contact List

A Project Contact List was developed at the start of this project and maintained throughout. The Contact List initially contained relevant Agency, First Nations, and Special Interest Group Contacts (based on previous projects and local knowledge) and residents living within the Study Area. Additional names were added to the Contact List at their request.

2.4.2 Notice of Commencement

A combined Notice of Commencement and Notice of Public Consultation Centre (PCC) #1 was issued in October 2014. The combined Notice was published in the Waterloo Chronicle on October 15, 2014, posted on the City website on October 14, 2014, and mailed to all parties on the Project Contact List. Copies of the notification letter and a list of the recipients are included in Appendix A.

2.4.3 Public Consultation Centre #1

On October 21, 2014 the first PCC (PCC #1) was held at Creekside Church, located at 660 Conservation Drive from 5:00 to 8:30 PM. As noted above, the Notice of the PCC was combined with the Notice of Commencement and published in the Waterloo Chronicle on October 15, 2014, posted on the City website on October 14, 2014, and mailed to all parties on the Project Contact List. Thirty-nine (39) people attended the PCC, including City and Stantec representatives.

The purpose of PCC #1 was to obtain input on the problem identification and potential opportunities. Poster boards were displayed to provide an overview of the project, summarize the project objectives, outline key issues and opportunities, and describe existing conditions within the Study Area. Comment sheets were also provided at the event in order to collect feedback from attendees.

Written feedback was received from approximately 33 people in response to the combined Notice of Commencement and PCC #1. The majority of the responses were requests to be kept informed throughout the project. Remaining comments were focused on the following:

- Opportunities to provide sidewalks and multi-use trails to provide safer routes for pedestrians and cyclists
- Concern for impact of proposed upgrades to local businesses (i.e. through road closures)
- Concerns for impacts to the environment (i.e. wildlife and environmentally sensitive areas) and heritage features as a result of development and infrastructure upgrades
- Ability to subsidize infrastructure costs based on proposed population densities

- Managing surface water flows to maintain the flow balance and address potential flooding concerns for local residents

- Impact on land owners as a result of expropriation of lands, potential impacts on property value, and aesthetics

- Feedback from agencies identifying relevant planned work, areas of concern or interest, and future consultation requests/requirements

A copy of the presentation and Agency and Public responses are provided in Appendix A. Also included in Appendix A are a sample of the notification letter and a list of the recipients. Please note, a print error was made on the presentation boards for the size of the Study Area (shown on Board 3), as previously noted in Section 1.1.

2.4.4 Public Consultation Centre #2

On February 10, 2015 the second PCC (PCC #2) was held at Creekside Church (similar to PCC #1) from 6:00 to 8:30 PM. Notice of the PCC was published in the Waterloo Region Record on January 31, 2015, and mailed to all contacts on the Project Contact List. Thirty-five (35) people attended the PCC including Stantec and City representatives. A notice was posted on the City website on February 20, 2015 soliciting feedback on the proposed district plan and referencing the PCC.

The purpose of PCC #2 was to present potential servicing alternatives and to obtain input from the public to incorporate feedback into the evaluation of alternatives. Poster boards were displayed to provide an update on the project schedule, an overview of the natural environment and cultural and heritage studies, and alternatives for water, sanitary, stormwater, and transportation upgrades. Comment sheets were also provided at the event in order to collect feedback from attendees. Written feedback was provided from approximately eight (8) people in response to PCC #2. The majority of the feedback was received from residents who noted concerns or comments for the following:

- Increased traffic volume associated with proposed development and the potential for traffic calming measures

- Impact to properties based on road widening

- Impact to water supply with respect to private water supply servicing

- Managing stormwater flows to avoid flooding and impacts to aquatic life

- Availability of municipal servicing for lots currently on private services

- Impact on environmentally sensitive lands, wildlife and species at risk, and native plants and forested areas

Additional feedback was also received from agencies to clarify future consultation requests/ requirements and from representatives of developers.

Preferences for sanitary servicing alternatives were noted in two comments received. One (1) resident expressed a preference for Alternative 2 to avoid servicing through lands that are currently under review for development. One (1) developer representative indicated a preference for Alternative 1 to minimize the number of pump stations to service the proposed development within BCM. Feedback regarding transportation upgrades indicated a preference for separate cycling lanes to provide safer environment, particularly for children.

Appendix A contains a copy of the boards, public and agency responses, along with a sample of the notification letter and a list of the recipients. Please note, a print error was made on the presentation boards for the size of the Study Area (shown on Board 3), as previously noted in Section 1.1.

2.4.5 Public Consultation Centre #3

On October 7, 2015 the third PCC (PCC #3) was held at Creekside Church (similar to PCC #1 and #2) from 5:30 to 8:30 PM. Notice of the PCC was published in the Waterloo Region Record on September 23, 2015 and mailed to all contacts on the Project Contact List. Nineteen (19) people attended the PCC including Stantec and City representatives.

The purpose of PCC #3 was to present the preferred servicing alternatives and to obtain input from the public to incorporate feedback into the final ESR. Poster boards were displayed to provide an update on the project schedule, an overview of the alternatives for water, sanitary, stormwater, and transportation upgrades. Comment sheets were also provided at the event in order to collect feedback from attendees.

Written feedback was provided from approximately seven (7) people in response to PCC #3. The majority of the feedback was received from agencies, planners, and residents who noted concerns or comments for the following:

- Increased traffic volume associated with proposed development at Wilmot Line and Conservation Drive
- Potential impact to wildlife and species at risk based on road widening
- Clarification of field investigation activities completed as part of this Study
- Quantifying wetland impacts for the preferred stormwater management option
- Environmental management during construction including removal of invasive plant species and impacts to aquifers
- Opportunities for a bypass to reduce potential traffic impacts through the Village of Erbsville

- Request for additional information regarding conceptual design for local servicing and transportation upgrades
- Clarification regarding sanitary drainage areas

Input from the public was taken into consideration to clarify the conceptual designs and refine the evaluation of alternatives. It is noted that updates were made to the sanitary drainage areas from those presented in the PCC boards based on the feedback received. The area extending into the Township of Woolwich was removed as it was outside of the Study Area boundary, and an additional area was included based on updates to the Draft BCM District Plan. Additional details regarding the updates to the drainage areas are provided in Section 4.2.3. Appendix A contains a copy of the boards, public and agency responses, along with a sample of the notification letter and a list of the recipients. Please note, a print error was made on the presentation boards for the size of the Study Area (shown on Board 2), as previously noted in Section 1.1.

2.4.6 Filing of the Environmental Study Report (ESR) and Notice of Completion

All parties that previously expressed an interest in the project will be notified by letter regarding the completion of the project and filing of the ESR. In addition, a Notice of Completion will be placed in the local newspapers, in accordance with the requirements of the Environmental Assessment Act.

A review period of not less than 30 calendar days will be provided for the ESR commencing upon publication of the Notice of Completion. During this period, comments will be received from all agencies and stakeholders.

Copies of the ESR will be made available for viewing at the following locations:

- Waterloo City Hall, 100 Regina Street South, Waterloo ON
- City of Waterloo website - http://www.waterloo.ca/en/living/conservation-drive-beaver-creek-road-ea.asp

The Notice of Completion is available in Appendix A.

2.5 ALTERNATIVES EVALUATION CRITERIA

Evaluation criteria were developed to capture environmental, social, technical, and economic issues relevant to this project. A summary of the evaluation criteria and associated weightings is provided in Table 2-1. It can be noted that each category is weighted equally across the individual categories so each had similar influence on the scoring regardless of the number of criteria in each category. Each of the alternatives for sanitary, stormwater and transportation infrastructure were evaluated based on the criteria outlined in Table 2-1.

Table 2-1: Evaluation Criteria, Weight, and Description

Criteria	Weight	Description
Technical		
Capacity and Level of Service	3	Transportation: • Ability to accommodate traffic demands (intersection level of service (LOS), capacity, queues) Sanitary: • Ability to accommodate expected flows and peak wet weather flows Stormwater: • Ability to accommodate peak flows Water: • Ability to accommodate typical demands and fire flows
Operations and Maintenance	1	Transportation: • Ability to manage motor vehicle traffic, cyclists, transit vehicles and pedestrians through implementation of turn lanes and traffic calming Sanitary, Stormwater, and Water: • Consideration for ongoing operations/ maintenance requirements, consistency with current operational practices
Consistency with Planned Upgrades and Planning Policies	2	• Potential to coordinate with other planned works (roads, etc.) and achieve multiple planning objectives. Consistency with relevant planning policies
Constructability	1	• Ease of construction
Safety	3	Transportation: • Safely accommodates cyclists and pedestrian traffic, consideration for appropriate traffic speed, and consideration for adequate lighting and sightlines at intersections and bends. Sanitary: • Ability to accommodate peak flows and reduce the risk of flooding/sewer back-up. Stormwater: • Ability to accommodate peak flows and convey them to Laurel Creek Reservoir without undue flooding Water: • Ability to meet water quality objectives and provide adequate fire flow protection
Natural Environment		
Impact on Terrestrial	3	• Potential for and/or severity of impacts to terrestrial system based on alignment or footprint of infrastructure

Criteria	Weight	Description
System		
Impact on Aquatic System	3	• Potential for and/or severity of impacts to aquatic system based on alignment or footprint of infrastructure
Impact to Wildlife	3	• Potential for and/or severity of impacts to wildlife based on alignment or footprint of infrastructure
Regulatory Considerations	1	• Ease of obtaining the necessary regulatory approvals and Source Water Protection requirements
Socio-Cultural Environment		
Impact to Property	2	• Requirements for property acquisition and impact to existing structures/features
Visual Impact	2	• Potential for and/or severity of visual impacts to the community
Potential for Noise	2	• Potential impacts of noise/vibration on the established communities and businesses
Community Impact During Construction	2	• Measure of the potential impact to the community during construction, related to pedestrian/vehicular mobility, retail/residential access, dust/noise, transit/traffic delays
Archaeological and Cultural Heritage Impact	2	• Potential for loss of archaeological resources and built heritage features
Economic Environment		
Capital Cost	6	• Capital cost to implement proposed alternative
Operating and Maintenance Cost	4	• Cost to operate and maintain the proposed alternative over its lifecycle

3.0 STUDY AREA INVENTORY

3.1 PLANNING PROJECTIONS

3.1.1 Existing Development

The Study Area is approximately 405 hectares consisting of generally undeveloped land in the north-west area of the City of Waterloo. The land is primarily designated as Low Density Residential and Open Space in the City Official Plan (2014), with significant portions west of the Village of Erbsville designated as part of the Laurel Creek Headwaters Environmentally Sensitive Landscape. Currently, the land uses include a church, go-kart track, seasonal trailer park, Grand River Conservation Authority Nature Centre, farms, rural residential properties, and the Erbsville area. Roads within the study area are generally rural in nature, and existing land uses primarily have private water and sanitary servicing.

3.1.2 Future Development

The BCM District Plan was completed in parallel with this study to refine the land use direction provided by the City's Official Plan (2014). The BCM represents approximately 156 ha of the 405 ha of land within the Study Area, as shown in Figure 3-1, which is the largest area expected to be developed within the Study Area in the short-term planning horizon. Planning information for BCM was applied to remaining developable areas within the Study Area to determine the overall planning projections.

The BCM District Plan indicates the proposed land uses for future development include:

- Low Density Residential - Single and Semi-Detached Homes
- Low Density Residential - Townhomes
- Mixed Use Medium Density Residential - Townhomes
- Mixed Use Medium Density Residential
- Mixed Use Neighbourhood Commercial
- Open Space Land Uses - Parks
- Natural Systems

Population densities in the BCM ranged from 33 persons and jobs/hectare (p+j/ha) to 89 p+j/ha depending on the land use designation for a given area. The average density was estimated to be 59 p+j/ha. A copy of the BCM District Plan Draft Report (June 2015) is provided in Appendix B for reference.

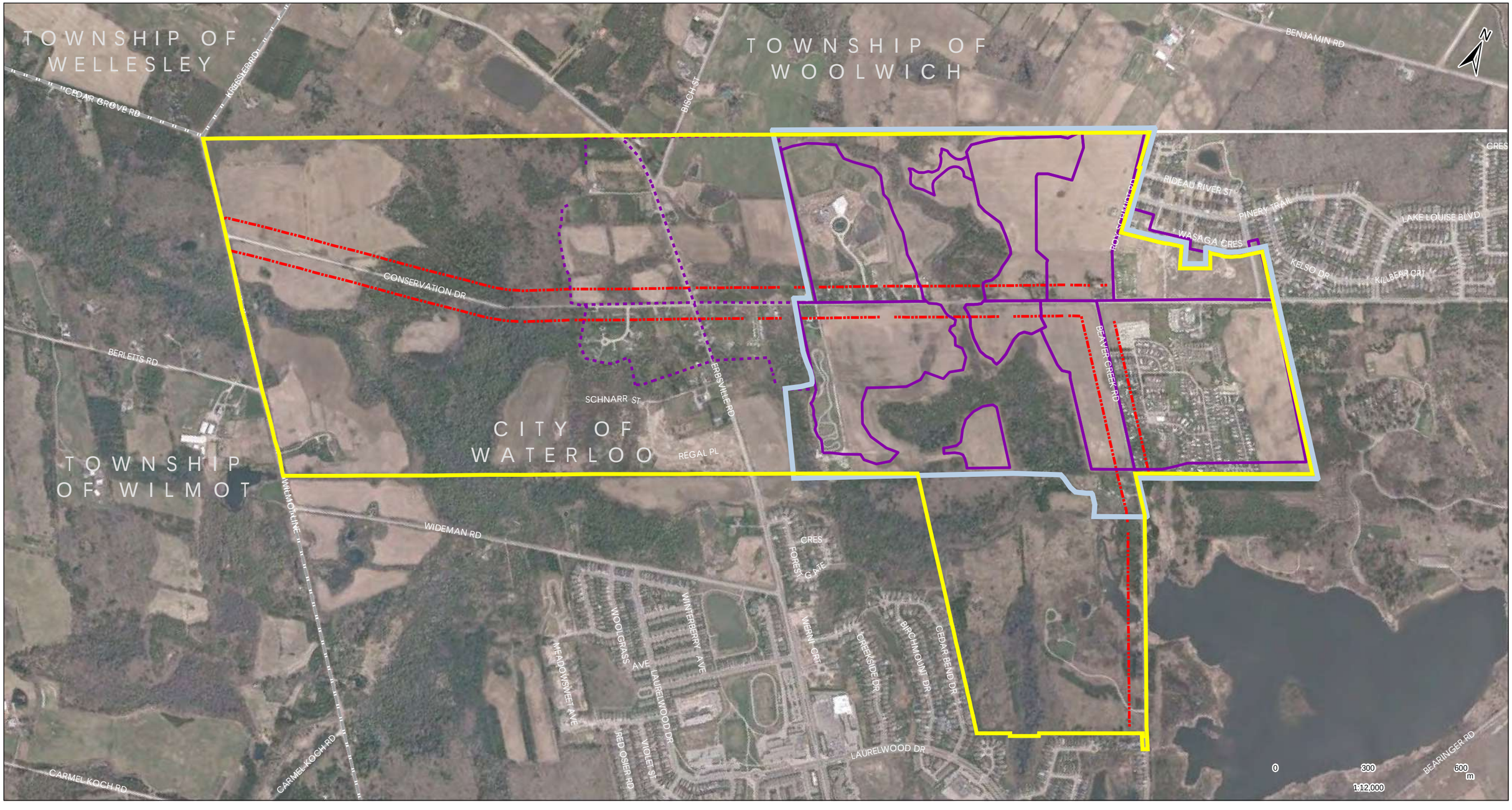
For the purposes of this study, the average population density was applied to developable lands within the Study Area to determine the overall population projections. It should be noted that the distribution of population will deviate from the average density based on land use designations; however, this will not have a significant impact on the upgrades for trunk watermains and sanitary sewers. For the purposes of determining transportation upgrades, traffic data for future conditions was provided in the BCM District Plan based on the local distribution of population.

Figure 3-1 illustrates the areas identified as potential developable land within the entire Study Area, which totals approximately 166 ha (includes the developable area for BCM and west of BCM). It can be noted that developable area within the Study Area has been well defined within the BCM, however, the developable areas for the remaining lands is to be refined as development proceeds. For the purposes of this study, developable lands west of BCM were considered up to the boundary for Environmentally Sensitive Landscape (ESL) as per the City Official Plan (2014). No further environmental buffers were considered to provide a conservative estimate of potential growth for the purposes of sizing proposed infrastructure. Based on the average population density, the future population for the entire Study Area is projected to be approximately 9,794 persons and jobs.

3.2 NATURAL ENVIRONMENT

Through the Natural Heritage Study, the terrestrial environment in the Study Area was evaluated based on background information, land use and a site investigation. The report was completed in 2014 to satisfy the intent and requirements of the Schedule C Municipal Class EA and is included in Appendix C.

The identification and description of the existing natural environment conditions within the Study Area relies heavily on previous studies and reports completed by public agencies and private developers over the past few years including the North Waterloo Scoped Subwatershed Study (NWSSS) (Ecoplans, MHBC and Stantec, 2013). The NWSSS was reviewed to determine whether any rare species or habitats were recorded within the Study Area. Field investigations as part of the NWSSS included aquatic habitat mapping, fish community sampling, Brook/Brown Trout spawning surveys, benthic/ macro-invertebrate sampling, wetland/core feature delineation, vegetation community assessment, floral inventory, various avian surveys, Lepidoptera and Odonata surveys, herpetofauna surveys and mammal surveys. Specialized species at risk surveys and a wildlife assessment were also conducted as part of the NWSSS. The extent of the NWSSS within the Study Area included Conservation Drive from 500 m East of Erbsville Road to Beaver Creek Road, and along Beaver Creek Road from Conservation Drive to the south end of the Trailer Park.



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Revised: 2015-12-10 By: kbuchanan

December 2015
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Stantec

Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2014.
3. 2010 orthoimagery © First Base Solutions, 2014.

Legend
- Study Area Boundary
- Focus of the Class EA
- Beaver Creek Meadows District Plan
- Developable Area
- Developable Area to be Refined as Development Proceeds

Client/Project
City of Waterloo
Beaver Creek Rd. & Conservation Dr. Upgrades and Extension of Municipal Services Municipal Class EA

Figure No.
3-1

Title
Study Area

As part of this Natural Heritage Study, vegetation surveys, wildlife habitat assessments and aquatic assessments were undertaken in areas that were not previously surveyed in the NWSSS. An updated aquatic habitat assessment was conducted where Beaver Creek crosses Conservation Drive to confirm findings of the NWSSS. Field surveys were undertaken in the following locations:

- Conservation Drive from Wilmot Line to Beaver Creek Road
- Beaver Creek Road from Conservation Drive to the Laurel Creek Nature Centre Lands

Site visits were conducted on September 16, 2014, to confirm the presence of Natural Heritage Features, map vegetation, and to determine general characteristics of the Study Area. During the field visit, the Study Area was evaluated with respect to dominant vascular plants, site topography, wetland areas, incidental wildlife contacts, and aquatic and terrestrial habitat potential. Prior to the site visits a review of background information, satellite images and topographic maps was conducted to identify potential Natural Heritage Features and species of conservation concern. Photographs of the Study Area were taken and observations of any wildlife, vegetation or natural features were recorded.

The Study Area is located within the physiographic region classified by Chapman and Putnam (1984) as the Waterloo Hills, which is commonly referred to as the Waterloo Moraine. The Waterloo Moraine occupies a large portion of the Regional Municipality of Waterloo, with the surface of this physiographic feature consisting of sandy hills, ridges of sandy till, kames or kame moraines and intervening hollows of outwash sand and gravel, which all can be capped by glacial till. Due to the sandy nature of this region, drainage is particularly good. A number of small kettle lakes are present in this region, as are numerous small swamps. Refer to Figure 3-2 for an overview of designated natural features in the Study Area.

3.2.1 Terrestrial Environment

The Study Area is representative of a typical southern Ontario landscape mosaic, consisting of urban, rural residential, institutional (church), natural, agricultural, educational (Laurel Creek Nature Centre), and recreational (Erbsville Kartway) uses. The Study Area is predominantly agricultural, with large blocks of natural heritage features.

Stantec

Legend

- EA Study Area
- North Waterloo Subwatershed Study Area Boundary
- Aquatic Habitat Assessment Survey Area
- Natural Heritage Assessment Area
- Core Natural Feature (RMOW)
- Laurel Creek Headwaters Environmentally Sensitive Landscape
- Environmentally Sensitive Policy Area (ESPA)
- Watercourse

Wetlands

- Evaluated-Provincial
- Evaluated-Other
- Other GRCA Regulated Wetlands

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.
3. Orthoimagery © First Base Solutions, 2014.

December 2015
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Client/Project

Beaver Creek/Conservation Drive
City of Waterloo
Waterloo, Ontario

Figure No.

3.2

Title

Designated Natural Heritage Features

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Revised: 2015-12-04 By: ccoghlan

3.2.2 Environmental Designations

There are a number of designated natural features within the Study Area and on adjacent lands, including Regional Municipality of Waterloo Environmentally Sensitive Policy Areas (ESPAs), the Laurel Creek Headwaters Environmentally Sensitive Landscape (ESL), Provincially Significant Wetlands (PSWs), locally significant wetland, Regionally and City designated significant woodlands, natural hazards (i.e., floodplain), and the Laurel Creek Conservation Area (CA).

3.2.2.1 Environmentally Sensitive Landscapes

Laurel Creek Headwaters Environmentally Sensitive Landscape

The majority of the Study Area along Conservation Road, west of Erbsville Road is designated as part of the Laurel Creek Headwaters Environmentally Sensitive Landscape (ESL). The Laurel Creek Headwaters ESL links several important natural habitats and landforms on the Waterloo Moraine.

3.2.2.2 Environmentally Sensitive Policy Areas

Environmentally Sensitive Policy Areas (ESPA) identified in the Study Area are described below.

Laurel Creek Forest (ESPA 80)

Within the Study Area, the Laurel Creek Forest (ESPA 80) occupies the majority of tree cover west of the Laurel Creek Reservoir, and small sections of forest south of Conservation Drive, approximately 300 m east of Erbsville Road and southeast of Beaver Creek. The Laurel Creek Forest consists of a combination of swamp and upland habitat associated with Laurel Creek, and connects Schaefer's Woods to the Laurel Creek Reservoir. Swamp communities within the Laurel Creek Forest are part of the Sunfish Lake/Laurel Creek PSW Complex.

Laurel Creek Conservation Area (ESPA 18)

The Laurel Creek Conservation Area is located east of Beaver Creek Road and includes the Laurel Creek Reservoir and surrounding ESPA area. Laurel Creek Conservation Area is approximately three square km (3 km^2) in size, 40% of which consists of the Laurel Creek Reservoir, a man-made lake with a dam to help maintain and control water levels in the Grand River. Most of the Laurel Creek Conservation Area is part of the Sunfish Lake/Laurel Creek PSW Complex.

Schaefer's Woods (ESPA 17)

Within the Study Area, Schaefer's Woods (ESPA 17) occupies the majority of tree cover west of Erbsville Road within the Laurel Creek Headwaters ESL. Portions of Schaefer's Woods consist of mixed swamp habitat that is part of the Sunfish Lake/Laurel Creek PSW Complex.

3.2.2.3 Species at Risk

The Endangered Species Act (ESA) identifies wildlife species considered to be at risk in Ontario and designates them as threatened, endangered, extirpated or of special concern. Provincial species at risk are identified by the Committee on the Status of Species at Risk in Ontario (COSSARO). COSSARO is a committee of wildlife experts and scientists, including those who provide Aboriginal Traditional Knowledge, that classify species according to their degree of risk based on the best available scientific information, community knowledge and aboriginal traditional knowledge.

The ESA protects endangered and threatened species by prohibiting anyone from killing, harming, harassing or possessing protected species, as well as prohibiting any damage or destruction to their habitat. Endangered and threatened species on the SARO List are provided with general habitat protection under the ESA. General habitat protection extends to areas that species depend on to carry out their life processes, such as reproduction, rearing, hibernation, migration or feeding. For some species protected habit may be identified by regulation. Regulated habitat provides a more precise definition of a species' habitat and may describe features, geographic boundaries or other unique characteristics. Once finalized, protection of regulated habitat replaces the general habitat protection for that species.

Any activity that may impact a protected species or its habitat requires the prior issuance of a Permit from the Ministry of Natural Resources (MNR), unless the activity or species is subject to any of the special provisions in Ontario Regulation 242/08. Permits may only be issued under certain circumstances, which are limited to activities required to protect human health and safety, activities that will assist in the protection or recovery of the species, activities that will result in an overall benefit to the species or activities that may provide significant social or economic benefit without jeopardizing the survival or recovery of the species in Ontario.

The Study Area contains habitat that could support habitat for species at risk including Blandings Turtle, Least Bittern, Barn Swallow, Eastern Meadowlark and Northern Myotis and Little Brown Myotis. If these species were encountered during the project, construction would be not permitted to continue in the area until approval from the MNR is granted.

Blanding's Turtle

The Blanding's Turtle (Emydoidea blandingii) is provincially ranked S3 (vulnerable) and is designated a provincially and federally threatened species. It is afforded general habitat protection under the ESA (2007).

Blanding's Turtle frequent lakes, ponds, and marshes, and prefer shallow water with abundant aquatic vegetation and a soft bottom (MacCulloch, 2002). They prefer shallow water that is rich in nutrients, organic soil and dense vegetation. Adults usually occupy open or partially vegetated sites, whereas juveniles occupy areas with thick aquatic vegetation including sphagnum, water lilies and algae. Nesting occurs in dry conifer or mixed hardwood forests, up to 410 m from any body of water, in loose substrates including

sand, organic soil, gravel and cobblestone. Nesting may also occur along gravel roadways (COSEWIC, 2005).

Blanding's Turtle habitat assessments were conducted as part of the NWSSS. According to MNR correspondence as part of the NWSSS, a Blanding's Turtle was recorded in the Laurel Creek Reservoir in 2009 and to the west of the reservoir in 2013. The General Habitat Description for the Blanding's Turtle (MNR, 2013), considers the Laurel Creek Reservoir to be Category 1 habitat (based on overwintering habitat) with a low tolerance to disturbance. Any wetland or watercourse less than 2 km from this Category 1 habitat is considered to be Category 2 habitat with a moderate tolerance for disturbance, and wetlands or watercourses within 250 m of Category 2 habitats are considered to be Category 3 habitats with the greatest tolerance to disturbance.

3.2.3 Significant Wildlife Habitat

Wildlife habitat is defined as an area where plants, animals, and other organisms live and find adequate amounts of food, water, shelter, and space needed to sustain their populations. Specific wildlife habitats of concern may include areas where species concentrate at a vulnerable point in their annual life cycle; and areas which are important to migratory or non-migratory species. Guidelines and criteria for the identification of significant wildlife are detailed in the Significant Wildlife Habitat Technical Guide (October 2000), the Natural Heritage Reference Manual (June 1999), the Significant Wildlife Decision Support System (OMNR 2000), and the Significant Wildlife Habitat (SWH) Criteria Schedules. Pursuant to the SWH Region 6E Criterion Schedule (MNR, 2012), there are four general types of significant wildlife habitat:

1. Seasonal concentration areas.
2. Rare or specialized habitat.
3. Habitat for species of conservation concern.
4. Animal migration corridors.

Seasonal Concentration Areas

Seasonal Concentration Areas are areas where animals occur in relatively high densities for the species at specific periods in their life cycles and/or in particular seasons. Seasonal Concentration Areas tend to be localized and relatively small in relation to the area of habitat used at other times of the year.

Candidate significant wildlife habitat for seasonal concentration areas recorded within the Study Area included:

- Waterfowl staging and stopover areas (terrestrial)
- Waterfowl staging and stopover areas (aquatic) within the Laurel Creek Reservoir and surrounding wetland
- Habitat for migrating shorebirds in the Laurel Creek Reservoir when water levels are low and exposed mudflats are present
- Bat maternity colonies within the mixed and deciduous forest communities

- Turtle overwintering areas within the Laurel Creek Reservoir, Laurel Creek and Beaver Creek, and the meadow marsh and open aquatic communities along Beaver Creek Road
- Yarding and winter congregation areas for deer within the large areas of coniferous and mixed forest/swamp

Rare Vegetation Communities or Specialized Habitat for Wildlife

Rare vegetation communities include areas that contain a provincially rare vegetation community or areas that contain a vegetation community that is rare within the planning area.

No regionally rare vegetation communities were identified within the Study Area.

Specialized wildlife habitats include areas that support wildlife species that have highly specific habitat requirements, areas with exceptionally high species diversity or community diversity or areas that provide habitat that greatly enhances species' survival.

Specialized habitat for wildlife identified within the Study Area included:

- Amphibian woodland breeding habitat within mixed and deciduous swamp communities along Conservation Drive. Significant habitat for amphibian breeding (woodlands) was confirmed during the NWSSS call count surveys in the open aquatic community east of Erbsville Road and north of Conservation Drive and the swamp thicket community north of Conservation Drive at Beaver Creek.

Candidate specialized habitat for wildlife identified within the Study Area included:

- Waterfowl nesting habitat within meadow and naturalized coniferous plantation communities adjacent to the Laurel Creek Reservoir, and in the forest community adjacent to the swamp community along Conservation Drive

- Amphibian wetland breeding habitat within the Laurel Creek Reservoir and the associated meadow marsh community

Species of Conservation Concern

Species of conservation concern includes four types of species: (a) those that are rare, (b) those whose populations are significantly declining, (c) those that have been identified as being at risk to certain common activities, and (d) those with relatively large populations in Ontario compared to the remainder of the globe.

Habitat for species of conservation concern identified within the Study Area included:

- Woodland area sensitive bird breeding habitat within ESPA 17

Candidate habitat for species of conservation concern identified within the Study Area included:

- Marsh breeding bird habitat within the Laurel Creek Reservoir

A habitat assessment for the Study Area is provided below for special concern species, recorded as a recent occurrence (within the last 40 years) in the Natural Heritage Information Centre database or identified as potentially occurring within the Study Area based on suitable habitat. The Study Area contains habitat that could support Black Tern, Eastern Wood-Pewee, Wood Thrush, Map Turtle, Snapping Turtle and Monarch.

Animal Movement Corridors

Migration corridors are areas that are traditionally used by wildlife to move to one habitat from another. This is usually in response to different seasonal habitat requirements. The Draft SWH Region 6E Criterion (MNR, 2012) speaks specifically to amphibian movement corridors. These corridors are only considered when wetland breeding amphibian habitat is identified for Eastern Newt, Blue-spotted Salamander, Spotted Salamander, Gray Treefrog, Spring Peeper, Western Chorus Frog or Wood Frog.

Open aquatic areas including the Laurel Creek Reservoir provide potential amphibian breeding habitat (wetlands). The NWSSS observed a high abundance of amphibian road mortality along Beaver Creek Road where it passes over the Laurel Creek Reservoir. Natural features on either side of Beaver Creek Road at the Laurel Creek Reservoir therefore appear to make up an important amphibian movement corridor, although the presence of Beaver Creek Road reduces its significance.

Although the NWSSS also identified a high abundance of amphibian road mortality along Conservation Drive at Beaver Creek, this area was not considered to be a significant amphibian movement corridor since the Beaver Creek corridor is quite narrow and surrounded by agricultural lands.

3.2.4 Aquatic Resources

3.2.4.1 Laurel Creek

Laurel Creek is a headwater tributary of the Grand River that flows in a south-easterly direction through the Study Area and discharges to the Grand River south of the Study Area limits. Laurel Creek and its tributaries have a total length of approximately 47 km, with an estimated third of these tributaries being in a degraded condition due to channelization, stream bank alteration, and beaver activity (GRCA 1993).

The reach upstream of the reservoir has been classified as an existing coldwater system as well as an important source for groundwater discharge, possibly supplying baseflow to the creek and its associated wetland features (GRCA 1993).

Laurel Creek crosses Beaver Creek road in the southern portion of the Study Area. A large concrete box culvert along Beaver Creek Road separates the larger Laurel Creek Reservoir to the east from a smaller bay to the west. Due to the size of the reservoir, habitat at the culvert consists more of lacustrine than riverine habitat. A large, open expanse of water greater than 1 m deep is present on both sides of the culvert, with cattails lining the banks. Substrates appear to consist primarily of muck, silt and detritus, with some boulder and sand observed. Cyprinid species were observed on the downstream side of the culvert.

3.2.4.2 Unnamed Tributary to Beaver Creek

An unnamed tributary is located on the south side of Conservation Drive. This feature is not mapped, according to Land Information Ontario (LIO) data, and is unclassified with respect to drainage and thermal regime. This feature consists of a large wetland on the north side of the road with no channelized feature present on the north side. South of Conservation Drive, a narrow, grassy swale lined with aquatic vegetation directs flow south past a residence and into the adjacent wetland. Minimal flow was observed in both the wetland and the swale and substrates such as silt and gravel were observed near the culvert, likely washed in from the road. According to the adjacent landowner, water is always present in the swale, occasionally backing up due to dense vegetation in the channel south of his property. Cyprinid species were observed on the north (upstream) side of the culvert, therefore this reach is currently functioning as fish habitat.

3.2.4.3 Beaver Creek

Beaver Creek is a headwater tributary of Laurel Creek and flows in a southerly direction through the Study Area, discharging into Laurel Creek at the southern end of the study limits, near the Laurel Creek Conservation Area lands (Laurel Creek Nature Centre). This tributary of Laurel Creek is approximately 6.1 km long and originates south (downstream) of Paradise Lake (GRCA 1993). According to the Laurel Creek Watershed Study (GRCA 1993), this tributary was classified as a potential coldwater stream, although portions of the watercourse have been degraded by intensive agricultural activities through the years.

Beaver Creek is classified by the GRCA as a Type C Drain (permanent, warmwater with no sensitive species present). Where Beaver Creek crosses Conservation Drive, a large concrete headwall is present with an approximately 3 m wide culvert draining from north to south. At the crossing location, the watercourse is approximately 2 m wide and approximately 15 cm deep. Habitat within the surveyed reach consists of riffle, pool and run on the upstream side, and flat on the downstream side. Some minor erosion was noted along the banks. Substrates consisted of silt, gravel, sand and cobble, with the cobble only observed on the upstream side. Upstream, the riparian cover is dense, with large and small woody debris providing cover within the watercourse. Downstream, the riparian cover is moderate, with overhanging trees and shrubs on the east side providing cover. This reach is currently functioning as permanent fish habitat.

Beaver Creek displays a relatively diverse fish community, with a mix of cool and warmwater species who are moderately tolerant or tolerant to change (see list below, Ecoplans 2013):

- Fathead Minnow
- Creek Chub
- Bluegill
- Brook Stickleback
- White Sucker
- Northern Redbelly Dace
- Blackchin Shiner
- Blacknose Dace
- Johnny Darter
- Rainbow Darter
- Common Shiner
- Pumpkinseed
- Longnose Dace
- Hornyhead Chub

Rainbow Darter and Blackchin Shiner are both habitat specialists, with Rainbow Darter found primarily in fast flowing gravel/cobble riffles and Blackchin Shiner found primarily in clear, vegetated lakes and pools or slow runs with sandy substrates.

Brook Trout and Brown Trout were not captured during any of the previous fish community surveys; however, suitable trout spawning habitat is present within the lower reaches of Beaver Creek. Four (4) years of spawning surveys did not reveal any confirmed spawning activity within Beaver Creek, although “scrapes” or “possible scrapes” were observed (Ecoplans 2013).

Fish community sampling results from GRCA and for the NWSSS indicate that both Beaver and Laurel Creeks support diverse coolwater and warmwater forage/baitfish communities. Coolwater systems contain species that are best adapted, prefer or usually occur at summer water temperatures between 19 and 25°C, or within both the coldwater and warmwater ranges (Ontario Freshwater Fishes Life History Database 2009). Warmwater fish species are those best adapted or that prefer summer water temperatures above 25°C.

3.2.5 Natural Heritage Features

A natural heritage study was completed for the project area to identify the Significant Natural Features outlined below. Several distinct natural features occur within the Study Area based on a review of available background information, site observations, air photo interpretation and existing planning documents. These natural features are briefly outlined below.

3.2.5.1 Wetlands

Wetlands are defined in the Provincial Policy Statement as lands that are seasonally or permanently covered by shallow water, as well as lands where the water table is close to or at the surface. There are four (4) major wetland types; which are classified as swamps, marshes, bogs, and fens. A significant wetland is defined as an area identified as provincially significant by the Ministry of Natural Resources using evaluation procedures established by the province, as amended from time to time. Accordingly, it is the responsibility of the MNR to both identify and classify wetlands as significant in Ontario.

Provincially Significant

Sunfish Lake/Laurel Creek Provincially Significant Wetland Complex

The majority of the wetland communities throughout the Study Area are part of the Sunfish Lake/ Laurel Creek Provincially Significant Wetland (PSW) Complex. This complex is comprised of 1.1 km^2 of wetlands that consist of 82% swamp and 18% marsh.

Two wetlands identified as "unevaluated" in the NWSSS occurred on the north side of Conservation Drive, one east, and one west of Erbsville Road. Both wetlands were identified as a Poplar Mineral Deciduous Swamp (SWD4-5) during the 2014 field investigations. The unevaluated wetland west of Erbsville Road also had a small Cattail Mineral Shallow Marsh (MASM1-1) and open aquatic feature associated with it. Consultation with the MNR determined that both of these wetlands should be complexed with the Sunfish Lake/Laurel Creek PSW Complex.

Other Wetlands

Other small wetlands that were not associated with the Sunfish Lake/Laurel Creek PSW Complex are identified as "Other GRCA Regulated Wetlands" on Figure 1, Appendix A of the Natural Heritage Report (Appendix C), including: a small, narrow SWD4-5 community north of Conservation Drive, along the west side of Erbsville Road; the MASM1-1 and SWD communities located on the south side of Conservation Drive, east of Erbsville Road; the MAMM1-9 community (MAM2-6 in the NWSSS) identified in the NWSSS located north of Conservation Drive and east of Erbsville Road; the small MASM1-1 wetland surrounded by coniferous forest, along the east side of Beaver Creek Road. The MAMM1-9 (MAS2-6) wetland in the Church property was assessed in the NWSSS using OWES criteria, and it was not considered as part of the Sunfish Lake / Laurel Creek PSW Complex.

The MNR determined that all of the above wetlands should not be included as part of the Sunfish Lake/Laurel Creek PSW Complex, due to their small size. Email correspondence is included in Appendix D of the Natural Heritage Report (Appendix C).

3.2.5.2 Woodlands

Significant Woodlands are defined as treed areas that provide environmental and economic benefits such as erosion prevention, water retention, and provision of habitat, recreation, and the sustainable harvest of woodland products. Woodlands include treed areas, woodlots or forested areas and vary in their level of significance. The identification and assessment of significant woodlands is the responsibility of the local planning bodies, in this case the City of Waterloo and Regional Municipality of Waterloo. Woodland significance is typically determined by evaluating key criteria which relate to woodland size, ecological function, uncommon woodland species, and economic and social value.

Within the Study Area, the Laurel Creek Forest (ESPA 80) and Schaefer's Woods (ESPA 17) are considered significant woodlands based on the above criteria and are

designated as part of the Core Greenland network in the Region of Waterloo ROP and the City of Waterloo Official Plan.

3.2.5.3 Valleylands

Protection of Significant Valleylands is important for the support of flood protection, erosion control, and passive recreational activities within Significant Valleylands. There are no Significant Valleylands within the Study Area.

3.2.5.4 Areas of Natural and Scientific Interest

Significant Areas of Natural and Scientific Interest (ANSI) are defined as areas of land and water containing natural landscapes or features that have been identified as having life science or earth science values related to protection, scientific study or education. A background search of the MNR Natural Heritage Information Centre (NHIC) database, and Regional and Municipal Official Plans was conducted to determine if there are any known Significant ANSIs on or within 120 m of the Study Area. There are no Life Science or Earth Science ANSI within the Study Area.

3.2.6 Natural Hazards

The GRCA is responsible for the identification, mapping and regulation of development activities within and adjacent to natural hazards within the Grand River watershed. Natural Hazards include the following:

- Floodplain
- Steep or Eroding Slopes
- Lakeshore Hazards (wave uprush, erosion, 100 year flood level and dynamic beaches)
- Unstable Soils

Based on a review of the GRCA mapping of the Study Area, floodplain has been identified in association with Beaver Creek, Laurel Creek and the Laurel Creek Reservoir. These floodplain areas and adjacent 15 m allowances are regulated by the GRCA pursuant to O. Reg. 150/06.

3.2.7 Summary of Natural Heritage and Natural Hazard Features

Based on the information provided in the previous sections, the following natural features, ecological functions and natural hazards represent constraint areas to be considered during the identification, assessment and selection of the proposed alternatives:

- Wetland communities included within the Sunfish Lake / Laurel Creek PSW Complex
- Small pockets of unevaluated wetland regulated by the GRCA (SWD4-5 community north of Conservation Drive, along the west side of Erbsville Road; the MASM1-1 and SWD communities located on the south side of Conservation

Drive, east of Erbsville Road; the MAMM1-9 community (MAM2-6 in the NWSSS) identified in the NWSSS located north of Conservation Drive and east of Erbsville Road; the small MASM1-1 wetland surrounded by coniferous forest, along the east side of Beaver Creek Road and the MAMM1-9 (MAS2-6) wetland on the Church property.)

- Significant Woodlands (Laurel Creek Forest and Schaefer's Woods) and other woodlands
- The Laurel Creek Headwaters Environmentally Sensitive Landscape
- Environmentally Sensitive Policy Areas (ESPA #17, 18, 80)
- Presence of Regionally significant botanical species
- Habitat for area sensitive and regionally significant breeding bird species
- Significant wildlife habitat in the larger habitat blocks including:
    - Amphibian woodland breeding habitat within the mixed and deciduous swamp communities
    - Woodland area sensitive bird breeding habitat within ESPA 17
- Candidate significant wildlife habitat in the larger habitat blocks including:
    - Waterfowl staging and stopover areas (aquatic) within the Laurel Creek Reservoir
    - Habitat for migrating shorebirds in the Laurel Creek Reservoir
    - Bat maternity colonies within the mixed and deciduous forest communities
    - Turtle overwintering areas within the Laurel Creek Reservoir and the adjacent open aquatic communities
    - Yarding and winter congregation areas for deer within the large areas of coniferous and mixed forest/swamp
    - Waterfowl nesting habitat in upland communities adjacent to the Laurel Creek Reservoir
    - Amphibian wetland breeding habitat within the Laurel Creek Reservoir and the adjacent meadow marsh communities
    - Marsh breeding bird habitat within the Laurel Creek Reservoir
- Potential habitat for threatened and endangered species including habitat for Northern Myotis, Little Brown Myotis, Least Bittern, Eastern Meadowlark and Blanding's Turtle
- Potential habitat for special concern species including habitat for Black Tern, Eastern Wood-Pewee, Wood Thrush, and Snapping Turtle
- Beaver Creek and Laurel Creek and its tributaries, including associated direct fish habitat
- Regulated floodplain associated with Laurel Creek, Beaver Creek and the Laurel Creek Reservoir

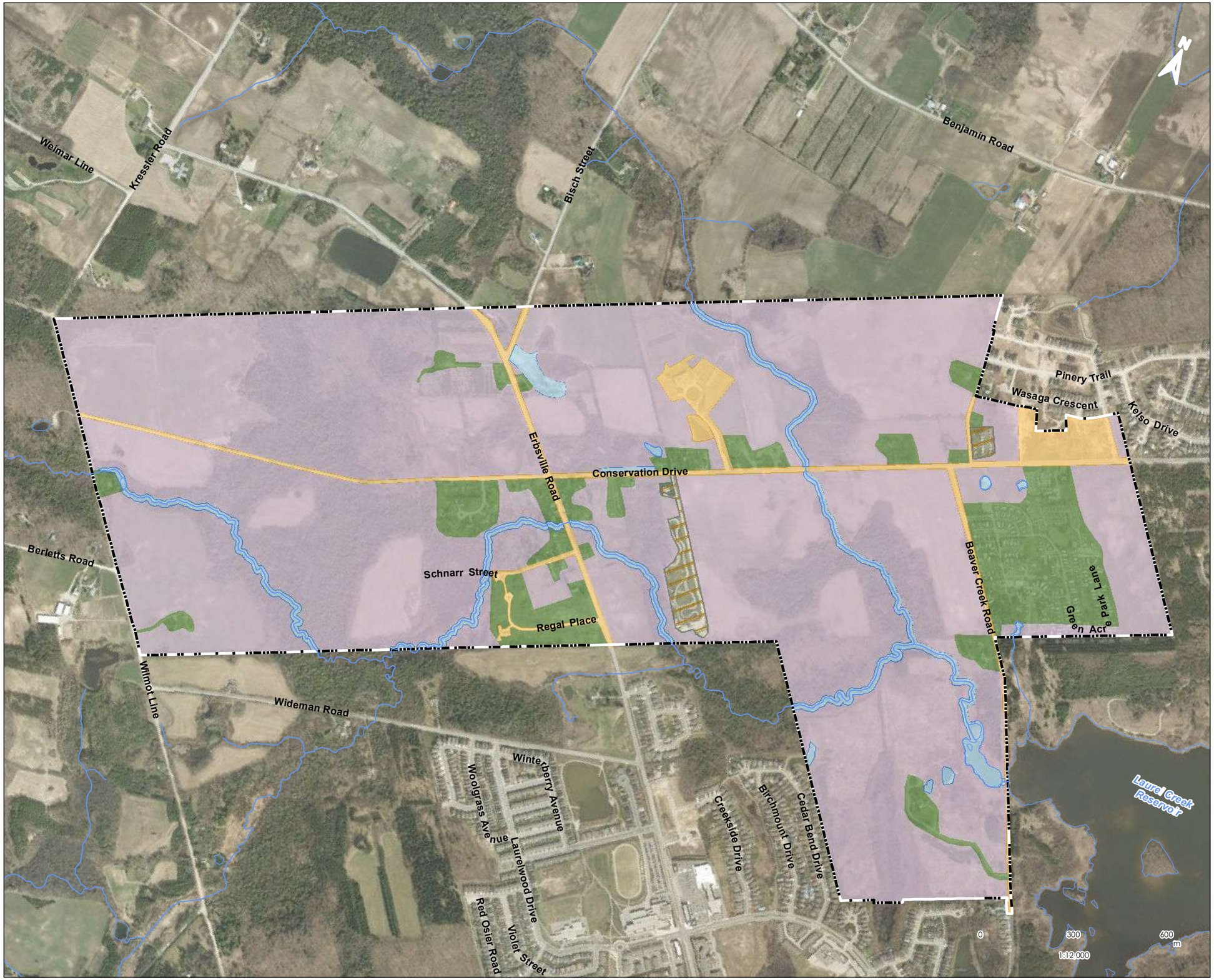
3.3 ARCHAEOLOGICAL FEATURES

A Stage 1 assessment was conducted by Stantec as part of the Schedule C Municipal Class EA which is required prior to undertaking any construction activities. The archaeological assessment was conducted in accordance with Ministry of Tourism, Culture and Sport's 2011 Standards and Guidelines for Consultant Archaeologists (Government of Ontario 2011). The Stage 1 archaeological assessment is also triggered by the Archaeological Master Plan 2005 Region of Waterloo (Region of Waterloo, 2005), as Section 4.0 states that all Regional projects that are identified as having archaeological potential must be subject to a preliminary Stage 1 assessment (Region of Waterloo 2005:10). Such projects include "road construction or widening; trunk sewer and watermain construction; construction or stormwater facilities; and construction of regional facilities (buildings, trails, etc.)" (Region of Waterloo 2005:10).

The Stage 1 archaeological assessment was completed August 27, 2015 and accepted by the Ministry of Tourism, Culture and Sport (MTCS) on October 2, 2015 to identify known and potential archaeological heritage resources within the Study Area, as well as to provide specific direction for the protection, management and/or recovery of these resources, if encountered. Background research and the inspection of properties were conducted to complete the Stage 1 assessment. The assessment indicated that portions of the Study Area retain archaeological potential, primarily in undisturbed areas outside of existing road corridors and built-up areas. Any area of archaeological potential that would be subject to construction disturbance as a part of transportation upgrades or municipal services will be subject to a Stage 2 Archaeological Assessment prior to construction. The majority of the areas that have been previously disturbed (i.e. existing road corridors and built-up areas) were not identified as areas that retain archaeological potential. In these areas, no further archaeological assessment is recommended. Figure 3-3 provides an overview of the identified areas that retain and do not retain archaeological potential. The full study is provided for reference in Appendix D.

3.4 CULTURAL AND HERITAGE FEATURES

As part of this Study, a Cultural Heritage Evaluation Report (CHER) was completed to identify heritage resources, including built heritage and cultural heritage landscapes, present within the Study Area. Potential heritage resources were identified through consultation and a windshield survey, inventoried, and evaluated according to Ontario Regulation (O. Reg.) 9/06, the criteria for determining cultural heritage value or interest (CHVI). A land use history was completed to provide a cultural context for the Study Area and to provide a background upon which to base evaluations. Where CHVI was identified, the resource was mapped and recommendations made for further study, where relevant. The CHER resulted in the determination of 21 properties within the Study Area that contained Heritage Resources. Figure 3-4 provides an overview of the identified properties. The CHER is provided in Appendix E for reference.



Stantec

Legend

- Study Area Boundary
- Disturbed, No Stage 2 Required
- Retains Archaeological Potential, Stage 2 Required
- Stage 2 Required to Confirm Previous Disturbance
- Portions Retain Archaeological Potential and Portions Require Confirmation of Disturbance, Stage 2 Required
- Wet, No Stage 2 Required

Natural Features

- Watercourse
- Waterbody

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
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3. Orthoimagery © First Base Solutions, 2010.

September 2015
165640041

Client/Project

City of Waterloo
Beaver Creek and Conservation Drive
Upgrades and Extension of Municipal Services
ESA Report

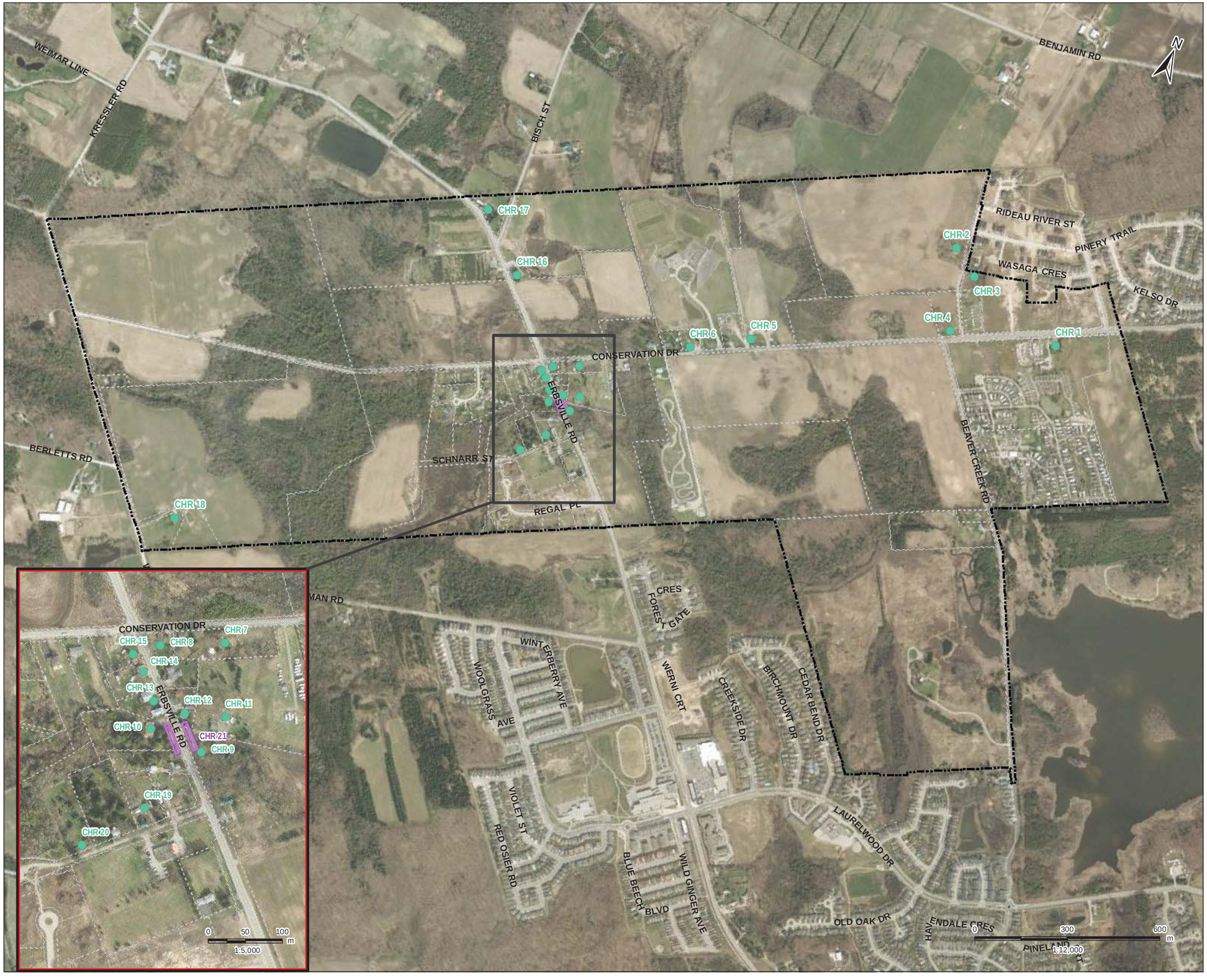
Figure No.

3-3

Title

Areas of Archaeological Potential

\\cd1004-f01\Work_group\01609\active\165640041\planning\drawing\MXD\SurfaceWater\Report_Figures\ESA\165640041_ESA_Fig01_Stg1AreaArchPotential.mxd
Revised: 2015-09-29 By: searles



Stantec

Legend

- Study Area
- Parcel Boundary
- Potential Cultural Heritage Resource
- Potential Cultural Heritage Resource (Laurel Creek Culvert)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
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3. Orthoimagery © First Base Solutions, 2010.

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Client/Project

City of Waterloo
Beaver Creek and Conservation Drive
Upgrades and Extension of Municipal Services
Cultural Heritage Evaluation Report

Figure No.

3-4

Title

Heritage Resources within the Study Area

\\cd1004-f011\Work_group\101609\active\165640041\planning\drawing\MXD\Cultural_Heritage\Evaluation_Report\165640041_CHER_Fig05_HeritageResouces.mxd
Revised: 2015-06-01 By: bcowper

4.0 ALTERNATIVE SOLUTIONS

4.1 WATER SERVICING

4.1.1 Existing Servicing

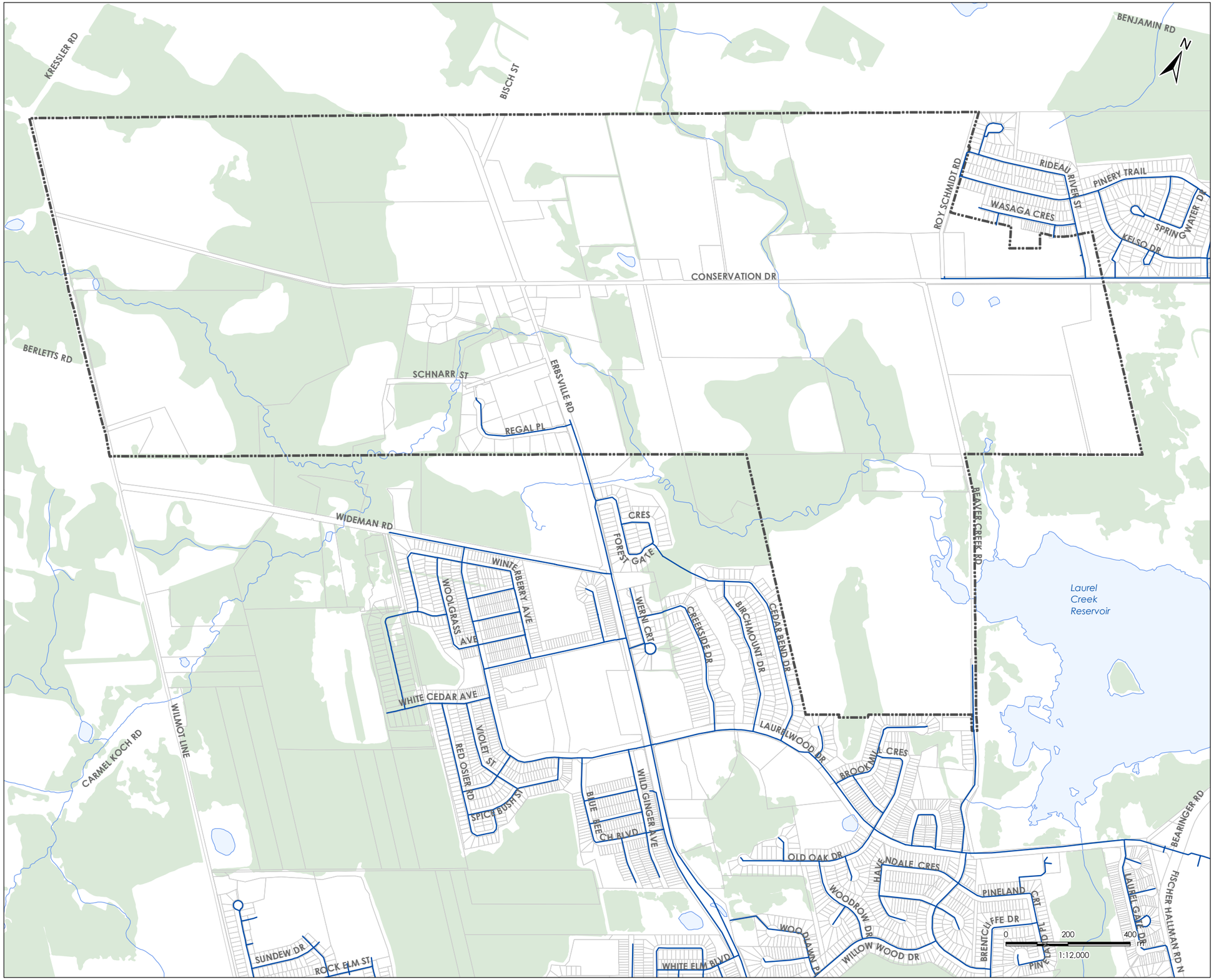
Existing land uses within the Study Area primarily have private water servicing. Municipal servicing extends from south of the Study Area up to and including Regal Place, and from east of the Study Area along Conservation Drive up to Roy Schmidt Road. Figure 4-1 provides a map of the existing municipal water services near the Study Area.

Existing watermains on Erbsville Road and Conservation Drive are 300 mm in diameter. The watermains along Erbsville Road and Conservation Drive operate in two (2) separate pressure zones in that they are separated within the system; however, they maintain the same hydraulic grade line. The watermain along Conservation Drive is within Waterloo Zone 4C and the watermain on Erbsville Road is within Waterloo Zone 5. Under build-out conditions, these two pressure zones will be interconnected and operated as one consolidated zone.

4.1.2 Design Criteria

The design criteria for water servicing is based on the Region of Waterloo and Area Municipalities Design Guidelines and Supplemental Specifications for Municipal Services (DGSSMS)(January 2015), the Tri-City Water Distribution Master Plan (Tri-City MP) (AECOM, 2009), Region of Waterloo Water Supply and Distribution Operations Master Plan (Stantec, 2015), and BCM District Plan Draft Report (June 10, 2015).

A summary of the design criteria used for the water servicing analysis is provided in Table 4-1.



Stantec

Legend

- Study Area
- Watermain
- Watercourse
- Waterbody
- Wooded Area

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
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October 2015
165640041

Client/Project

City of Waterloo
Beaver Creek Rd. and Conservation Dr. Upgrades and Extension of Municipal Services Municipal Class EA

Figure No.

4-1

Title

Existing Conditions Municipal Water Servicing Near Study Area

K:\01656\active\165640041_cow_beaver_creek_ea\preliminary\analysis\gis\mxd\Report\165640041_Report_Fig4-1_ExistingWater.mxd
Revised: 2015-10-08 By: kbuchanan

Table 4-1: Water Distribution Design Criteria

Parameter	Criteria	Reference
Operating Pressure		
Maximum Day Flow Conditions	350 kPa (50 psi) to 550 kPa (80 psi)	DGSSMS, 2015
Peak Hour	275 kPa (40 psi) to 700 kPa (100 psi)	DGSSMS, 2015
Maximum Pressure	700 kPa (100 psi)	DGSSMS, 2015
Simultaneous Maximum Day Flow and Fire Flow	Not less than 140 kPa (20 psi)	DGSSMS, 2015
Equivalent Population Density (Future Estimates)		
Residential	9,503	Calculated based on the Study Area developable land and the population density in the BCM District Plan Draft Report (June 10, 2015)
Employment	291	Calculated based on the Study Area developable land and the population density in the BCM District Plan Draft Report (June 10, 2015)
Future Demands		
Average Day Demand	225 L/cap/day	Tri-City MP (AECOM, 2009)
Maximum Day Factor	1.44	Tri-City MP (AECOM, 2009)
Fire Flows (estimated based on Fire Underwriter Survey (FUS), 1999)		
Residential Row Homes	133 L/s[1]	Water Supply for Public Fire Protection (Fire Underwriter Survey (FUS), 1999)
Industrial, Commercial, and Institutional Properties	250 L/s[1]	

Note 1: Fire flows estimated based on the FUS for representative buildings. Site specific fire flows will need to be determined using the FUS guidelines at the time of development based on the building architecture.

4.1.3 Water Demands

As noted previously, existing land uses within the Study Area primarily have private water servicing. In cases where users are connected to the existing municipal distribution system, the demands were accounted for in the hydraulic model provided by the Region of Waterloo (Region) based on historical metering records. No updates were made to the existing demands as part of the analysis for this study.

Future water demands were determined for the Study Area based on population projections in the BCM District Plan Draft Report (June 10, 2015) and an average per capita rate of 225 L/cap/day (as stated in the Tri-City MP (AECOM, 2009)). Residential and employment maximum day demands for the Study Area were calculated based on a peaking factor of 1.44.

A summary of population and corresponding demands is provided in Table 4-2.

Table 4-2: Summary of Proposed Population and Demands for Build-out Conditions

Parameter	Residential	Employment	Total
Population[1]	9,503	291	9,794
Average Demand (L/s)	24.8	0.8	25.5
Max Day Demand (L/s)[2]	35.6	1.1	36.7

Note 1: Populations based on 59 people + jobs per hectare as per the BCM District Plan Draft Report (June 10, 2015).

Note 2: The per capita rate of 225 L/cap/day and the Max Day Demand Factor of 1.44 has been applied based on the Tri-City Water Distribution Master Plan (Tri-City MP) (AECOM, 2009) for both residential and employment population.

4.1.4 Methodology for Water Servicing Analysis

As part of the Class EA process, consideration must be given to the “Do-Nothing” alternative to assess what would happen if no action is taken to address the problem and related concerns. This assessment provides a baseline against which the other project alternatives can be measured. In this case, in order to proceed with development in the area within the urban boundary, servicing must be supplied according to planning documents such as the Ontario Provincial Policy Statement and the City and Region Official Plan (2014). As outlined in the Ontario Provincial Policy Statement (2014), Section 1.6.6, and the Region of Waterloo Official Plan (2015), Section 5.C.3., extension of municipal water services are the preferred form of servicing for new developments where feasible. The City of Waterloo Official Plan, Section 5.2.2 (5), outlines that all development shall be provided with full municipal water services. As servicing from the municipal water system is feasible, the “Do-Nothing” option was not carried forward for further consideration.

Upgrades to the water distribution system have been identified to service the north-west area of Waterloo through previous studies such as the Water Supply and Distribution Operations Master Plan (Stantec, 2015). Although the alignment of proposed infrastructure in this area has been identified and preliminary sizing previously completed, the purpose of the water servicing analysis was to confirm the sizing and proposed configuration based on the most recent planning data and projected demands.

The Region maintains a hydraulic water model in H2OMap Water (Version 9.6), which was provided for the purposes of this analysis. The model is set-up for extended period simulations with scenarios established for existing and future conditions under average day and maximum day demands. The existing conditions model scenarios were used as a basis for analysis, with updates to account for proposed future growth as follows:

- Include proposed watermains along Conservation Drive and Beaver Creek Road, as per planned upgrades for the distribution system to strengthen the supply and provide looping in north-west Waterloo

- Increase demands within the Study Area based on future projections provided in Section 4.1.3. Note that the allocation of future demands was primarily along infrastructure proposed within the right-of-way for Beaver Creek Road and Conservation Drive

- Updates to the operation of the Lakeshore PS (currently servicing the Waterloo 4C pressure zone) based on the proposed interconnection between pressure zones Waterloo 4C and Waterloo 5

The updated hydraulic model was used to confirm the level of service for proposed growth based on various demand conditions including average day demand, maximum day demand, peak hour demand, and maximum day plus fire flow. Although detailed modeling within proposed developments was not completed, key representative locations for potential constraints within the Study Area were selected for review. These key locations were selected based on consideration for ground elevations and available land use planning data. For example, high ground elevation areas and land uses with high recommended fire flows were identified as key locations for review.

A preliminary review of staging was also completed for the proposed watermains along Beaver Creek Road and Conservation Drive as the extent of looping at a particular stage will have an impact on the level of service, particularly during high demand conditions such as maximum day plus fire flow. This review was completed to provide insight for potential staging of construction; however, on-going reviews will need to be completed as development proceeds to ensure adequate capacity is available throughout each development phase.

Following assessment of the sizing and alignment for the proposed watermains, an opinion of probable cost was estimated based on recent project experience and supplier information.

Additional details regarding the methodology and analysis for the proposed water infrastructure is provided in Appendix G.1.

4.1.5 Future Water Servicing Upgrades

The Study Area is located adjacent to pressure zone Waterloo 4C (WAT 4C) and Waterloo 5 (WAT 5). WAT 4C and WAT 5 operate at the same hydraulic grade line (HGL), however, undeveloped areas between each zone have resulted in each being operated independently. Proposed watermains to accommodate growth in this area will also provide looping between both zones, as part of a consolidated WAT 5 pressure zone.

Recommended water distribution infrastructure to support proposed growth in the Study Area is shown in Figure 4-2, and includes:

- Installing a 300 mm watermain along Conservation Drive between Beaver Creek Road and Erbsville Road
- Installing a 300 mm connection along Conservation Drive between existing watermains near the intersection with Rideau River Street
- Installing a 300 mm watermain along Beaver Creek Road between Laurelwood Drive and Conservation Drive
- Installing a 300 mm connection along Erbsville Road from Regal Place to Conservation Drive

These upgrades were reviewed in conjunction with the Lakeshore PS remaining online. As mentioned above, the Lakeshore PS is to potentially be decommissioned as part of the consolidation of pressure zones in this area. Existing and future conditions for the Lakeshore PS and the consolidated pressure zones are currently being investigated as part of the study referred to as the Staging and Implementation Plan for Consolidating Pressure Zones in North-Central Waterloo (Stantec, ongoing). Following the completion of this study, the operation of the distribution system should be reviewed to determine the impact on the level of service provided within the Study Area. Proposed watermain diameters may need to be increased along Beaver Creek Rd. and Conservation Dr. should the service level provided be inadequate based on the outcome of the Staging and Implementation Plan for Consolidating Pressure Zones in North-Central Waterloo Study. Should the Lakeshore PS remain in service, additional upgrades to pumping may also be considered if higher flows or pressures are required based on the findings of the ongoing Staging and Implementation Plan for Consolidating Pressure Zones in North-Central Waterloo Study. Alternative to upgrades to the water supply and distribution system, building design modifications for proposed development may also be investigated to reduce the recommended fire flow. The additional analysis to confirm the proposed watermain sizes on Conservation Dr. and Beaver Creek Rd. will be completed during detailed design. The opportunity for upgrades to the Lakeshore PS or building design modifications for proposed development to reduce the recommended fire flow will be determined in the Staging and Implementation Plan for Consolidating Pressure Zones in North-Central Waterloo.

Stantec

Legend

- Study Area
- Model Junction

Watermain

- Existing
- Proposed Dual Use Watermain

Size

- 150 mm
- 200 mm
- 250 mm
- 300 mm

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
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165640041

Client/Project

City of Waterloo
Beaver Creek Rd. and Conservation Dr. Upgrades and Extension of Municipal Services Municipal Class EA

Figure No.

4-2

Title

Proposed Watermain Upgrades

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Revised: 2015-12-14 By: kbuchanan

Service pressures within the proposed development area are expected to range between 354 kPa (minimum modeled peak hour pressure) and 569 kPa (maximum static pressure) based on modeling results and a review of ground elevations within the developable lands of the Study Area (between 347 mASL to 367 mASL based on the existing contour mapping).

Available fire flows are expected to be greater than 290 L/s along the recommended watermains providing looping to the area (as noted previously) when assuming a minimum residual pressure of 140 kPa. Available fire flows within proposed development areas are likely to be lower than this as a result of additional headlosses to convey water through local watermains. Representative locations were selected to review constraints within proposed development areas based on ground elevations and available land use planning data. Adequate available fire flows could be provided at the locations selected for review, however, internal looping is required to provide sufficient hydraulic capacity.

Detailed staging is to be evaluated at time of development, specific to proposed phasing to ensure adequate flows are available throughout each development stage. A preliminary review indicates that servicing is unlikely to be adequate for proposed employment lands until all recommended upgrades noted above are constructed, including the connection on Erbsville Road between Regal Place and Conservation Drive.

4.1.6 Opinion of Probable Cost

To review the economic impact of the proposed watermain upgrades, an opinion of probable cost has been prepared and is summarized in Table 4-3. The opinion of probable cost is intended to be Class C, accurate to -20% to + 35%. Additional details on opinion of probable costs are available in Appendix H.

Table 4-3: Proposed Water Servicing Upgrades Opinion of Probable Cost

Description	Item	Cost
Proposed watermains on Beaver Creek Road and Conservation Drive	Watermain & appurtenances (incl. contingency)	$2,436,000
	Engineering and Contract Administration	$244,000
	Total	$2,680,000

4.2 SANITARY SERVICING

4.2.1 Existing Sanitary Servicing

Existing land uses within the Study Area are primarily rural residential and/or agricultural. From a sanitary servicing perspective, the existing homes and facilities are primarily serviced with onsite septic systems. In general, local sewers do not exist within the road allowances. One exception is the Nature Centre which is serviced via an existing sanitary sewer from the south. Figure 4-3 shows the sanitary servicing in the vicinity of the Study Area.

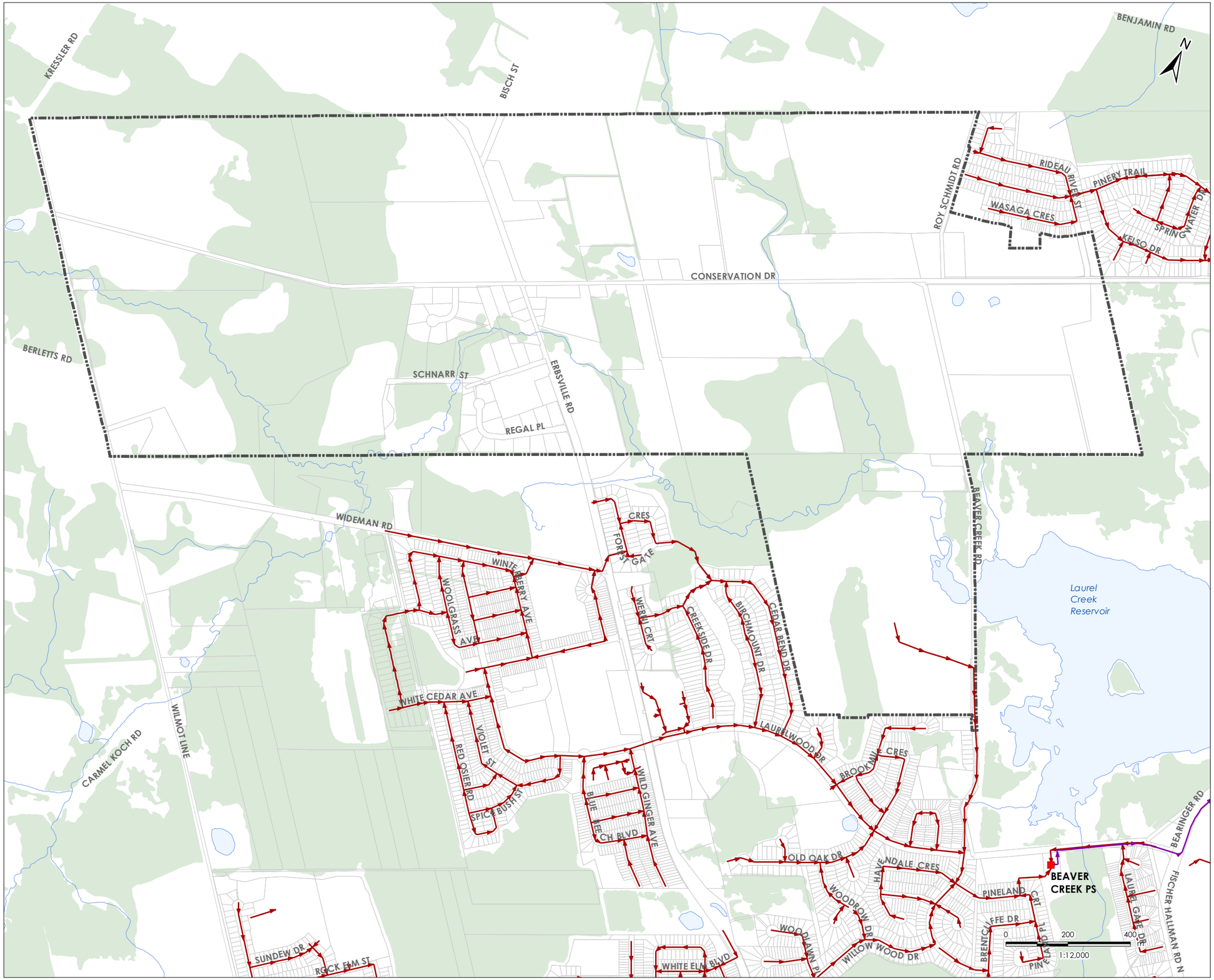
4.2.2 Design Criteria

The design criteria for the sanitary servicing is based on the Region of Waterloo and Area Municipalities Design Guidelines and Supplemental Specifications for Municipal Services (DGSSMS) (January 2015), and the BCM District Plan Draft Report (June 10, 2015).

A summary of the design criteria used for the sanitary servicing analysis is provided in Table 4-4.

Table 4-4: Sanitary Sewer Design Criteria

Parameter	Criteria	Reference
Population Density	59 people + jobs per hectare	BCM District Plan Draft Report (June 10, 2015)
Infiltration Allowance	0.15 litres/second/hectare (l/s/ha)	DGSSMS - Section B.3.1.2.6
Harmon Peaking Factor	$F = \frac{1 + 14}{4 + \sqrt{P}}$ Where P = Population/1000	DGSSMS – Section B.3.1.2.1
Manning's "n"	0.013 (all pipe materials)	DGSSMS – B.3.1.5
Minimum Gradient	1% - For First Reach 0.5% - Other	DGSSMS – B.3.1.6
Pipe Depth	Min. 2.8 m to pipe obvert	DGSSMS – B.3.1.10



Stantec

Legend

- Study Area
- Sanitary Pumping Station
- Sanitary Gravity Sewer
- Sanitary Forcemain
- Watercourse
- Waterbody
- Wooded Area

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
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Client/Project

City of Waterloo
Beaver Creek Rd. and Conservation Dr. Upgrades and Extension of Municipal Services Municipal Class EA

Figure No.

4-3

Title

Existing Conditions Municipal Sanitary Servicing Near Study Area

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Revised: 2015-12-14 By: kbuchanan

4.2.3 Methodology for Sanitary Servicing Analysis

The sanitary servicing strategies were developed to convey wastewater flows from future development areas to the proposed Beaver Creek Pump Station (PS) located on Beaver Creek Road. The Beaver Creek PS will discharge by forcemain south where it will connect to the existing gravity sanitary sewer. The necessity of the Beaver Creek PS is common to both of the alternative servicing strategies evaluated.

Sanitary drainage areas were identified based on the developable area within the Study Area. It should be noted that these areas were refined from those presented in the Public Consultation Centres based on feedback received after PCC #3. Specifically, updates to the drainage areas included:

- Removing the area that extended into the Township of Woolwich, as it is outside of the Study Area
- Adding Area 15 to be consistent with the updated BCM District Plan

Utilizing the sanitary drainage areas and available existing and proposed contour information, the analysis methodology included the following steps:

- Existing areas associated with the delineated sewershed areas were used in conjunction with Design Criteria from the DGSSMS to determine flows, including allowances for inflow/infiltration.
- Standard design practices were used to size infrastructure (gravity and forcemains) resulting in the majority of gravity sewers being 300 mm in diameter and forcemain diameters of 150 mm to 200 mm. Sizing of gravity and forcemain sewers will be determined during final design.
- The BCM District Plan and existing/proposed contour information were used to determine locations for the proposed Sanitary Pump Stations and contributing wastewater flows. The location of the Snowcrest Place PS was altered based on comments received from PCC #2, to reduce impacts on local existing residents.
- The BCM District Plan, existing/proposed contours, and standard design practices were used to determine future sanitary sewer depth requirements and associated installation methodologies (open cut vs. trenchless). These depths and installation methodologies were a critical factor in development of opinions of probable cost.
- Once sizing and installation methodologies were determined, costs for feasible alternatives were assessed based on recent project experience and supplier information.

Figure 4-4 shows the different sewersheds and a summary of the wastewater flows used for the sanitary servicing analysis and the respective receiving sewage pump station is provided in Table 4-5. For more detail, refer to Appendix G.2.

Stantec

Legend

- Sanitary Drainage Area
- Sanitary Drainage Area to be Refined as Development Proceeds

Notes

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165640041

Client/Project

CITY OF WATERLOO
BEAVER CREEK ROAD & CONSERVATION DRIVE
UPGRADES AND EXTENSION OF MUNICIPAL SERVICES

Figure No.

4-4

Title

Sanitary Flow Areas

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Revised: 2015-12-14 By: kbuchanan

Table 4-5: Determination of Assigned Sewage Pump Station Based on Projected Flows

Development Area ID	Development Area Size (ha)	Flow (L/s)	Assigned Sewage Pump Station
1	15.6	16.6	Beaver Creek PS (180 L/s) conveyed from Conservation Drive PS (100 L/s)
2	10.6	11.5	Beaver Creek PS (180 L/s)
3	13.0	13.9	
15	1.0	1.2	
5	9.8	10.7	
6	30	30.5	
7	8.7	9.6	
8	3.3	3.8	Beaver Creek PS (180 L/s) conveyed from Conservation Drive PS (100 L/s)
9	2.6	3.0	
10	16.7	17.7	
11	23.2	24.0	
12	15.7	16.7	Beaver Creek PS (180 L/s) conveyed from Conservation Drive PS (100 L/s) or Snowcrest Place PS (30 L/s)
13	8.3	9.1	
14	7.1	7.9	Beaver Creek PS (180 L/s) conveyed from Conservation Drive PS (100 L/s)
TOTAL	**165.6**	**176.1**	

Note 1: As per the clarification noted, Area 15 was added and the area previously referred to as Area 4 in the PCC presentation material was removed based on feedback received after PCC #3

4.2.4 Future Sanitary Servicing Alternatives

4.2.4.1 Do-Nothing Sanitary Servicing Alternative

As part of the Class EA process, consideration must be given to the “Do-Nothing” alternative to assess what would happen if no action is taken to address the problem and related concerns. This assessment provides a baseline against which the other project alternatives can be measured. In this case, in order to proceed with development in the area within the urban boundary, servicing must be supplied according to planning documents such as the Ontario Provincial Policy Statement and the Official Plan. As outlined in the Ontario Provincial Policy Statement (2014), Section 1.6.6, and the Region of Waterloo Official Plan (2014), Section 5.B.2., extension of servicing from the municipal wastewater system is preferred servicing option, unless it is demonstrated that such servicing is not feasible. The City of Waterloo Official Plan, Section 5.2.2.(5), outlines that all development shall be provided with full municipal sanitary services. As servicing from the municipal wastewater system is feasible, the “Do-Nothing” option was not was not carried forward for further consideration.

4.2.4.2 Alternative 1: Pump Stations in the Erbsville Area at Beaver Creek Road

Alternative 1 includes servicing areas west of Erbsville Road with a small pump station (30 L/s) located in the general area of Snowcrest Place. The forcemain from this pump station would discharge into a gravity sewer west of the tributary and south of Conservation Drive. Gravity sewers would then convey flows to the southern area of the development before flowing east through the ESPA lands. A trenchless crossing of approximately 500 m would be required, as shown on Figure 4-5, to convey flows by gravity to the proposed pump station on Beaver Creek Road (180 L/s). From the new Beaver Creek Road PS, a forcemain would be constructed to convey flows south to Beaver Creek Road. An overview of Alternative 1 is provided in Figure 4-5.

Alternative 1 may require localized low lift pump stations from Area 15 and Area 8 (Figure 4-4), based on available contour information and dependent on ultimate grading plans associated with development.

Alternative 1 is beneficial due to the reduced size of the second pump station (30 L/s) in the general area of Snowcrest Place, which has a lower associated capital and annual operating costs. In addition, this pump station is not required to service development in the short-term planning horizon and construction could be delayed until required. Challenges associated with Alternative 1 include a pump station located within close proximity to existing residents on Snowcrest Place. Furthermore, conveying flows by gravity results in approximately 1.5 km of sanitary sewer installed along areas with a high water table at a depth of greater than 10 m, requiring significant dewatering during construction, higher capital costs associated with deep sanitary sewers and manhole structures, and difficulty in future maintenance access. Alternative 1 would also require additional easements and permitting associated with crossing ESPA lands.

4.2.4.3 Alternative 2: Pump Stations at Beaver Creek Road and South of Conservation Drive

Alternative 2 includes servicing areas west of Erbsville Road with a gravity sewer starting at Snowcrest Place. The gravity sewer from Snowcrest Place would discharge into a gravity sewer west of the tributary and south of Conservation Drive. Gravity sewers associated with development would discharge to a pump station (100 L/s capacity) west of the tributary and south of Conservation Drive. A forcemain would then carry flows along Conservation Drive under (by trenchless methods) the tributary on Conservation Drive and discharge into a gravity sewer west of Beaver Creek. From Beaver Creek Road and Conservation Drive, a gravity sewer would convey flows to the new pump station on Beaver Creek Road (180 L/s). From the new Beaver Creek Road PS, a forcemain would be constructed to convey flows south on Beaver Creek Road to an existing gravity sewer. An overview of Alternative 2 is provided in Figure 4-6.

Alternative 2 may require localized low lift pump stations from Area 15 and Area 8 (Figure 4-4), based on available contour information and dependent on ultimate grading plans associated with development. However under Alternative 2, Area 8 would be able to drain by gravity to the Conservation Drive PS with a trenchless crossing of Beaver Creek as a potential servicing option.

Alternative 2 is beneficial as all work is within ROW's or lands planned for future development. This eliminates the need to locate a pump station adjacent to established residents at Snowcrest Place. In addition, the alignment of the sewer is no longer located through ESPA lands and can be installed at shallower depths (5-8 m instead of greater than 10 m in Alternative 1), which reduces the permitting requirements, dewatering efforts, capital costs, and operating and maintenance efforts for the sewers. Challenges for Alternative 2 include a larger pump station to service the western area of developable lands (100 L/s). This will result in higher capital and annual operating costs. The needs for a second pump station will also occur in a shorter planning horizon for this alternative in comparison to Alternative 1.

Stantec

Legend

- Sanitary Drainage Area
- Sanitary Drainage Area to be Refined as Development Proceeds
- Proposed Sanitary Pumping Station
- Proposed Gravity Sewer
- Proposed Gravity Sewer (> 10 m deep)
- Proposed Forcemain
- Potential Easement
- Property Acquisition Required

Notes

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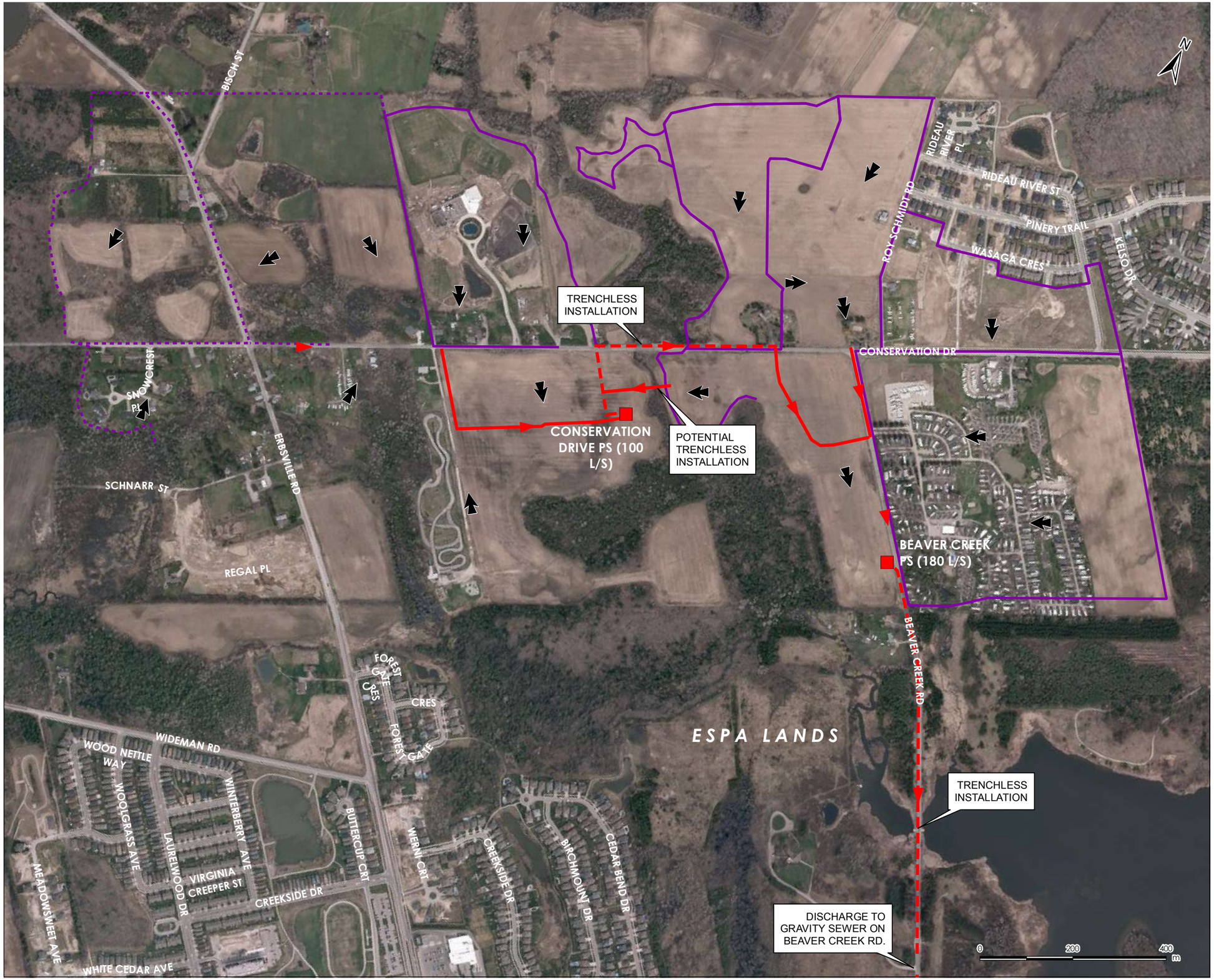
Figure No.

4-5

Title

Sanitary Servicing Alternative 1

V:\01656\active\165640041_cow_beaver_creek_ea\preliminary\analysis\gis\mxd\Report\165640041_ESR_Fig4-5_Sanitary1.mxd
Revised: 2015-12-14 By: kbuchanan



Stantec

Legend

- Sanitary Drainage Area
- Sanitary Drainage Area to be Refined as Development Proceeds
- Proposed Sanitary Pumping Station
- Proposed Gravity Sewer
- Proposed Forcemain
- Property Acquisition Required

Notes

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Figure No.

4-6

Title

Sanitary Servicing Alternative 2

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Revised: 2015-12-14 By: kbuchanan

4.2.5 Opinion of Probable Cost

To address the economic impact of the various alternatives, an assessment of capital costs has been prepared as summarized in Table 4-6. The opinion of probable cost is intended to be Class C, accurate to -20% to + 35%. Additional details on opinion of probable costs are available in Appendix H.

Table 4-6: Sanitary Servicing Opinion of Probable Cost Summary

Alternative	Item	Cost
Alternative 1: Pump stations in the Erbsville Area and Beaver Creek Road	Sewer and Forcemain	$8,221,000
	Pump Station (30L/s)	$750,000
	Pump Station (180 L/s)	$3,500,000
	Construction Contingency	$1,871,000
	Engineering and Contract Administration	$1,435,000
	Total	$15,777,000
Alternative 2: Pump stations at Beaver Creek Road and South of Conservation Drive	Sewer and Forcemain	$3,896,000
	Pump Station (100 L/s)	$2,500,000
	Pump Station (180 L/s)	$3,500,000
	Construction Contingency	$1,485,000
	Engineering and Contract Administration	$1,139,000
	Total	$12,520,000

Table 4-6 indicates a difference in opinion of probable capital cost between the two alternatives of approximately $3.3 million. Alternative 2 has the lower opinion of probable cost, which is approximately $12.5 million.

4.2.6 Evaluation of Servicing Alternatives

Alternatives 1 and 2 were evaluated based on the criteria described in Section 2.5. A rank of five (5) was considered most preferred and one (1) was the least preferred. A summary of the evaluation is provided in Table 4-7 and Appendix G.2 can be referenced for additional details.

Table 4-7: Evaluation of Sanitary Servicing Alternatives

Criteria	Category Weighting	Alternative 1	Alternative 2
Natural Environment			
Impact on Terrestrial	3	1	4
Impact on Aquatic System	3	1	3
Impact on Wildlife	3	1	4
Regulatory Considerations	1	3	5
Social Environment			
Impact to Property	2	1	4
Visual Impacts	2	3	2
Potential for Noise	2	3	3
Community Impact During Construction	2	2	4
Archaeological and Cultural Heritage	2	4	4
Technical			
Capacity and Level of Service	3	5	5
Operations and Maintenance	1	4	3
Consistency with Planned Upgrades and Planning Policies	2	2	5
Constructability	1	1	4
Safety	3	5	5
Economy			
Capital Cost	6	2	4
Operating and Maintenance Cost	4	3	2
Overall Rating		**101**	**151**

Note: Overall rating based on sum of each criteria weighting multiplied by the rank score for that item.

Table 4-7 indicates the preferred alternative for sanitary servicing is Alternative 2.

4.3 STORMWATER SERVICING

4.3.1 Existing Servicing

Existing land uses within the Study Area are primarily rural residential and/or agricultural. From a stormwater perspective, these areas function with overland flow and local swales following existing topography. The only formal storm drainage infrastructure is associated with the more urban areas, and typically does not drain into the Study Area.

The existing primary road network consists mostly of rural cross sections where runoff drains to roadside ditches and crosses through existing culverts. Larger watercourses (Laurel Creek, Beaver Creek) have large concrete box or corrugated steel pipe (CSP) structures. The exception to this is Conservation Drive east of Roy Schmidt Road, where the right-of-way has been partially upgraded to an urban section with curb and gutter and associated storm sewer infrastructure.

4.3.2 Design Criteria

The design criteria used in the development of stormwater alternatives are based on the North Waterloo Scoped Subwatershed Study (NWSSS) (Ecoplans, MHBC and Stantec, 2013), which received municipal and agency approval in 2014. The study outlines the stormwater management (SWM) strategy for the entire North Waterloo Subwatershed area for the protection of the existing watercourses (Laurel Creek, Beaver Creek and the unnamed tributaries), and includes:

- A combination of stormwater management practices or a treatment train approach be employed instead of a single end-of-pipe SWM facility
- Ministry of the Environment and Climate Change (MOECC) Enhanced water quality control (80% total suspended solids (TSS) removal)
- Maintain existing groundwater recharge rates
- Temperature mitigation measures for areas draining into Beaver Creek
- Erosion control and water quantity (flooding) control according to location
- Guidance for SWM facility location and grading

In general, SWM measures will be designed and implemented by individual developers, or combinations of developers through the normal planning and design process. However, flows draining to the Laurel Creek Reservoir must leave the development areas and cross external lands prior to discharging. Therefore, this Class EA process provides the framework for the review and evaluation of alternative discharge alignments.

4.3.3 Methodology for Stormwater Servicing Analysis

The SWM servicing analysis compares three alternative strategies to convey stormwater runoff to the Laurel Creek Reservoir from the contributing upstream lands. It was assumed that the development lands would provide appropriate stormwater management and that the common outlet along Beaver Creek Road to the Laurel Creek Reservoir would be the focus of this assessment. The unnamed tributary east of Beaver Creek Road would

continue to receive an appropriate level of flow following development to protect aquatic habitat and wildlife in the area, however the details would be determined during the development process. All alternatives were consistent with the recommendations of the NWSSS, which incorporated the assessment of Laurel Creek and Beaver Creek floodplains. No additional changes to flood elevations are anticipated due to this Class EA.

Following confirmation of boundary conditions (Beaver Creek Road culvert dimensions/elevation, Laurel Creek Reservoir operating conditions, etc.), the analysis methodology included the following steps:

- Existing and approved Guelph All-Weather Storm-Event Runoff (GAWSER) hydrological modeling from the NWSSS (November 2013) was used to determine peak flows to be conveyed along Beaver Creek Road.

- Standard design practices were used to size infrastructure (pipes, channels, etc.) to convey the proposed flows under anticipated conditions. Free flow was determined using Manning's equation for open channel and storm sewers, and hydraulic calculations were completed using CulvertMaster to assess submerged (pressure) flow in pipes. Each alternative assumes that the design flow is contained (i.e., does not spill into adjacent areas).

- Once sizing was completed, costs were assessed based on a combination of recent project prices and supplier quotations

Summary sheets with assumptions and design information for each alternative are provided in Appendix G.3.

4.3.4 Future Stormwater Servicing Alternatives

4.3.4.1 Do-Nothing Stormwater Management Alternative

As part of the Class EA process, consideration must be given to the "Do-Nothing" alternative to assess what would happen if no action is taken to address the problem and related concerns. This assessment provides a baseline against which the other project alternatives can be measured. In this case, in order to proceed with development in the area within the urban boundary, servicing must be supplied according to the NWSSS (November, 2013) outlined in Section 4.3.2 and the Ontario Provincial Policy Statement (2014). In Section 1.6.6 of the Provincial Policy Statement, planning for stormwater management aims to prevent increases in contaminant loads, minimize changes in water balance and erosion, not increase risks to human health, safety, and property damage, maximize the extent and function of pervious surfaces, and promote stormwater management best practices. Due to the proposed development, the level of pervious surface and land use will be altered. Therefore, to meet the objectives of the planning documents, the "Do-Nothing" option was not considered feasible and was not carried forward for further consideration.

4.3.4.2 Alternative 1: Direct Flows to the Existing Watercourse

Alternative 1 includes directing flows to an existing watercourse east of Beaver Creek Road and south of Green Acre Park, as shown in Figure 4-7. Stormwater flows from the upstream development areas would be directed to a storm sewer on Beaver Creek Road, which would discharge to the existing unnamed watercourse east of the road. From this point, flows would be conveyed to the Laurel Creek reservoir. Summary sheets with assumptions and additional design information is provided in Appendix G.3.

Alternative 1 is beneficial as it will require limited long-term maintenance and provide a significant separation distance between the stormwater flows and Beaver Creek Road. Challenges to this solution are related to the impact on the watercourse and environment, as well as the complexity of construction. Re-directing runoff from the development area to the existing watercourse would increase the drainage area from about 38 ha to 73 ha. In addition to conveying flow from almost double the original catchment area, the land use would also change from primarily rural/agricultural to urban, producing a further increase in flow. Since water quantity controls are not a requirement for areas draining to the Laurel Creek Reservoir, the significant magnitude of increases in flow to the unnamed watercourse would necessitate the complete reconstruction of the watercourse to augment the conveyance capacity and to maintain channel stability. This would require a much larger channel cross section, and the installation of in-stream structures and bank treatments, which would significantly alter the area. Given the wet soil conditions in this area, complex construction practices will be required along with ongoing monitoring efforts. This alternative will also require the removal of the existing stream and disturbance of a large portion of the surrounding area. Depending on groundwater conditions, dewatering efforts may also be required to complete construction of the various structures. Anticipated impacts include the removal (and reconstruction) of approximately 300 m of existing stream channel/aquatic habitat, approximately 0.7 ha of existing wetland area/terrestrial habitat, 0.08 ha of woodland area and a potentially significant disturbance to local wildlife. Access for constructability would be more difficult in comparison with other options and acquiring permits for the proposed work would be more difficult. Long-term maintenance/monitoring access would also be required to the area, potentially creating another informal access to the Conservation Area.

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Revised: 2015-07-30 By: kbuchanan

July 2015
165640041

Stantec

Legend

- Proposed Storm Sewer
- Proposed Stream Reconstruction Area

Notes

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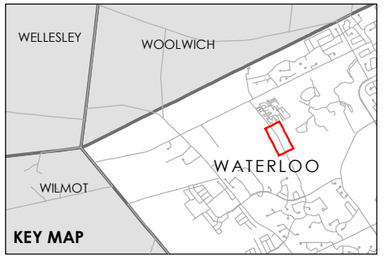

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Figure No.

4-7

Title

Stormwater Management Servicing Alternative 1

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Revised: 2015-07-30 By: kbuchanan

July 2015
165640041

Stantec

Legend

Proposed Storm Sewer

Notes

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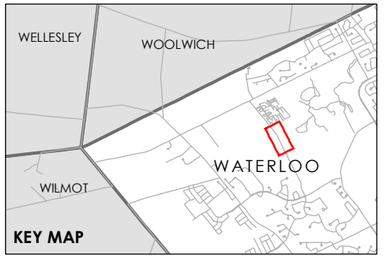

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UPGRADES AND EXTENSION OF MUNICIPAL SERVICES

Figure No.

4-8

Title

Stormwater Management Servicing Alternative 2

4.3.4.3 Alternative 2: Direct Flows to Storm Sewer

Alternative 2 includes directing stormwater flows to a storm sewer along Beaver Creek Rd, as shown in Figure 4-8. The storm sewer would convey flows from the development areas and discharge to the existing Laurel Creek culvert. Summary sheets with assumptions and additional design information for each alternative are provided in Appendix G.3.

Alternative 2 is beneficial as the impacts to existing terrestrial and aquatic habitat and wildlife would be minimized. This design is a standard drainage system and no additional area would be required to manage flows. However significant technical, economic and constructability challenges are also associated with Alternative 2 as the storm sewer would have a submerged outlet based on ground elevations and water levels. As a result, the size of storm sewer increases significantly, and construction and maintenance requirements would be more difficult. The increase in storm sewer size causes various complications to the design and construction process, including the loss of space to accommodate other services within the road allowances (watermain, sanitary forcemain, utilities, etc.), which require separation for safety and design compliance reasons. As a result, one or more service may require location beyond the right-of-way limits. The submerged storm sewer condition also results in complex installation requirements. These include over 300 m of sewer installation below the water table, necessitating extensive dewatering operations. The sewer grades also dictate that the invert must match the invert of the Laurel Creek culvert, therefore the culvert will require dewatering during construction and flows must also be by-passed around the structure for a period of time. From a maintenance perspective, the sewer will be permanently submerged to various degrees (partial submergence in the winter when the Reservoir is low and fully submerged at summer Reservoir levels), making any maintenance inspections or repair work difficult. The storm sewer size and lack of grade on the road also mean that there is minimal cover over the sewer, which may increase maintenance issues in the future.

4.3.4.4 Alternative 3: Direct Flows to Swale

Alternative 3 includes directing stormwater flows to a swale along Beaver Creek Road, as shown in Figure 4-9. A storm sewer will collect flows from the development areas and discharge to a swale adjacent to the east side of the road that will outlet to Laurel Creek Reservoir. Summary sheets with assumptions and additional design information for each alternative are provided in Appendix G.3.

Similar to Alternative 2, Alternative 3 is beneficial as it will minimize the impacts to existing terrestrial habitat, aquatic habitat, and wildlife. The design is a standard drainage system and construction and maintenance requirements would be less challenging than Alternative 1 or 2. Although the construction and operation are simplified, the swale is located adjacent to Beaver Creek Road, and as such, additional area is required, impacting approximately 0.2 ha of wetland and 0.4 ha of woodland habitat.

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Revised: 2015-07-30 By: kbuchanan

July 2015
165640041

Stantec

Legend

- Proposed Storm Sewer
- Proposed Ditch

Notes

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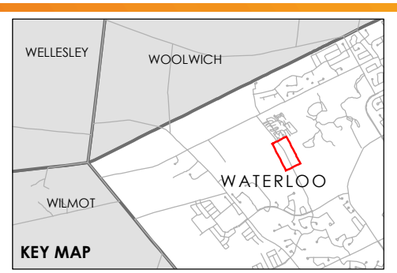

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Figure No.

4-9

Title

Stormwater Management Servicing Alternative 3

4.3.5 Opinion of Probable Cost

To address the economic impact of the various alternatives, an opinion of probable cost has been prepared and is summarized in Table 4-8. The opinion of probable cost is intended to be Class C, accurate to -20% to + 35%. Additional details on the opinion of probable costs are available in Appendix H.

Table 4-8: Stormwater Management Opinion of Probable Cost Summary

Alternative	Item	Cost
Alternative 1: Direct Flows to Existing Watercourse	Storm sewer & appurtenances	$264,000
	Stream reconstruction	$451,000
	Construction Contingency	$108,000
	Engineering & Contract Administration	$83,000
	Total	$906,000
Alternative 2: Direct Flows to Storm Sewer	Storm sewer & appurtenances	$3,260,000
	Construction Contingency	$489,000
	Engineering & Contract Administration	$375,000
	Total	$4,124,000
Alternative 3: Direct Flows to Swale	Storm sewer & appurtenances	$149,000
	Ditch construction	$192,000
	Construction Contingency	$52,000
	Engineering & Contract Administration	$40,000
	Total	$433,000

Table 4-8 indicates the opinion of probable cost is significantly lower for Alternative 3 than Alternative 1 or 2. The cost of each alternative only included those components associated with the drainage option and excluded costs associated with roadworks as these were already included in the alternatives for transportation upgrades.

4.3.6 Evaluation of Servicing Alternatives

Throughout the process, the various alternatives were reviewed and discussed by the Project Team, and presented to agency representatives and the public for comment.

Alternatives 1 through 3 were evaluated based on the criteria described in Section 2.5. A rank of five (5) was considered most preferred and one (1) was the least preferred. A summary of the evaluation is provided in Table 4-9 and Appendix G.3 can be referenced for additional details.

Table 4-9: Evaluation of Stormwater Servicing Alternatives

Criteria	Category Weighting	Alternative 1 - Direct Flows to Existing Watercourse	Alternative 2 - Direct Flows to Storm Sewer	Alternative 3 - Direct Flows to Swale
Natural Environment				
Impact on Terrestrial System	3	1	5	3
Impact on Aquatic System	3	1	5	5
Impact to Wildlife	3	1	5	4
Regulatory Considerations	1	1	5	4
Social Environment				
Impact to Property	2	1	5	3
Visual Impact	2	5	5	3
Potential for Noise	2	5	5	5
Community Impact During Construction	2	1	4	5
Archaeological and Cultural Heritage Impact	2	3	4	3
Technical				
Capacity and Level of Service	3	5	5	5
Operations and Maintenance	1	3	1	5
Consistency with Planned Upgrades and Planning Policies	2	3	3	3
Constructability	1	1	1	5
Safety	3	5	4	5
Economy				
Capital Cost	6	3	1	5
Operating and Maintenance Cost	4	3	1	5
Overall Rating		**110**	**141**	**174**

Note: Overall rating based on sum of each criteria weighting multiplied by the rank score for that item.

Table 4-9 indicates the preferred alternative for stormwater servicing is Alternative 3.

4.4 TRANSPORTATION SERVICING

4.4.1 Existing Conditions

4.4.1.1 Existing Transportation Infrastructure

Roads within the Study Area are primarily rural in nature, and contain only unsignalized intersections. Within the Study Area, the Conservation Drive corridor is a designated major collector link between Westmount Road and Erbsville Road. The section of roadway west of Erbsville Road is designated as a local rural road and terminates at Wilmot Line. Conservation Drive east of Westmount Road terminates within the Lakeshore North neighbourhood. The Beaver Creek Road corridor is a designated minor collector link between Conservation Drive and Laurelwood Drive. Conservation Drive currently terminates at Beaver Creek Road to the north and extends south into the Laurelwood and Beachwood West neighbourhoods.

An inventory of the existing Beaver Creek Road and Conservation Drive roadway geometrics and features of the roadway cross-section are found in Table 4-10 as follows.

Table 4-10: Inventory of Existing Beaver Creek Road – Conservation Drive Geometrics and Roadway Section Features

Item	Conservation Drive (Snowcrest Place to Beaver Creek Road)	Beaver Creek Road (Conservation Drive to South of Laurel Creek Nature Centre)
Right-of-Way (ROW) Width (m)	+/-12.2m	12.2-16.1m
No. of Thru Lanes	2	2
Roadway Width (m)	+/- 7.0m	+/-7.0m
Typical Lane Width (m)	3.50	3.50
Raised Medians (Y/N)	N	N
Painted Medians (Y/N)	N	N
Section Type (Urban/ Rural)	Rural	Rural
Shoulder (Y/N)	Y	Y
Road & Roadside Drainage	Open Ditches	Open Ditches
Sidewalks	N	N
Bike Lanes	N	N
Pavement Cross-Slope (typical)	+/-2%	+/-2%
Superelevated Sections (Y/N)	N	N
Sight Distance Issues/Concerns		
Horizontal	N	N
Vertical	Y	N

4.4.1.2 Pavement Condition

The existing pavement on Conservation Drive and Beaver Creek Road within the study limits is asphalt. A geotechnical investigation of the existing pavement structure was completed as part of this study and is provided in Appendix I. In general, the existing pavement within the roadway corridor is in various states of degradation with moderate to severe levels of longitudinal and transverse cracking, as well as pavement rutting throughout the project corridor. It is generally concluded from the investigation that the pavement has served its useful life and full pavement reconstruction is warranted.

4.4.1.3 Structural Culverts and Bridges

There is one reinforced concrete culvert, one round corrugated steel plate culvert, and one structural plate corrugated steel pipe-arch located within the study limits. The culverts are designated by the City as follows:

Structure	Identification No.
Laurel Creek Reservoir	RS-65
Equalization Culvert	RS-67
Beaver Creek	RS-68

Detailed assessments of the existing conditions of each of these existing structures, following the Ontario Structure Inspection Manual format, are included in Appendix K, for further reference. A brief assessment of these structures is as follow:

Laurel Creek Reservoir (ID# RS-65): The Laurel Creek Reservoir Structure is a reinforced concrete culvert located under Beaver Creek Road and conveys flows from Beaver Creek into the Laurel Creek Reservoir. The structure was last inspected in July 2014 and found to be in good condition. A recommendation was made for minor rehabilitation including replacement of the existing guide rail and supporting connections to the culvert structure within 1 to 5 years. Given the anticipated timing of the Beaver Creek Road improvements, the recommended works would be included in the City's road reconstruction contract.

Equalization Culvert (ID# RS-67): This round corrugated steel plate culvert is located on Conservation Drive, approximately 100 m east of Erbsville Road and conveys flows from the low area north of Conservation Drive south to a seasonal watercourse which outlets to Laurel Creek. The culvert was last inspected in July 2014 and determined to be in fair condition, with a recommendation for replacement within 6 to 10 years. Given the anticipated timing of the Conservation Drive improvements, the recommended works should be moved forward and included in the City's road reconstruction contract.

Beaver Creek Culvert (ID# RS-68): The corrugated steel pipe arch culvert structure is located under Conservation Drive approximately 150 m west of Beaver Creek Road. The culvert structure conveys Beaver Creek flows from north of Conservation Drive southward to Laurel Creek. The culvert was last inspected in July 2014 and determined to be in fair condition, with a recommendation for rehabilitation work including headwall replacement and addition of guide rails within 1 to 5 years. Given the anticipated timing of the Conservation Drive improvements, the recommended works would be included in the City's road reconstruction contract.

4.4.1.4 Existing Traffic and Transportation Conditions

As part of this Study a detailed traffic operations and safety assessment was completed for the Conservation Drive and Beaver Creek Road corridor within the Study Area and included considerations for the surrounding intersections that may potentially be impacted by the future growth within the Beaver Creek Meadows Study Area. The complete Transportation Overview (Stantec, 2015) report can be found in Appendix F. The Transportation Overview addressed the following items relevant to existing conditions:

- Existing traffic operations through the Conservation Drive and Beaver Creek Road corridor and identification of areas/locations where capacity limitations result in traffic congestion

- Recent collision histories along Conservation Drive and Beaver Creek Road within the project limits, and identification of any patterns or trends, along with possible solutions to reduce the number of collisions and improve the safety of the corridor

The existing road conditions including traffic volumes, level of service (LOS) assessment, and intersection and mid-block analysis, indicate that the four (4) primary unsignalized intersections within the Study Area are not presently experiencing traffic congestion or delays. Two (2) other access locations, Creekside Church and Green Acre Park, also included in the traffic analysis where found to be operating satisfactorily.

In terms of other modes of transportation, Conservation Drive has been identified in the Regional Cycling Master Plan and City Transportation Master Plan as an approved on-road cycling route and as such, there is a need to address and improve cycling facilities through the study corridor to satisfy this objective. Currently there are no designated sidewalks or trails to facilitate efficient pedestrian movements within the Study Area.

There is one existing Grand River Transit route in the vicinity of the Study Area, Bus Route 73 - Northlake, which currently circulates round-trip from the Albert McCormick Rec Centre through the Northlake neighbourhood as far as Lake Louise Boulevard, just east of the Study Area. The key origins/destinations for transit routes through the area are the universities of Waterloo and Wilfrid Laurier, and Conestoga Mall.

The City provided the historical collision summary along Conservation Drive and Beaver Creek Road for the period between 2010 and 2013. From the data provided, none of the

unsignalized intersections within the Study Area met the justification for improvements for collision experience within the Ontario Traffic Manual Book 12. Such justification would involve a minimum of five (5) reportable collisions of types preventable by traffic signals during a three-year period. Based on a review of the historical collision data along both Conservation Drive and Beaver Creek Road, there does not appear to be a discernable pattern or area of concern that could be remedied through specific improvements under current conditions.

There were no locations along Conservation Drive or Beaver Creek Road where existing horizontal geometry was identified as a possible cause of collisions; however, concern was noted at the Public Consultation Centres regarding the poor sight lines at the southeast corner of Erbsville Road and Conservation Drive due to the proximity of a large shed along the east side of Erbsville Road. The vertical sight lines on the west leg of the Conservation Drive and Beaver Creek Road intersection are substandard by current design standards and best practices. Improvements to the road profile approaching the intersection would result in better sight distances, reduce driver discomfort, and potentially reduce all types of vehicular collisions.

4.4.2 Design Criteria

Roadway design criteria were established and refined early in the study to arrive at a suitable set of design criteria that would be applied to the development of roadway designs as part of the preferred solution. The design criteria used in the development of the design alternatives during the functional design stage are derived from the Transportation Association of Canada (TAC) standards and local engineering standards. The lane and entry width requirements for the proposed roundabout intersection was developed using existing and projected traffic volumes. The following Table 4-11 summarizes the existing and proposed design criteria which form the basis for the transportation design alternatives prepared as part of the Class EA.

Table 4-11: Preliminary Design Criteria

Attribute	Present Conditions	Design Standards	
		TAC	Proposed Standards
Classification	Rural Collector	UCU60	UCU60
Design Speed (Note 1)	50 km/h	60 km/h	60 km/h
Posted Speed Conservation Drive Beaver Creek Road	 50 km/h 60 km/h	 N/A N/A	 50 km/h 60 km/h
Number of Lanes	2	N/A	2
Minimum Stopping Sight Distance	45m±	75-85 m	94 m
Minimum Radius Conservation Drive Beaver Creek Road	 N/A 250m±	 1290m (NC) 185m (RC)	 2000m 250m (RC)
Maximum Grades Conservation Drive Beaver Creek Road	 6.1% 6.2%	 6-10%	 4.5% 5.2%
Minimum Grades	0.2% (flat)	0.3%	0.4%
Vertical Curves (Min K) Crest Sag	 6 10	 10 to 13 8 to 9	 17 10
Lane Widths Through (TL) Left Turn Right Turn	 3.5m± N/A N/A	 3.5 to 3.7m 3.3 m 3.3 m	 3.5m to 3.7m 3.5 m N/A
Superelevation	N/A	N/A)	N/A
Right-of-Way Conservation Drive Beaver Creek Road	 12.2 to 16.1 m 12.2 to 16.1 m	 N/A N/A	 20 to 24 m 20 m
Sidewalk Width	N/A	-	1.5 m
Multi-Use Trail Width	N/A	-	2.5 - 3.0 m

Notes 1: Design speeds of 10 km/hr greater than posted speeds on Conservation Drive are recommended as a safety allowance for determining future intersection locations.

4.4.3 Future Transportation Needs

The function of the road will change significantly in the future as it will move from a rural collector to an urban collector, and this is reflected in the following sections outlining the future transportation needs of the Study Area.

4.4.3.1 Conventional and Operational Intersection Improvements

The majority of alternative design concepts will include either conventional intersection improvements or operational intersection improvements.

Conventional intersection improvements are normally considered to address specific identified traffic operations and/or capacity issues. These improvements include installation of additional turning movement lanes and/or the extension of existing turning lane storage lengths to accommodate more queued traffic in peak hours. The number, type and length of turning lanes would be developed through traffic analysis. Geometric modifications to the intersection layout and its orientation are typically minor with conventional intersection improvements, and improvements can be considered as building upon the existing layout, rather than altering it.

Operational intersection improvements encompass a more significant alteration of the existing intersection geometrics and layout, by realigning the intersecting roadways to an orientation that facilitates better traffic movements, typically by creating dedicated pathways through the intersection for the larger volume traffic movements, as opposed to having those heavy movements turning through the intersection. These improvements include major reorientation of the intersections and priority movements, improving sight lines, turning radii, lane widths and other geometric layout features. As with the conventional intersection improvements, this improvement may also include the addition of auxiliary turning lanes as necessary, with the number, type and length again determined through traffic analysis.

The existing intersection at Erbsville Road and Conservation Drive is being considered for conventional intersection improvements as this would accommodate the heaviest traffic movements. A minor realignment of the intersection is also included at this location to allow for clearance to existing buildings. The option of an Erbsville bypass on Erbsville Road paralleling east of the current Erbsville Road alignment was discussed based on feedback received from the public. Consideration of an Erbsville bypass is not in the current Region of Waterloo Transportation Master Plan and is not within the current scope of this study. The existing intersection at Conservation Drive and Beaver Creek Road is being evaluated for both conventional and operation improvements through implementation of left turn lanes or a roundabout.

4.4.3.2 Future Traffic Conditions

The Transportation Overview report located in Appendix F takes into account the future development for the Beaver Creek Meadows area, as presented in the BCM District Plan, and anticipated traffic from the surrounding road network. A detailed analysis of traffic

operations at all existing intersections and selected mid-block locations was completed for the current, 2021, and 2035 Horizon Year traffic volumes. This analysis indicated that there would be deficient traffic movements in the 2021 analysis under a two-way stop condition at the intersection of Conservation Drive and Erbsville Road. The 2035 analysis includes an all-way stop condition as recommended beyond the 2021 horizon. The Conservation Drive and Beaver Creek Road intersection analysis includes a roundabout with the addition of a north leg for future conditions. The analysis indicates the future intersection should operate satisfactorily beyond the 2021 horizon; however, it may experience deficient traffic movements for the PM peak westbound movement approaching the 2035 horizon. The provision for an additional westbound lane through the roundabout has been considered in the recommended design alternative. It should be noted that future intersections along Conservation Drive between Erbsville Road and Beaver Creek Road have yet to be confirmed and controls for each new intersection will need to be identified once the ultimate development mix is determined by the developers.

4.4.3.3 Cycling Facilities

As part of its recommendations for cycle network planning, the Regional Cycling Master Plan and City Transportation Master Plan identified the Conservation Drive corridor as a planned on-road cycle route. The Regional Cycling Master Plan also identified a number of connecting cycle routes. The Region of Waterloo has recently completed the Walk Cycle Waterloo Region Active Transportation Master Plan to enhance the current Region of Waterloo Transportation Master Plan. The emphasis of this plan is the promotion and integration of forms of active transportation within the Region of Waterloo.

Walk Cycle Waterloo Region Active Transportation Master Plan is a regional plan that focuses on improvements to or creation of new active transportation facilities within Regional corridors. The plan also recognizes that there are gaps in connectivity of the planned network and includes coordination with area municipalities to ensure connectivity where regional facilities could not be provided. Although not included in the Walk Cycle network plan, planned development of active transportation facilities on Conservation Drive would enhance the network by bisecting a large area of northwest Waterloo which is not serviced by the Walk Cycle network. The Beaver Creek Meadows area is situated within the heart of this area.

The provision of cycling facilities, either bike lanes or multi-use trails, were a major consideration during the functional design stages because of their presence (or lack thereof) and the type (on-road vs. off-road) as well as the interaction of these bike lanes with general motor vehicle traffic. All of these considerations had bearing on the layouts of the alternative design concepts and their subsequent impacts.

Dedicated on-road bike lanes are those portions of the street designated for exclusive use by bicycles (dedicated lanes), and are typically adjacent to motorized vehicle lanes on the roadway, separated by striping, signage and/or pavement markings. They are typically 1.5 m wide when specifically designated as on-road cycle lanes. Other common provision for cyclists includes “shared” traffic lanes in areas where there is limited space and there are no pavement markings provided to delineate the cycle lane from the motorized vehicle

lane but signage and/or pavement markings indicates that the lane is intended for shared use.

The alternative to an on-road cycle lane is a Mixed Use or Multi-Use Trail (MUT). A multi-use trail is open to use by bicycles, roller blades, joggers, skate boards, and pedestrians and is typically located away from the roadway, or off-road. MUT's are physically separated wherever possible from motor vehicle traffic by open space (roadside boulevard) and/or physical barriers. The benefit of a MUT is the ability to accommodate a variety of active transportation users including pedestrians and cyclists while providing users with an enhanced level of comfort due to the physical separation from traffic. However, MUT can create other safety risks, in particular the conflicts with driveway and access crossings. Consequently, MUT's are not favoured on roadways with a significant number of driveways and/or local street accesses, and on-road cycle lanes are generally preferred under those circumstances.

4.4.3.4 Pedestrian Facilities

As part of its Transportation Master Plan, the City aims to create walkable communities wherever possible; communities wherein housing and services that residents would utilize on a regular basis are located within a safe and easy walking distance and via dedicated facilities.

Improvements proposed for pedestrians within the Conservation Drive and Beaver Creek Road corridor would enhance the pedestrian experience by creating a safe and inviting pedestrian corridor, and expanding on transportation options and streetscaping that better serves a full range of users.

Similar to the concerns about facilitating cycling traffic along the corridor as part of any solution, there is also significant emphasis on ensuring that the functional designs for all alternatives provide adequate pedestrian facilities that will not only close any continuity gaps in the existing pedestrian network along the corridor, but will avoid unnecessary crossings of the roadway to reach pedestrian facilities.

4.4.3.5 Roundabouts

As discussed during the assessment of alternative solutions in Section 5, it was determined that a roundabout option was feasible at the intersection of Conservation Drive and Beaver Creek Road. In response to this, a roundabout design alternative was developed for the intersection in combination with conventional improvements at the Erbsville Road and Conservation Drive intersection.

4.4.3.6 Traffic Calming

The implementation of traffic calming measures is being considered due to the persistent excessive traffic speeds on Conservation Drive and on Beaver Creek Road to an extent. The options for effective traffic calming tend to be limited with the introduction of on-road

bicycle lanes. Types of traffic calming measures that may be considered for the study corridors include:

- Narrowed travel lanes
- Curb extensions
- Pavement colourization/warning markers

It should be noted that current traffic speeds could be attributed to the rural nature of the existing study area and urbanization of the corridor, including implementation of mid-block roundabout intersection(s), may provide the necessary calming measures. The implementation of traffic calming measures will be further evaluated during the detailed design stage.

4.4.3.7 Transit Facilities

Discussions regarding implementing transit facilities and stop locations were limited to general discussion during the study. It is known that future facilities will be incorporated as future demand dictates. Planning for future stops will be initiated during the detailed design phase.

4.4.4 Methodology for Transportation Servicing Analysis

The alternative design concepts for transportation servicing within the Study Area were generated through an iterative process. Based on the future transportation needs, logical or functional solutions at different points along the corridor were generated. An initial assessment of the preliminary alternative components was combined with input received at the PCCs to develop four (4) alternatives for further development and identification of potential impacts and costs.

A number of scenarios were considered to determine preliminary alternative components to carry forward to the final development and evaluation of alternatives. These included:

- Diversion and Improvements to Alternate Roadways
- Develop Alternate Routes within Study Area
- Modifications to Traffic Operations
- Enhanced Intersection Improvements Including Roundabouts
- Widening of Roadways
- Realignment of Roadways

Not all design elements are applicable to specific intersections due to the context of those intersections and their individual characteristics. The following table summarizes the design elements applicable at each intersection and which can be practically considered in combination at those locations.

Table 4-12: Summary of Transportation Design Elements by Intersection

	Conventional	Realigned	Roundabout	On-Road Cycle Lanes	Mixed Use Trail
Conservation Drive and Erbsville Road	✓	✓	X	✓	✓
Conservation Drive and Beaver Creek Road	✓	X	✓	✓	✓

Based on the feedback provided following PCC#2, items such as providing active transportation facilities and enhanced transit service throughout the corridor were also implemented for the alternative design concepts. As previously noted, four (4) alternative design concepts were advanced for further development and identification of potential impacts and costs.

4.4.5 Future Transportation Servicing Alternatives

4.4.5.1 Do-Nothing Transportation Alternative

As part of the Class EA process, consideration must be given to the “Do-Nothing” alternative to assess what would happen if no action is taken to address the problem and related concerns. This assessment provides a baseline against which the other project alternatives can be measured.

This alternative consists of maintenance of existing conditions with the possibility of minor improvements at specific locations that would have little to no net effect on addressing the overall study needs. The City’s base program of normal maintenance and reconstruction would require reconstruction of the pavement along with addressing deficiencies in sidewalks and municipal infrastructure, and addressing the need for pedestrian and cycling facilities.

Based on the projected growth within the Study Area and the projected future traffic demands in the Beaver Creek Meadows Area, the “Do-Nothing” alternative would result in a breakdown of traffic level of service (increase in delay) through the Study Area and the northwest Waterloo area Transportation Network. The “Do-Nothing” alternative while maintaining existing conditions fails to address the issues identified in the Problem Statement. This option was not considered feasible, and therefore was not carried forward for further evaluation.

4.4.5.2 Alternative 1: Upgrade Roadway to a Standard Collector Road Centered Along Existing Right-of-way

Improvements to Conservation Drive and Beaver Creek Road, in general, are being implemented to satisfy future growth, safety and improvements to pedestrian and cyclist accessibility. Alternative 1 provides these elements through improvements to the vertical geometry (sight lines) and the addition of sidewalks and on-street bicycle lanes. The proposed horizontal road alignment would follow the existing alignment and the required property acquisition would be based on an equal sufficient offset from the centerline of the existing road to accommodate the desired road width. The proposed acquisition is based on acquiring sufficient lands to accommodate a 20 m right-of-way (ROW). Conservation Drive is designated as a major collector road east of Erbsville Road in the City's Official Plan with an ultimate ROW width of 26 m. The balance of the ROW would be acquired through dedication as the area develops.

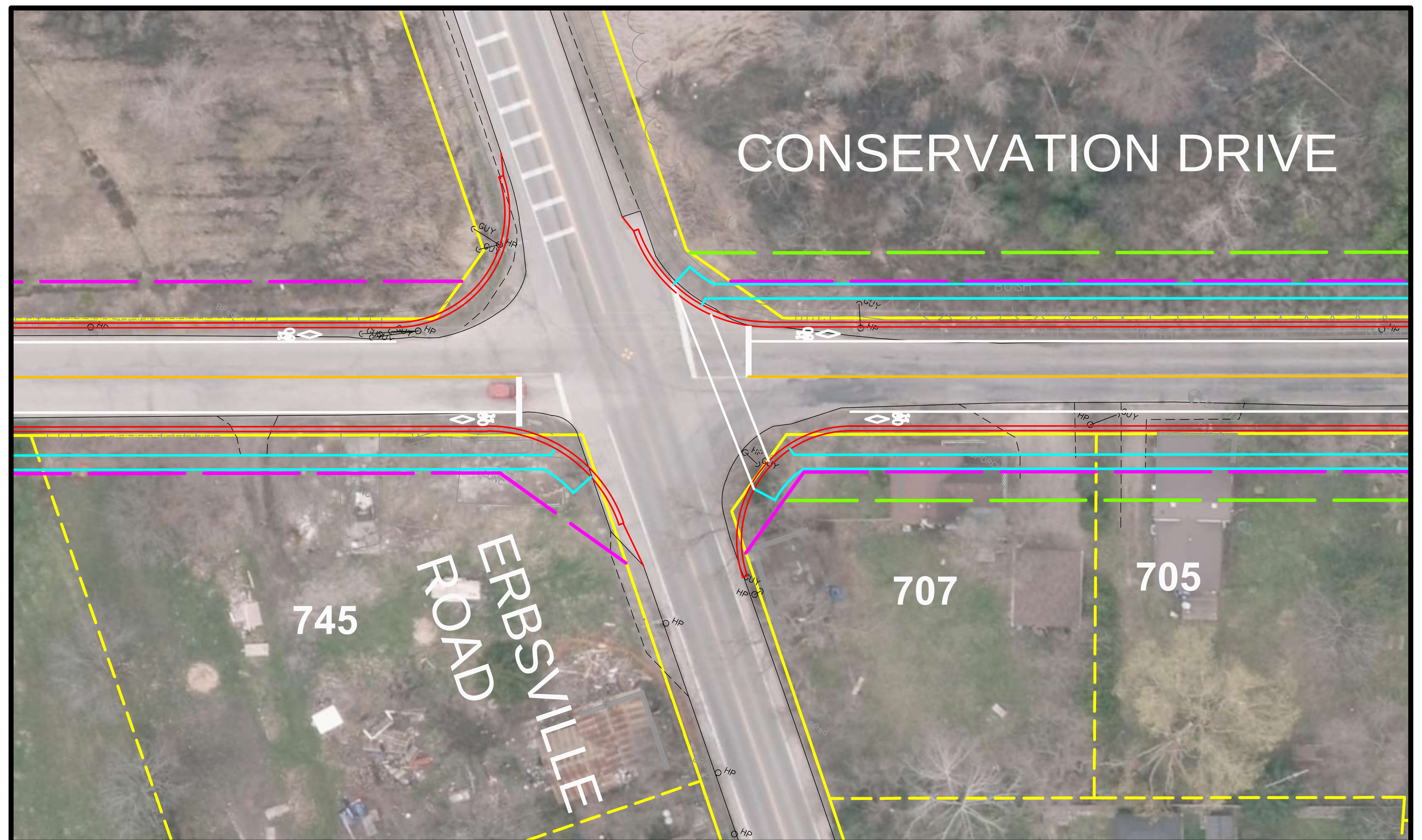
Beaver Creek Road is designated as a minor collector road with an ultimate ROW width of 20 m. Alternative 1 improvements for Beaver Creek Road are similar to Conservation Drive with exception of the section of roadway adjacent to the environmentally sensitive lands within the Laurel Creek Conservation Area where a restrained cross-section is proposed to limit impacts to the east side of the roadway. In order to limit impacts in this area, the minimized cross-section is proposed for all alternatives.

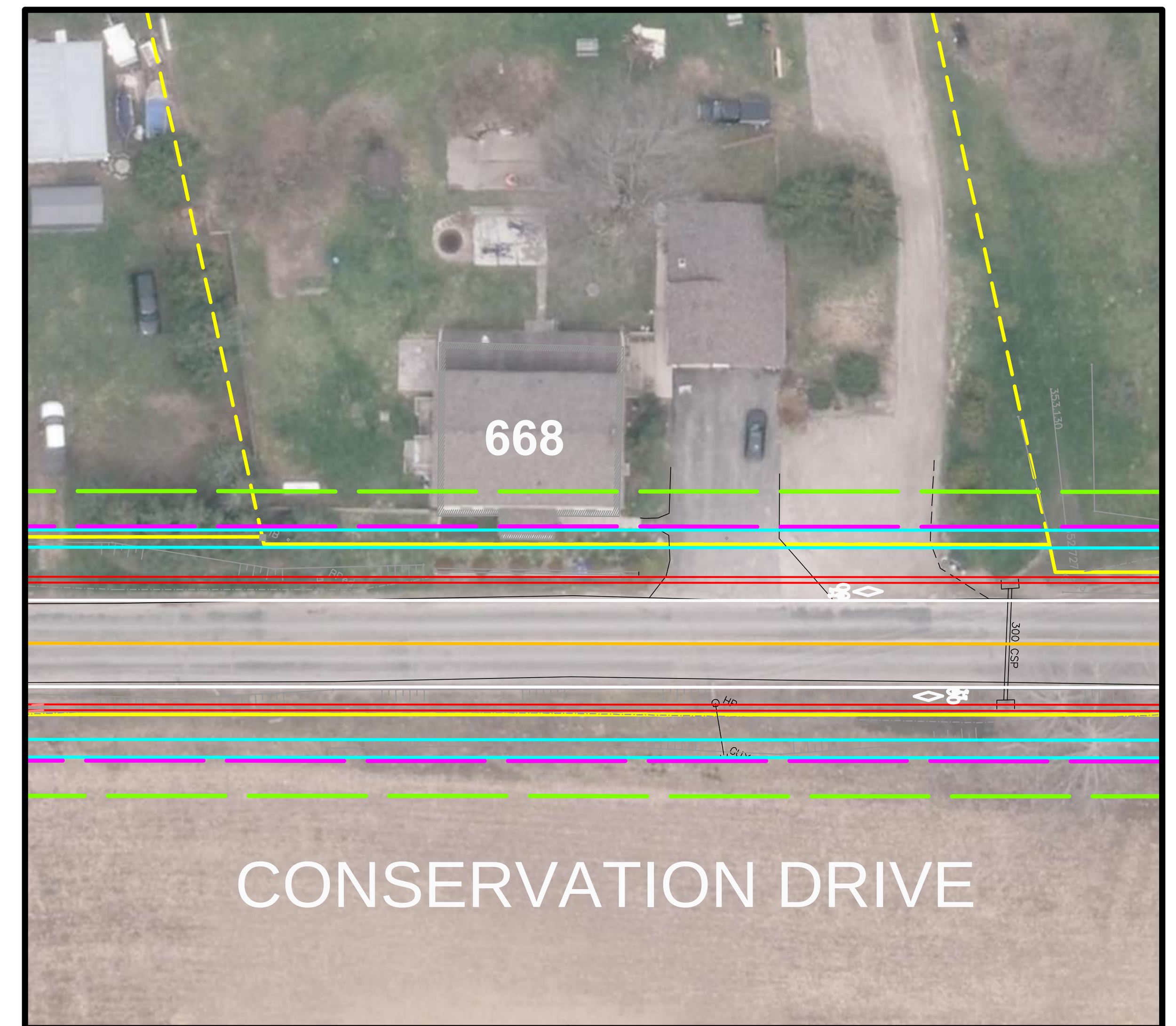
By widening Conservation Drive equally along the existing ROW alignment with Alternative 1, there will be direct impacts to at least four residential structures. The residential structures at #705, #707 and #560 Conservation Drive would require demolition to accommodate the road widening potentially resulting in a full buyout of these properties. The impact to the residential structure at #668 Conservation Drive would require the removal of the enclosed porch off the front of the building. A structural assessment would have to be completed to confirm if this modification would be feasible.

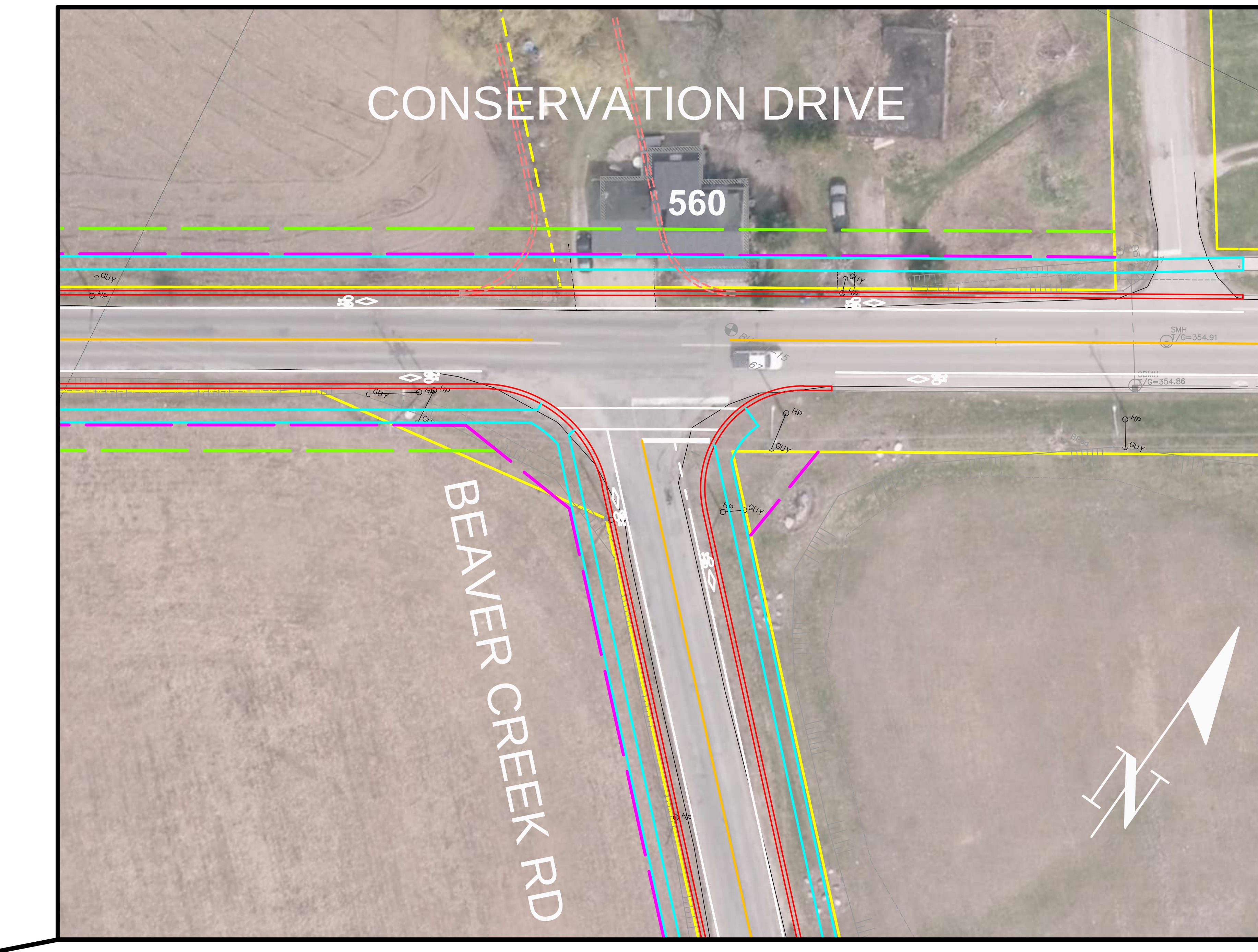
Due to the close proximity of the existing hydro poles along the edge of pavement on Conservation Drive and Beaver Creek Road, Waterloo North Hydro will be required to relocate the existing hydro poles to accommodate the proposed horizontal and vertical alignment changes. This will be required for each of the proposed alternatives.

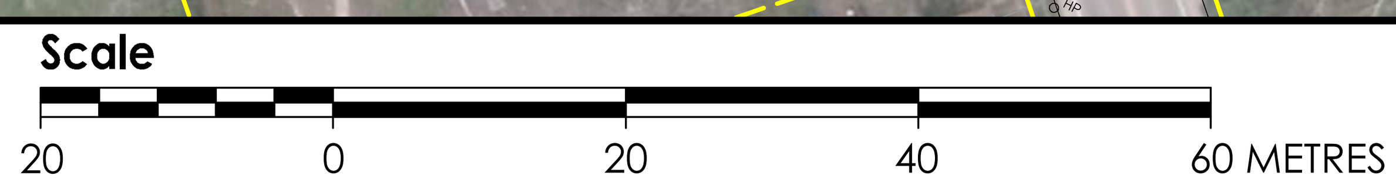
The current operational capacities at the existing intersections within the Study Area are good; however, Alternative 1 does not provide for operational improvements with future development of the Beaver Creek Meadows area.

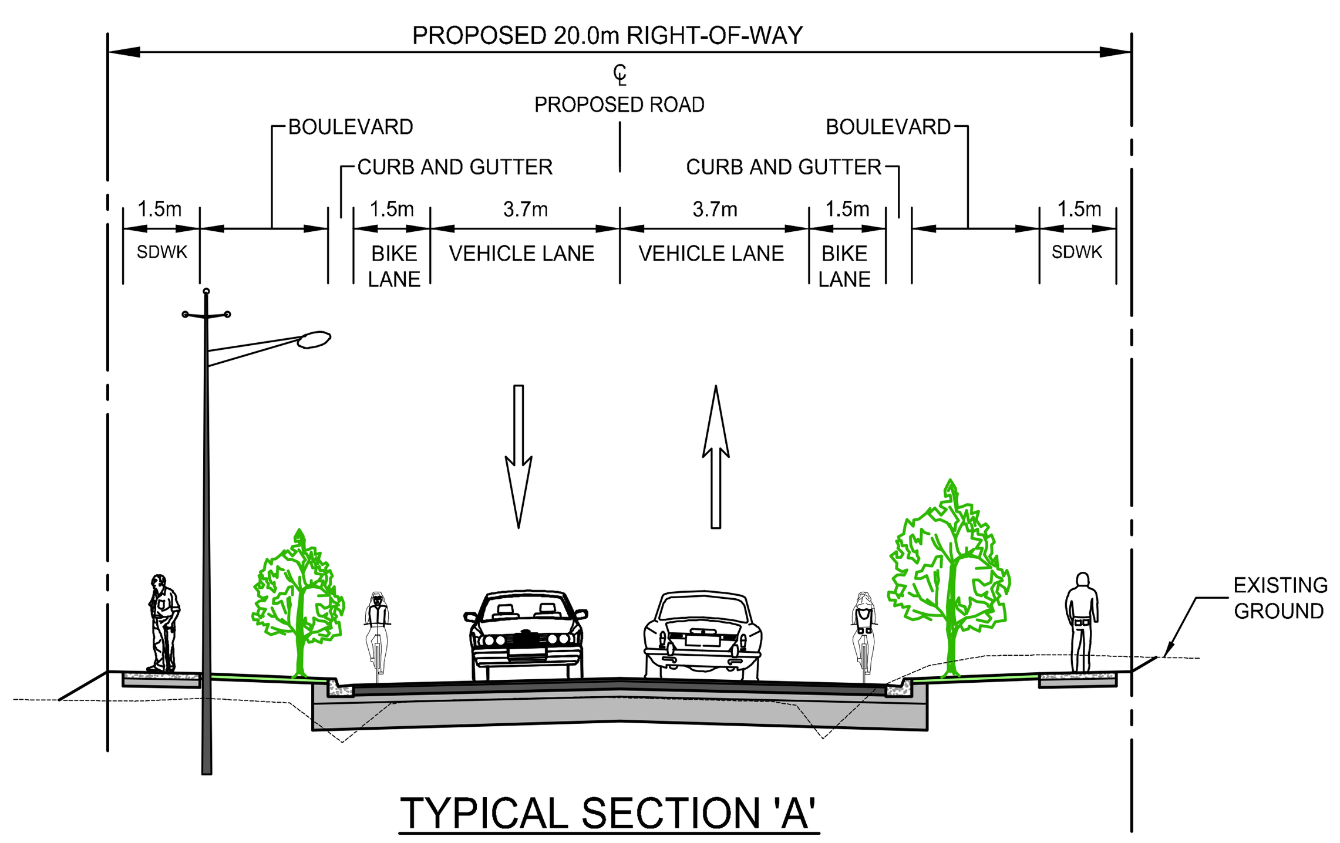
Refer to Figure 4-10 for an overview of the design components of Alternative 1, and refer to Appendix G.4 for detailed drawings.









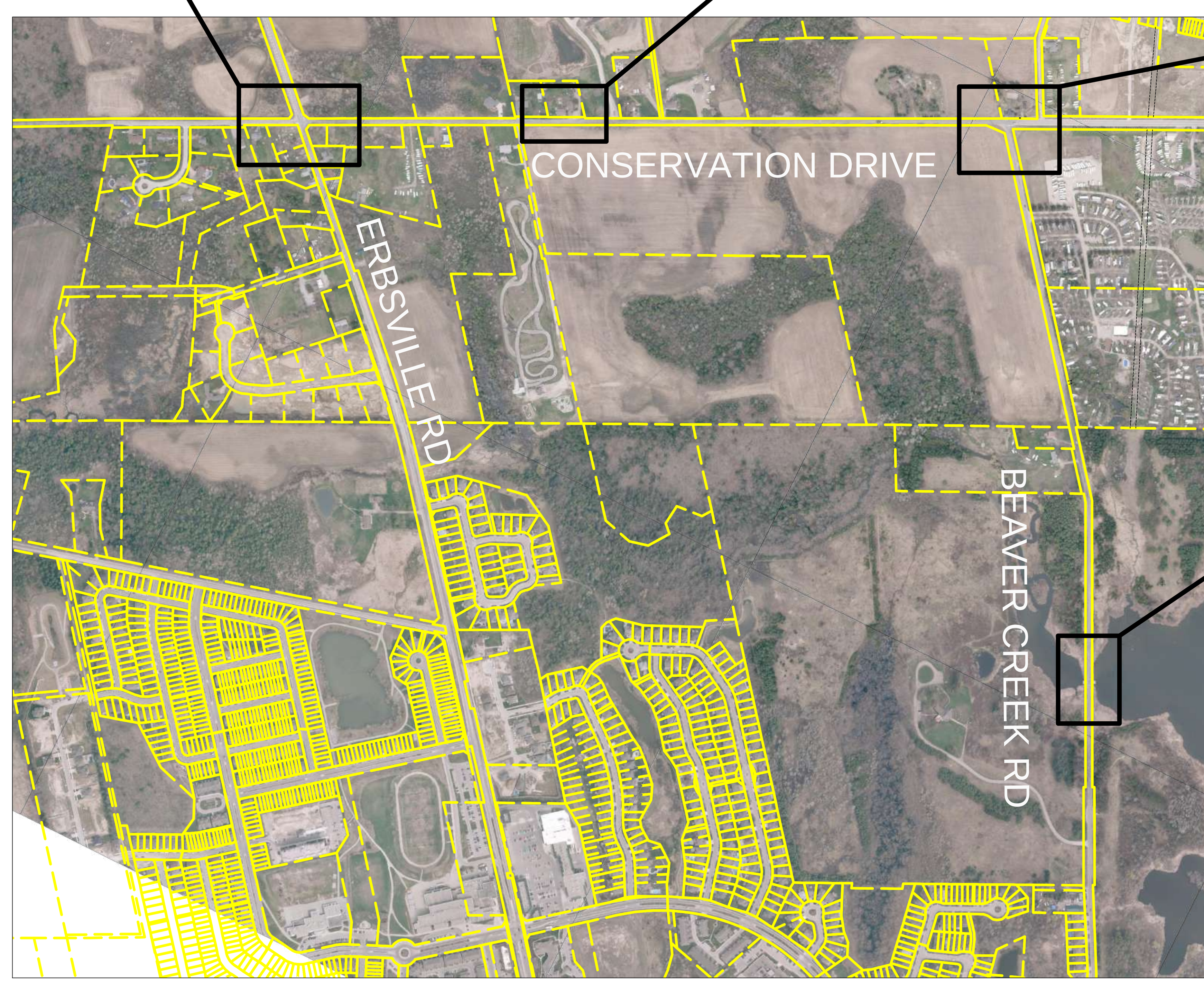


TYPICAL SECTION 'A'

STANDARD COLLECTOR ROAD (W-203) WITH BOULEVARD SIDEWALKS AND ON-STREET BICYCLE LANES

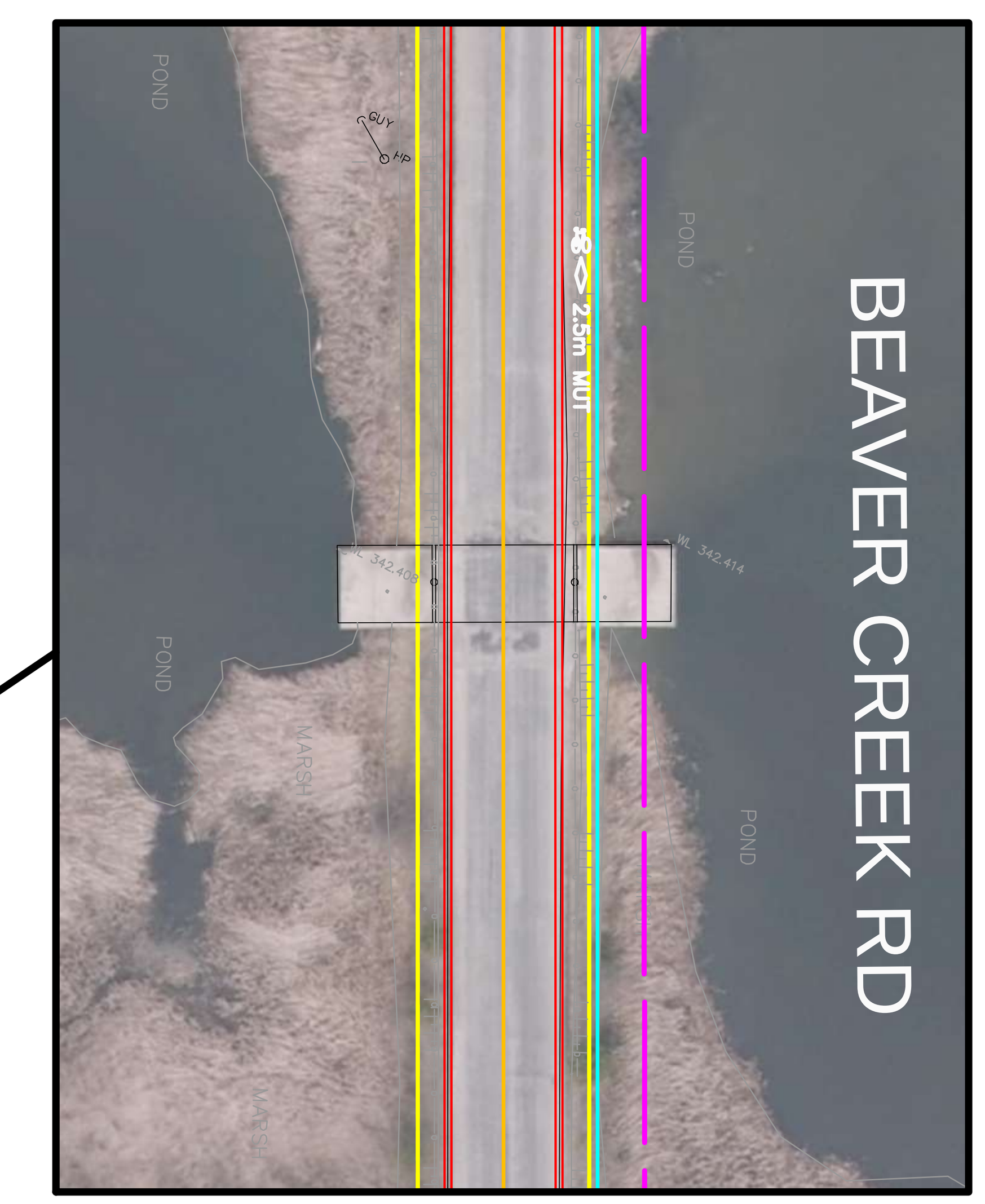
LEGEND

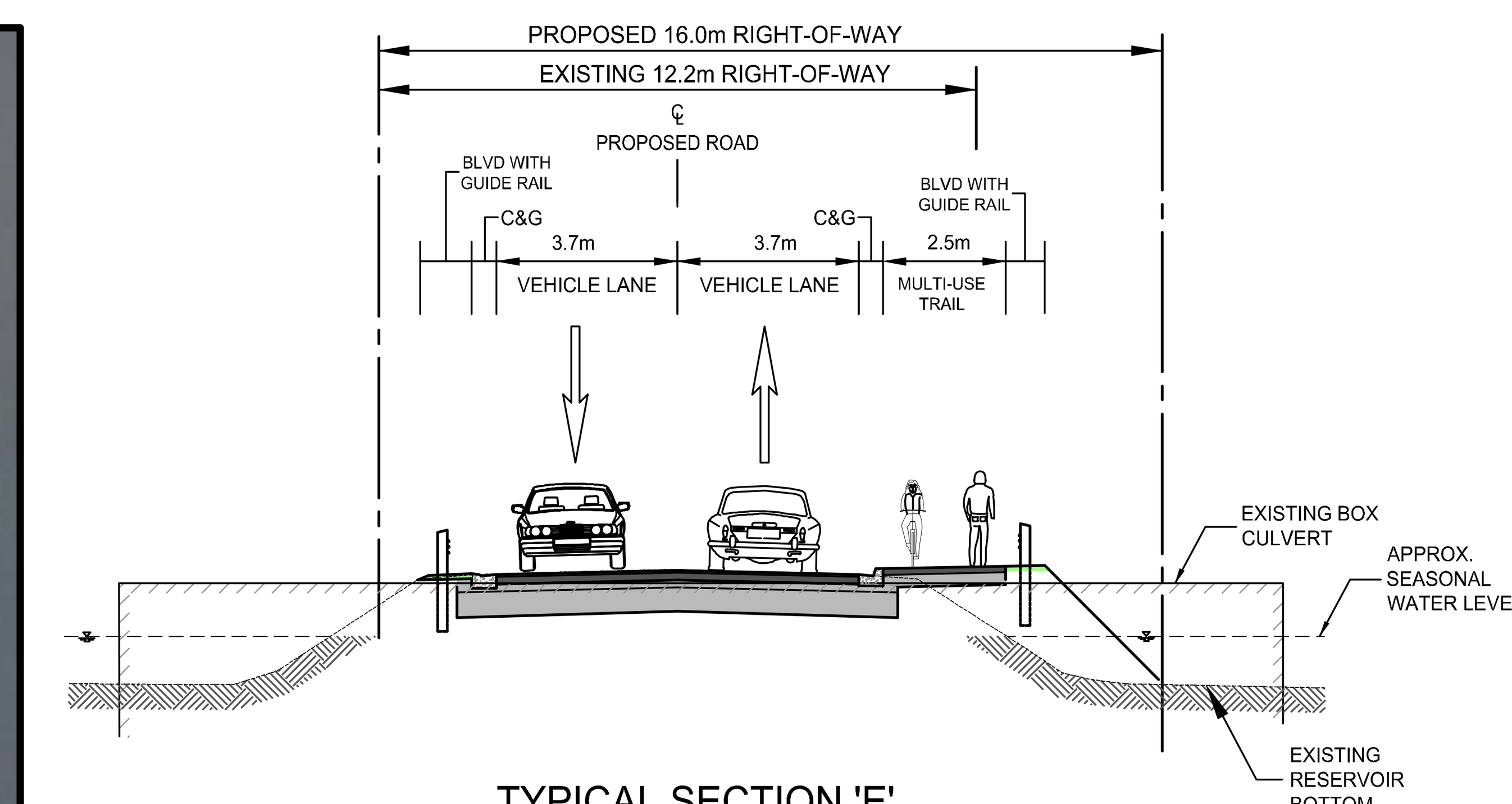
- EXISTING RIGHT-OF-WAY
- EXISTING LOT LINE
- PROPOSED RIGHT-OF-WAY
- ULTIMATE RIGHT-OF-WAY (WATERLOO OFFICIAL PLAN)
- PROPOSED CURB
- PROPOSED 1.5m SIDEWALK
- 3.0 MUT — PROPOSED MULTI-USE TRAIL (WIDTH AS INDICATED)
- PROPOSED ON-STREET BIKE LANE
- FUTURE CURB



KEY MAP

NTS





TYPICAL SECTION 'E'

NARROW PAVEMENT WIDTH ON BEAVER CREEK ROAD TO MINIMIZE IMPACTS TO RESERVOIR & SENSITIVE LANDS (WITH MULTI-USE TRAIL ADJACENT TO ROAD)

NOTE:
SECTION 'E' IS TYPICAL OF EACH ALTERNATIVE DUE TO CONSTRAINTS WITHIN THE ENVIRONMENTALLY SENSITIVE LANDS

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STANDARD COLLECTOR ROAD (W-203) CENTERED ALONG EXISTING ROW (SECTION A) AND AS MODIFIED THROUGH LAUREL CREEK RESERVOIR (SECTION E)

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CITY OF WATERLOO
BEAVER CREEK RD. & CONSERVATION DR. UPGRADES AND EXTENSION OF MUNICIPAL SERVICES CLASS EA

Figure No.
4-10

Title
TRANSPORTATION ALTERNATIVE 1

4.4.5.3 Alternative 2: Minimized Pavement Width with Addition of Multi-Use Trail

Similar to Alternative 1, an emphasis on improving cyclist and pedestrian accessibility was maintained while incorporating a narrower roadway pavement. The implementation of a proposed multi-use trail in place of a sidewalk on the south side of Conservation Drive and east side of Beaver Creek Road was considered to provide for a mixed use bicycle and pedestrian facility. Also, given the potential impacts on the existing residential structures on Conservation Drive, Alternative 2 also focused on implementing minor alignment adjustments in order to avoid impacts to buildings.

While it was determined that Alternative 2 would be a less expensive alternative to construct, public input indicated that on-street cycling was still preferred over a dedicated off-street mixed use trail. Similar to Alternative 1, Alternative 2 does not provide for future traffic capacity growth.

Refer to Figure 4-11 for an overview of the design components of Alternative 2, and refer to Appendix G.4 for detailed drawings.

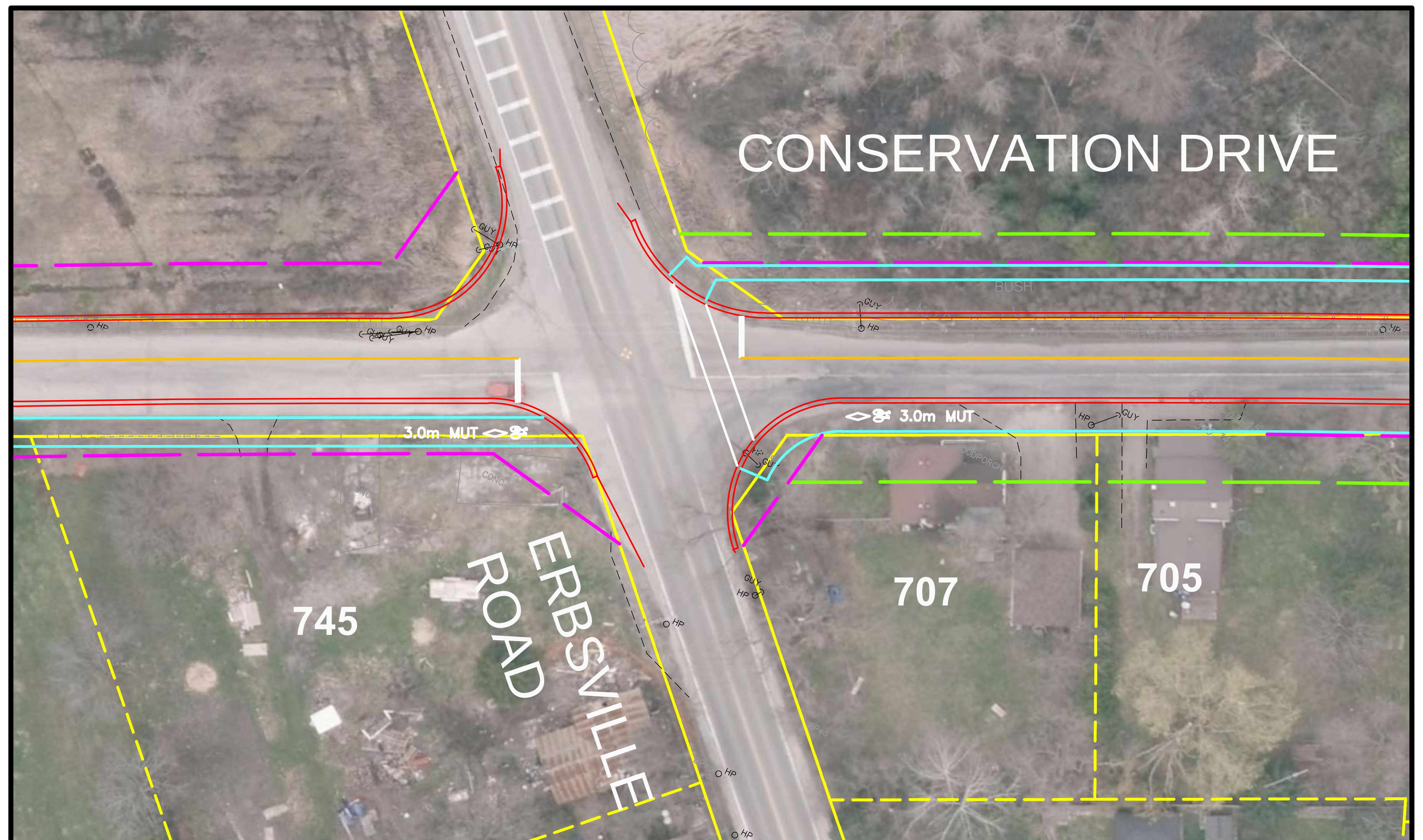
4.4.5.4 Alternative 3: Enhanced Intersection Improvements with Implementation of On-Street Bicycle Lanes

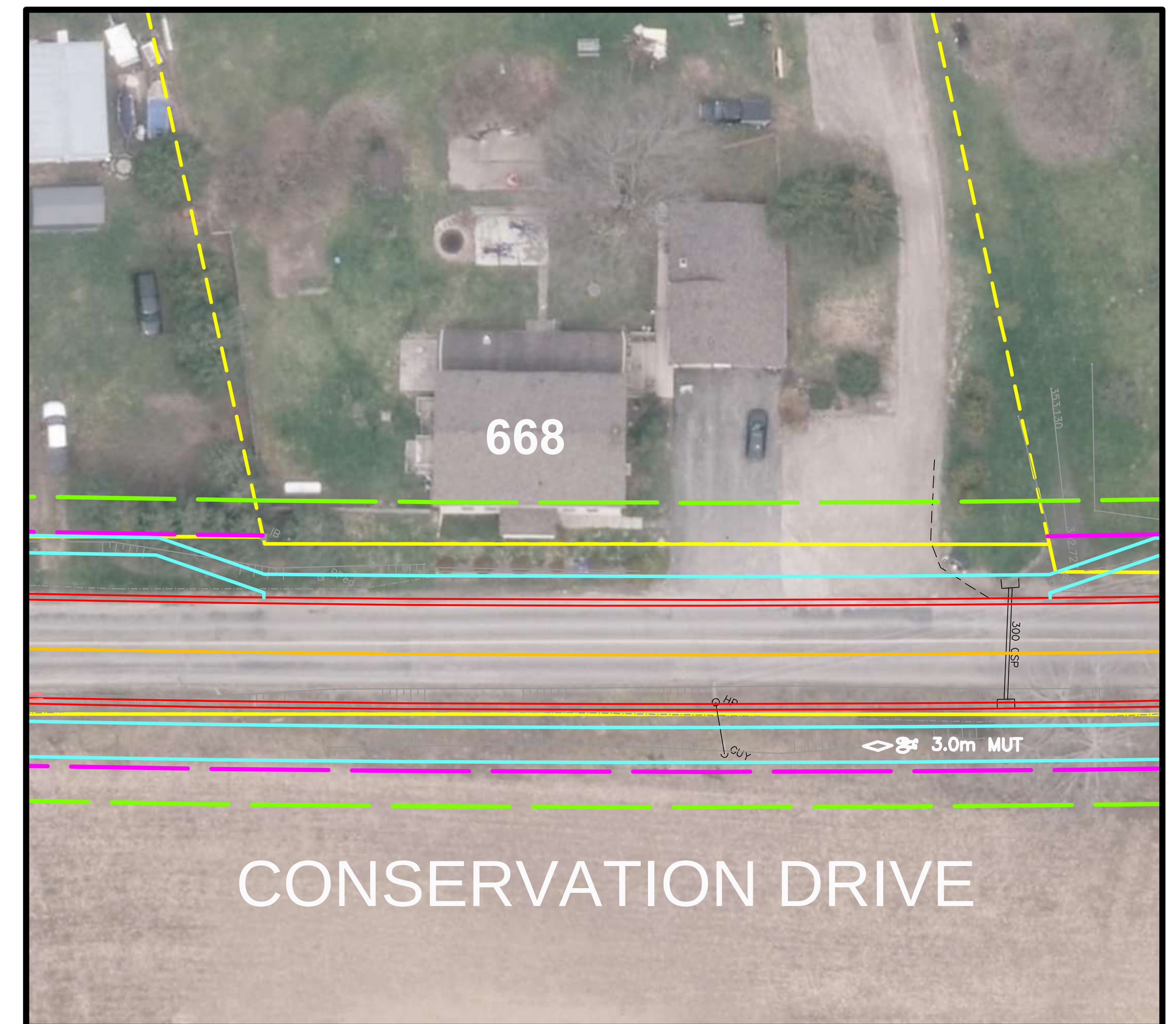
Alternative 3 was developed to address the desire for dedicated on-street cycling while including operational improvements at the existing and future intersections. Current traffic volumes do not warrant the implementation of traffic signals at the Conservation Road at Erbsville Road or Conservation Drive at Beaver Creek Road intersections; however, operational enhancements such as left turn lanes were implemented at these intersections to address future growth. Also, the addition of left turn lanes and pedestrian refuge islands on Conservation Drive were incorporated at future development intersection locations.

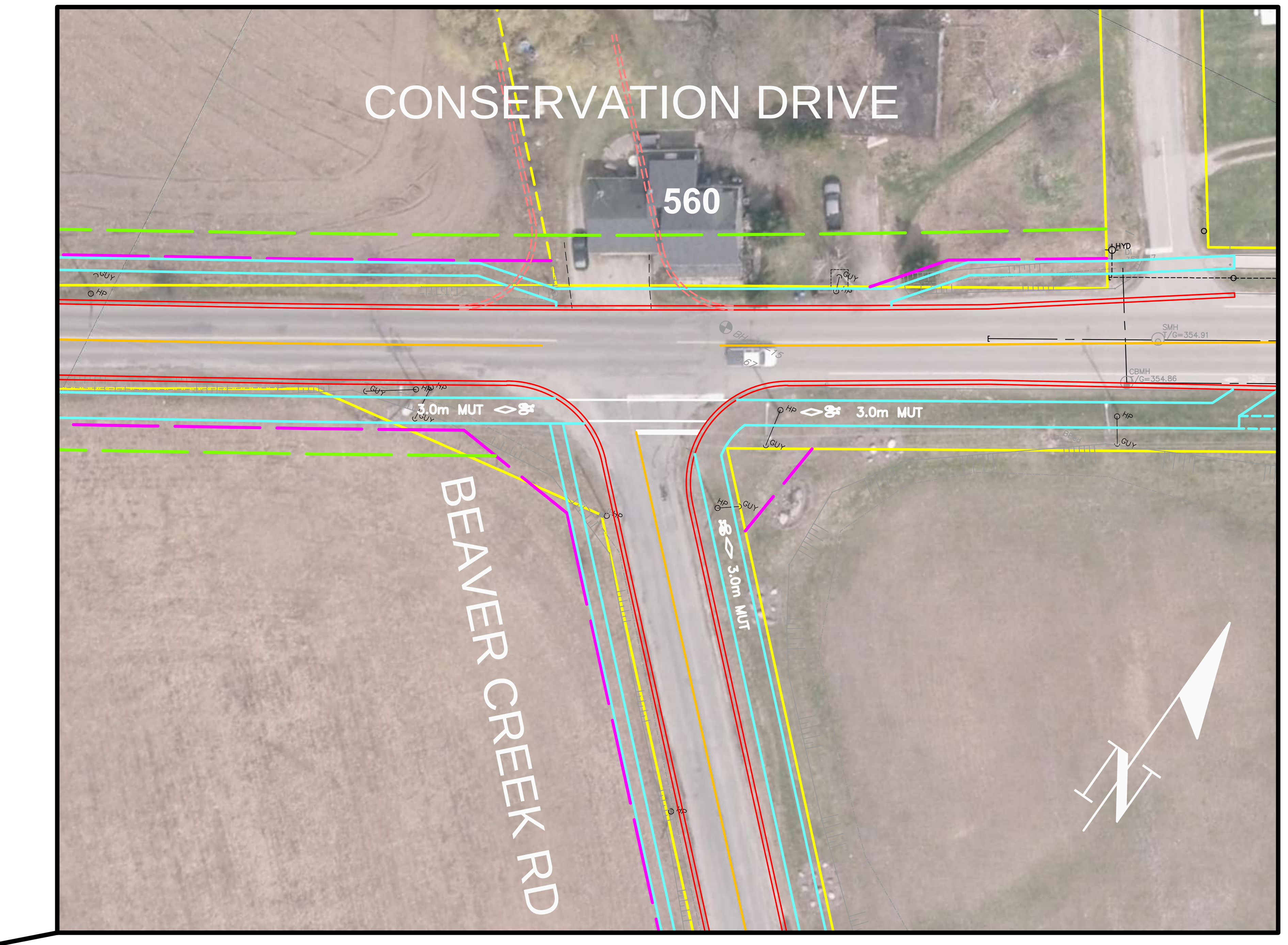
Further adjustments to the horizontal alignment were also incorporated to minimize or eliminate impacts to residential structures while accommodating the wider roadway pavement; however, these adjustments also increased the impact to environmentally sensitive land within the corridor.

In consideration of the above modifications, it was concluded that enhancements to accommodate future intersections could not be implemented without developing fixed locations for these intersections. This alternative could be viable through coordination with development but with the City's desire to commence the road reconstruction by 2016/2017, in advance of development coming on line, coordination would not be realistic thus increasing the likelihood of throw-away costs.

Refer to Figure 4-12 for an overview of the design components of Alternative 3, and refer to Appendix G.4 for detailed drawings.







Scale

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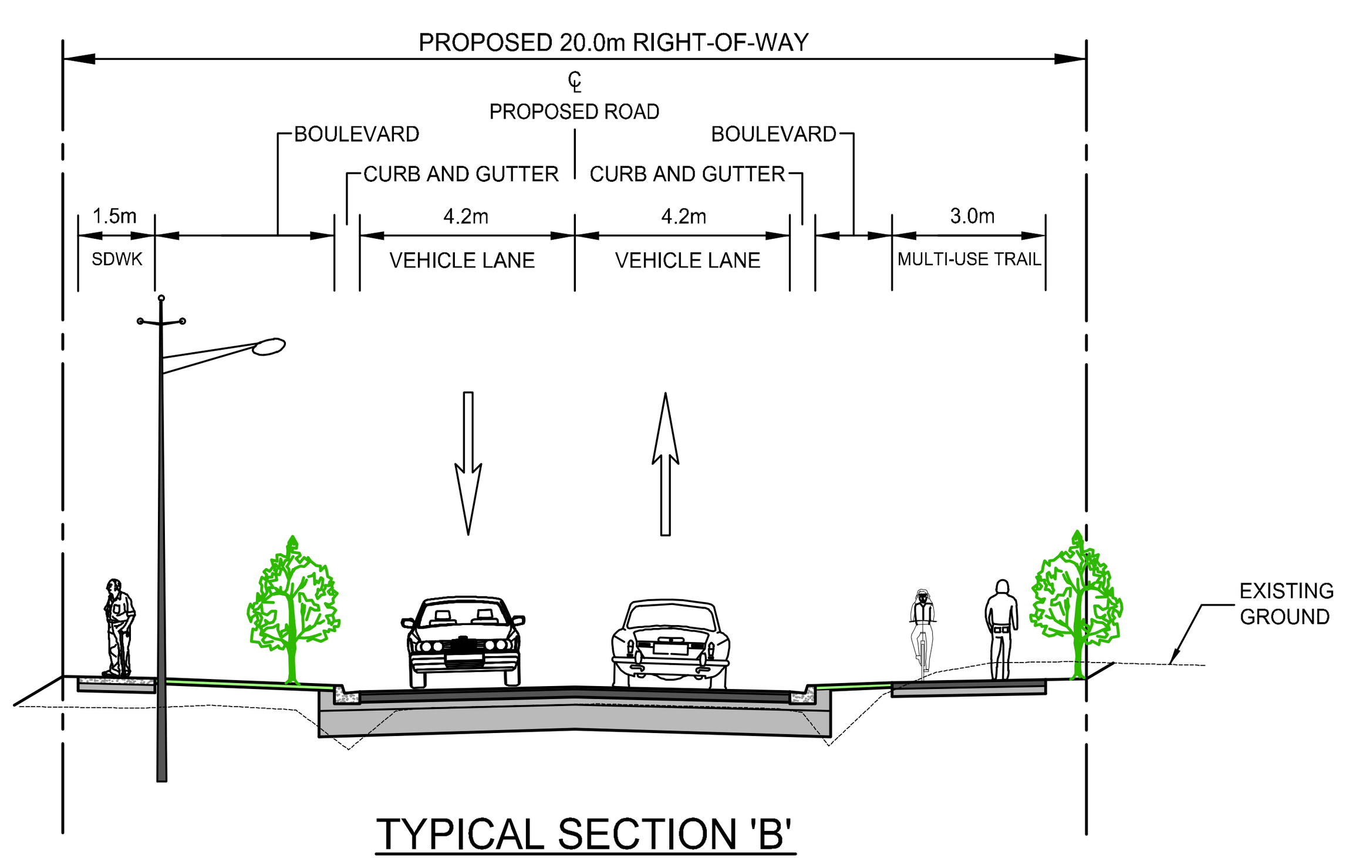
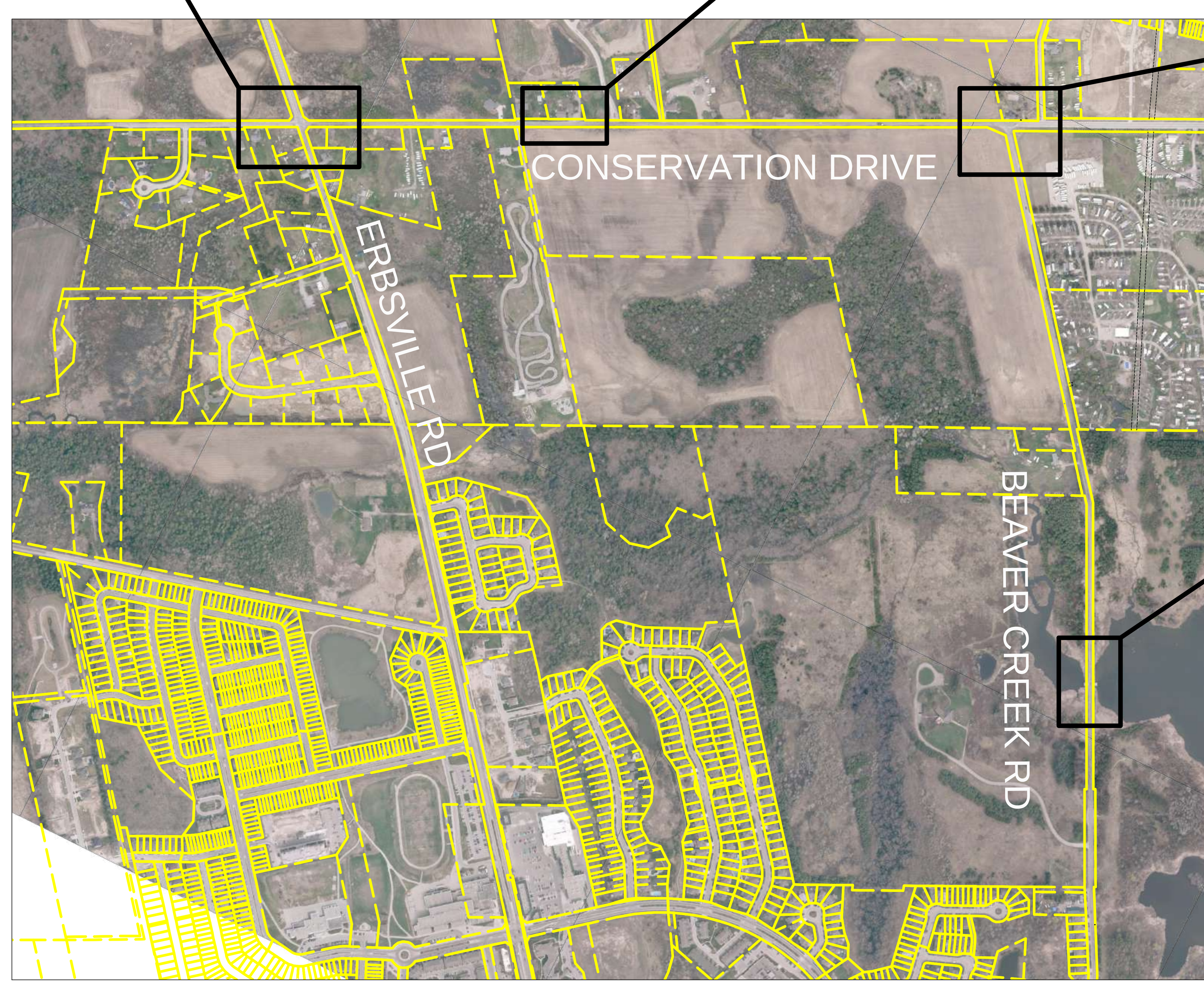


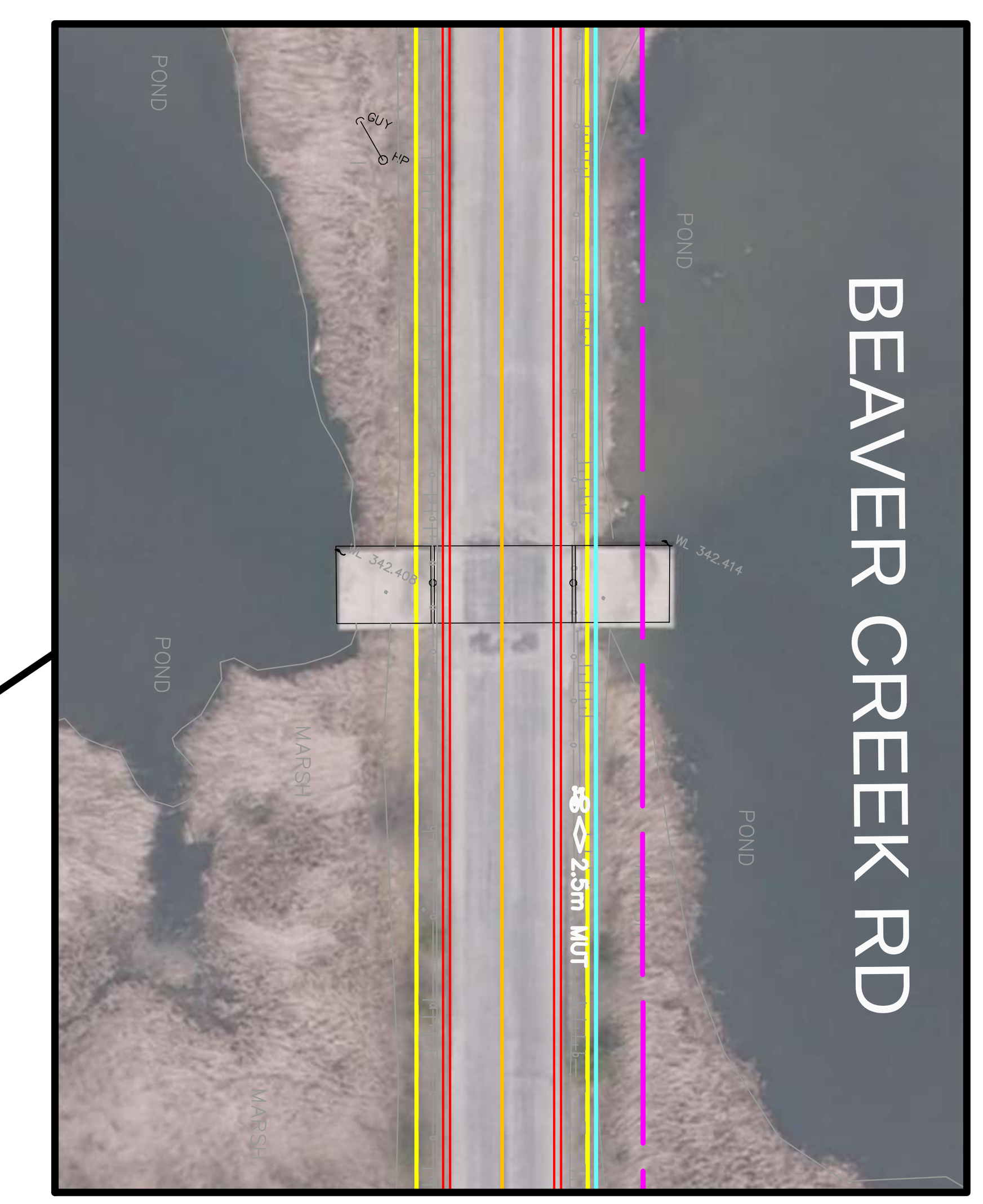
TYPICAL SECTION 'B'

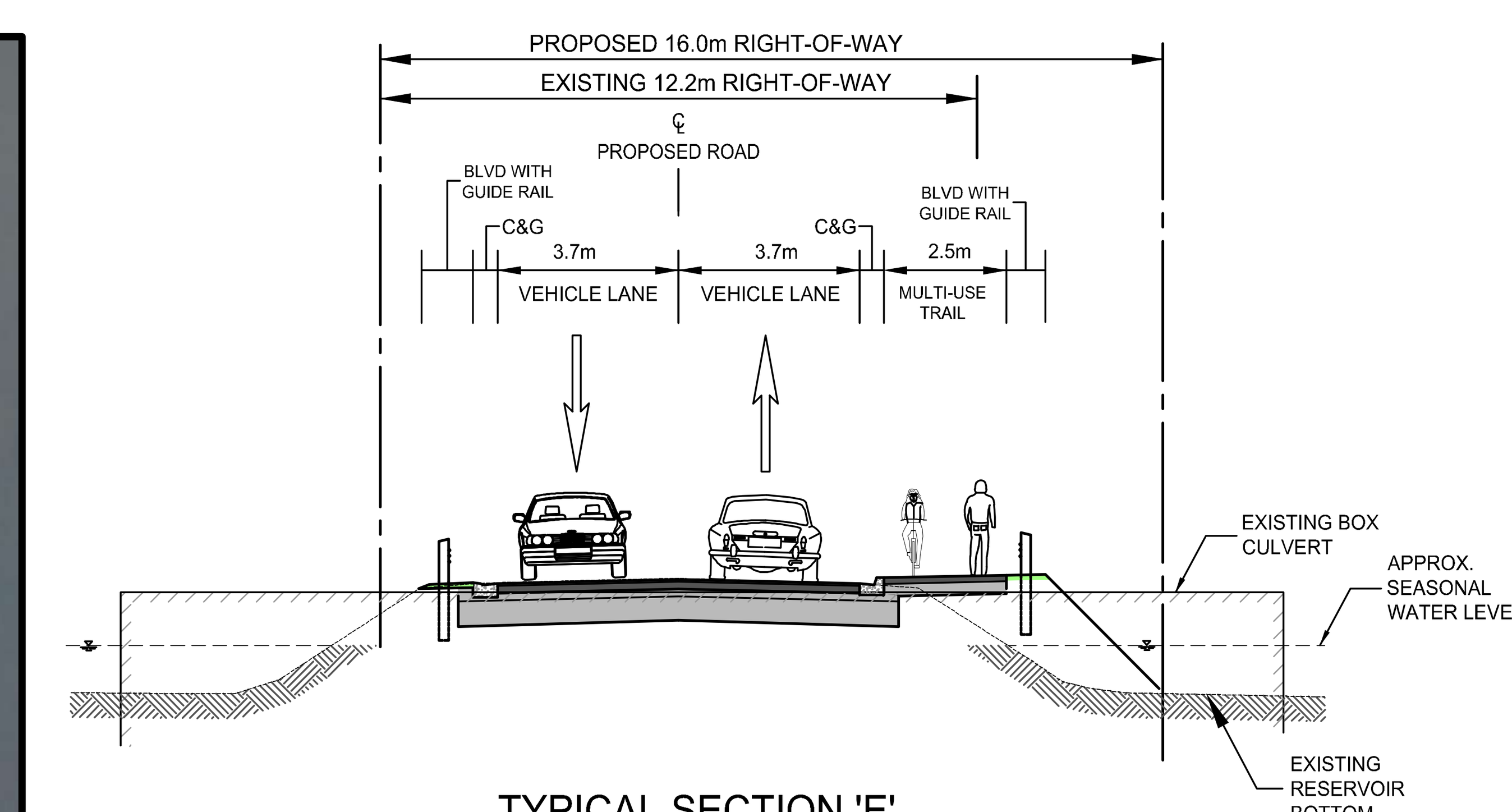
9.0m PAVEMENT WIDTH WITH BOULEVARD SIDEWALK AND MULTI-USE TRAIL



KEY MAP

NTS





TYPICAL SECTION 'E'

NARROW PAVEMENT WIDTH ON BEAVER CREEK ROAD TO MINIMIZE IMPACTS TO RESERVOIR & SENSITIVE LANDS (WITH MULTI-USE TRAIL ADJACENT TO ROAD)

NOTE:
SECTION 'E' IS TYPICAL OF EACH ALTERNATIVE DUE TO CONSTRAINTS WITHIN THE ENVIRONMENTALLY SENSITIVE LANDS

LEGEND

- EXISTING RIGHT-OF-WAY
- EXISTING LOT LINE
- PROPOSED RIGHT-OF-WAY
- ULTIMATE RIGHT-OF-WAY (WATERLOO OFFICIAL PLAN)
- PROPOSED CURB
- PROPOSED 1.5m SIDEWALK
- 3.0 MUT — PROPOSED MULTI-USE TRAIL (WIDTH AS INDICATED)
- PROPOSED ON-STREET BIKE LANE
- FUTURE CURB

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20m RIGHT-OF-WAY WITH 9.0m PAVEMENT WIDTH, BOULEVARD SIDEWALK AND MULTI-USE TRAIL (SECTION B) AND AS MODIFIED THROUGH LAUREL CREEK RESERVOIR (SECTION E)

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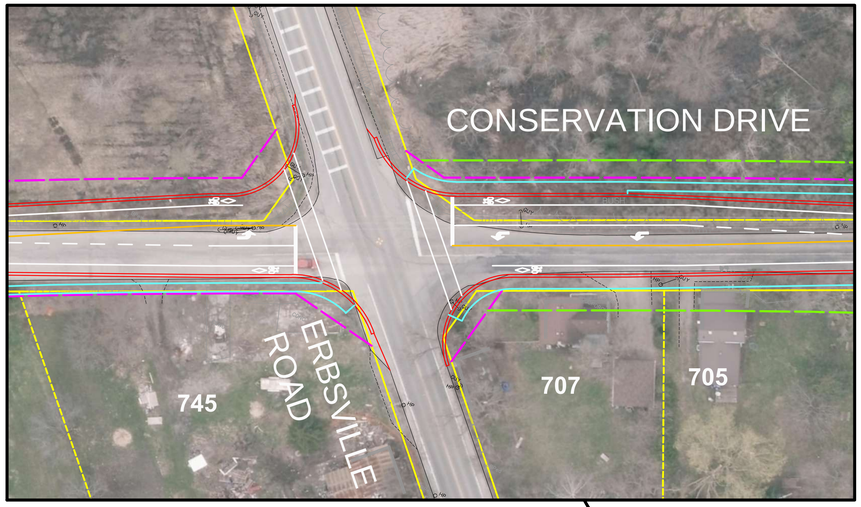
BEAVER CREEK RD. & CONSERVATION DR. UPGRADES AND EXTENSION OF MUNICIPAL SERVICES CLASS EA

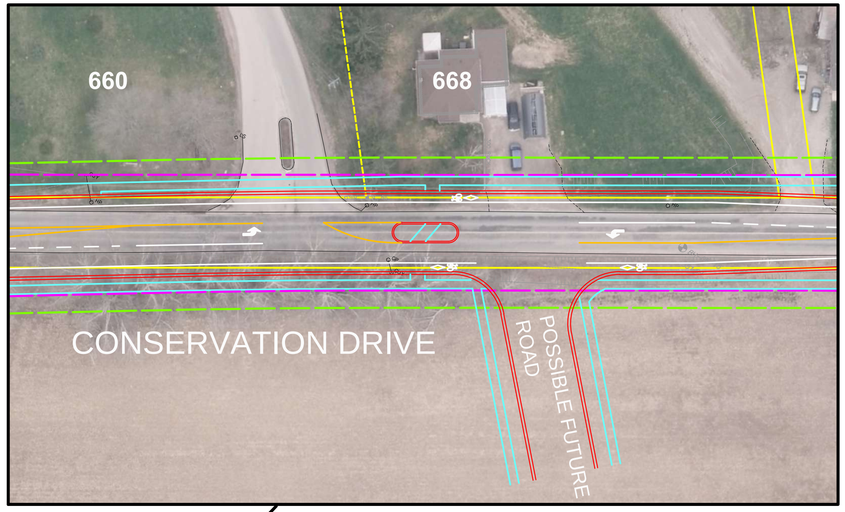
Figure No.

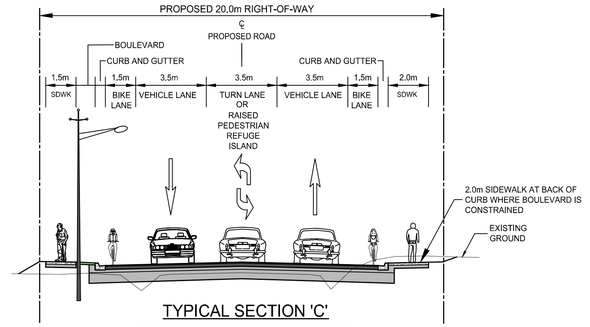
4-11

Title

TRANSPORTATION ALTERNATIVE 2







TYPICAL SECTION 'C'

WIDER PAVEMENT WIDTH AT INTERSECTIONS TO PROVIDE FOR LEFT TURN LANE OR RAISED PEDESTRIAN REFUGE ISLAND (TRAFFIC CALMING)

Scale

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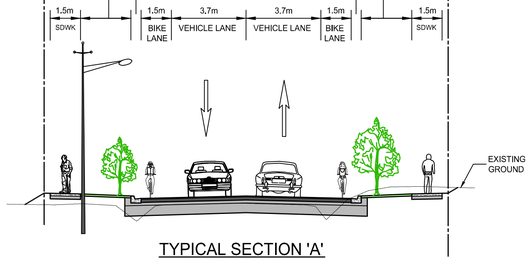
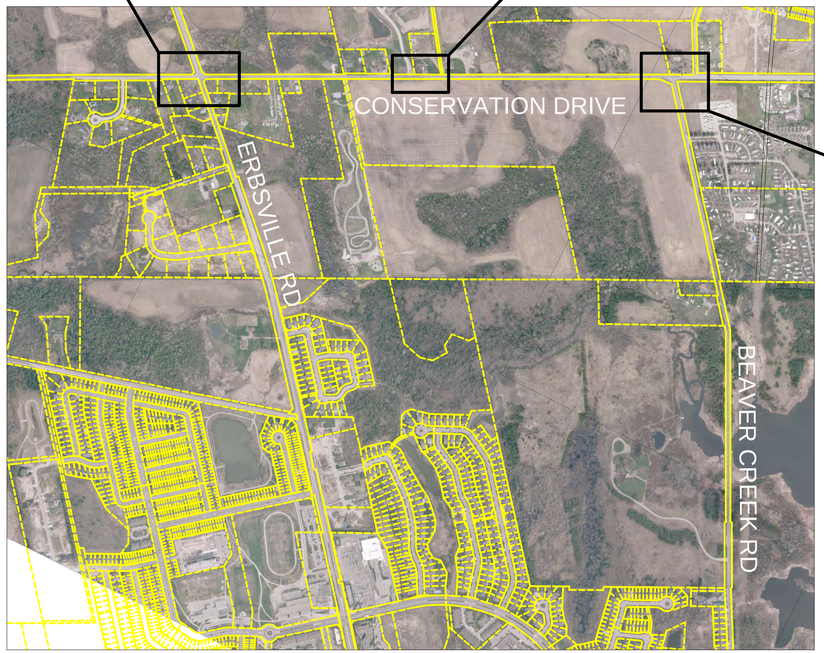


TYPICAL SECTION 'A'

STANDARD COLLECTOR ROAD (W-203) WITH BOULEVARD SIDEWALKS AND ON-STREET BICYCLE LANES



KEY MAP

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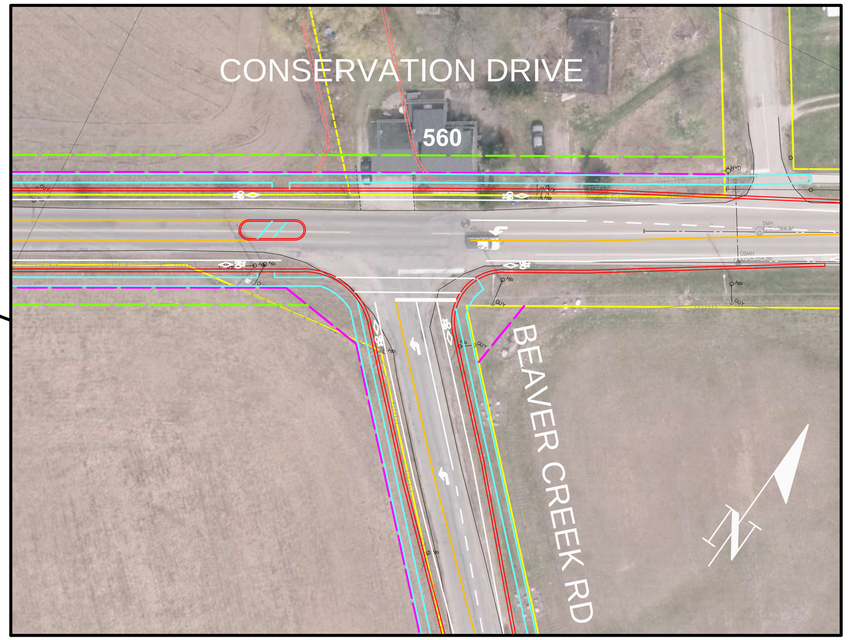

LEGEND

- EXISTING RIGHT-OF-WAY
- EXISTING LOT LINE
- PROPOSED RIGHT-OF-WAY
- ULTIMATE RIGHT-OF-WAY (WATERLOO OFFICIAL PLAN)
- PROPOSED CURB
- PROPOSED 1.5m SIDEWALK
- PROPOSED MULTI-USE TRAIL (WIDTH AS INDICATED) (3.0 MUT)
- PROPOSED ON-STREET BIKE LANE
- FUTURE CURB

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COLLECTOR ROAD (SECTION A) WITH EXISTING AND FUTURE INTERSECTION ENHANCEMENTS (SECTION C) ROAD ALIGNED TO AVOID EXISTING BUILDINGS

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BEAVER CREEK RD. & CONSERVATION DR. UPGRADES AND EXTENSION OF MUNICIPAL SERVICES CLASS EA

Figure No.

4-12

Title

TRANSPORTATION ALTERNATIVE 3

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2019/10/21 by: Madan, Al

4.4.5.5 Alternative 4: Enhanced Intersection Improvements including Roundabout at Conservation Drive and Beaver Creek Road

Implementation of a roundabout at Conservation Drive and Beaver Creek Road was identified in the BCM District Plan study. This intersection was identified as the future Beaver Creek Meadows community hub that will support a mix of commercial and high density residential development. Future signalization of this intersection was considered; however, the Project Team concluded that a roundabout would better serve the future traffic growth. The existing Roy Schmidt Road will be closed in conjunction with the development northeast of the intersection.

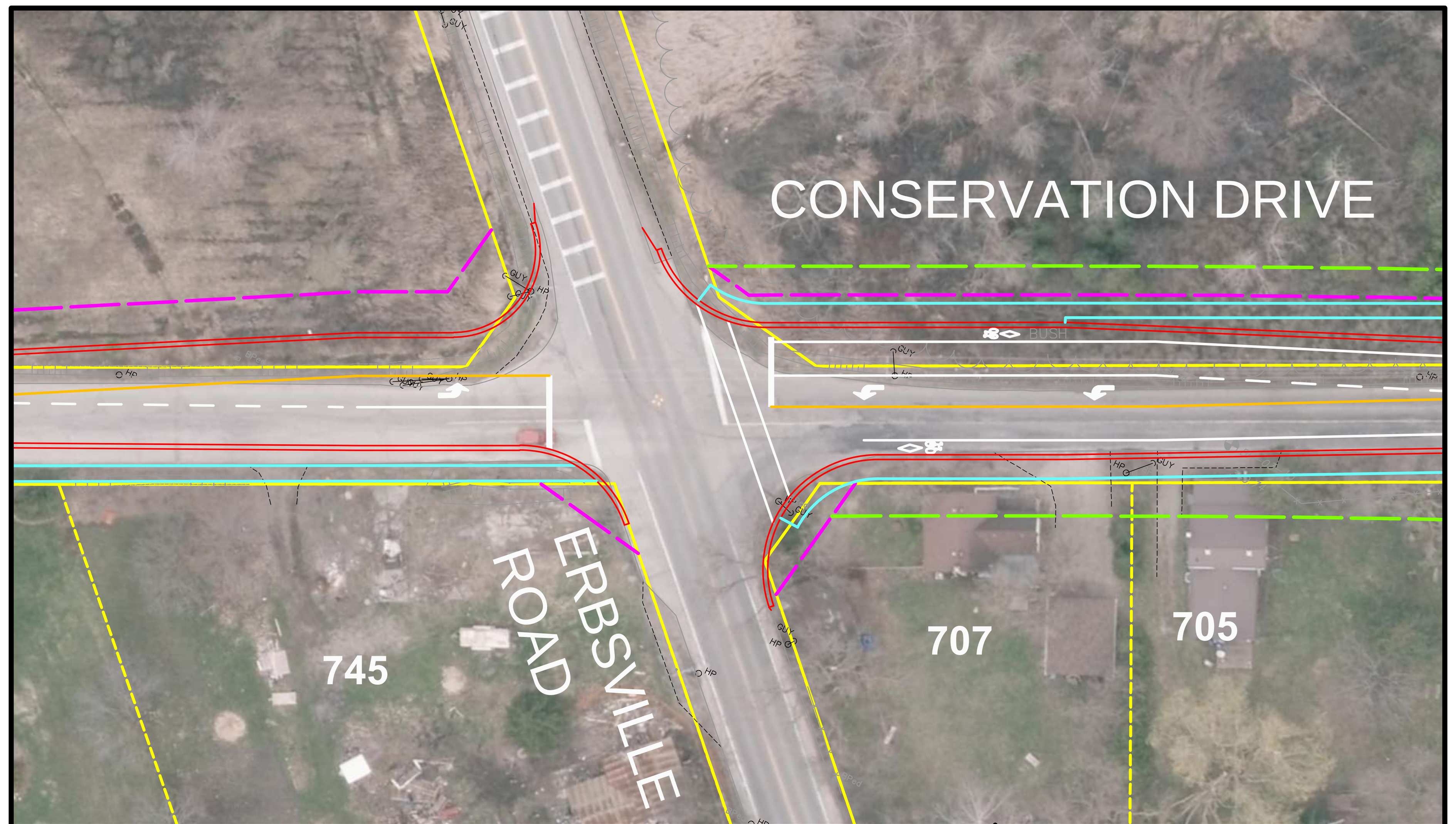
In considering the public's desire for both on and off-street bicycle access, Alternative 4 has also implemented dedicated on-street bicycle lanes and a multi-use trail along the south side of Conservation Drive and east side of Beaver Creek Road, similar to Alternative 2.

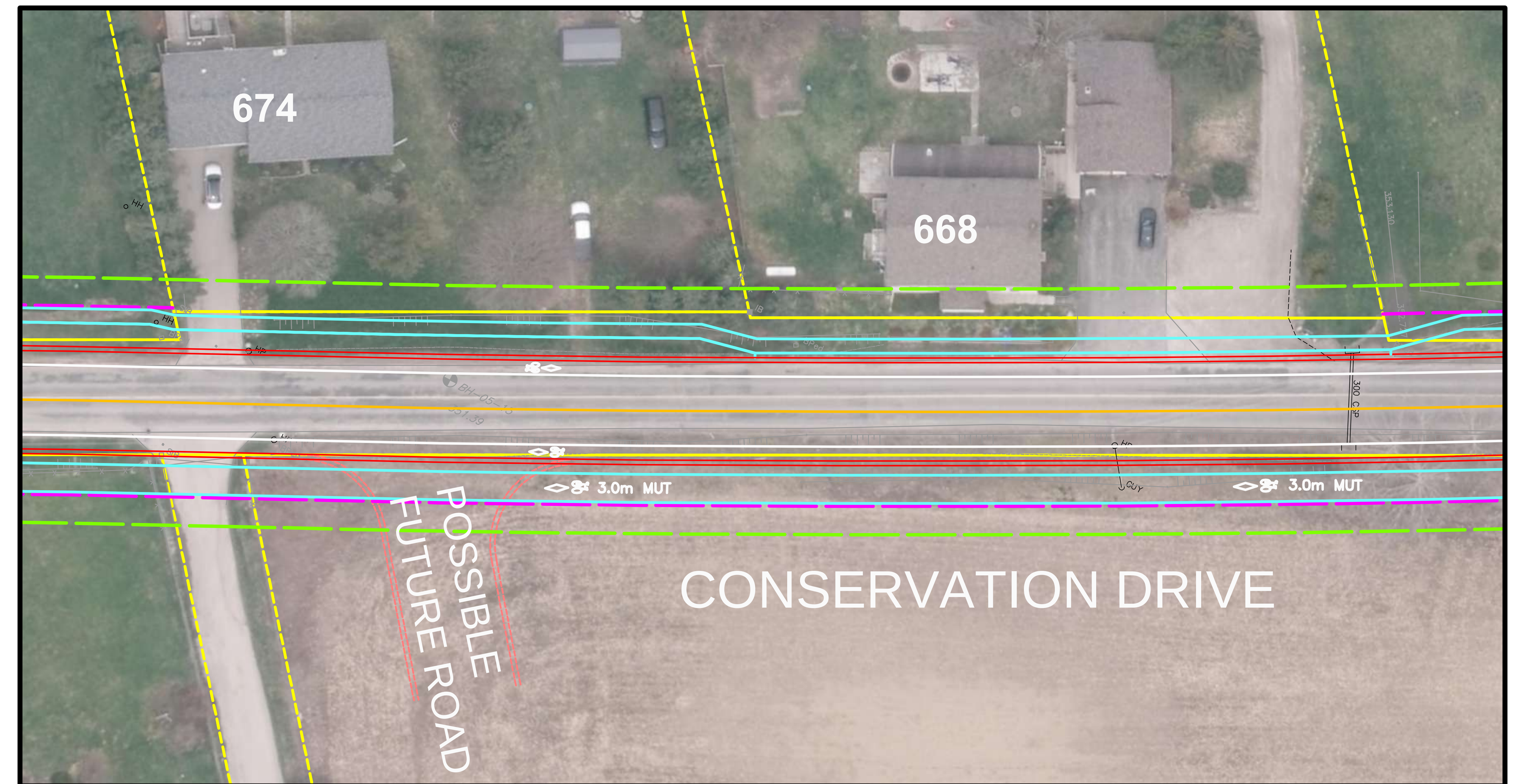
Implementation of access management will be critical to the BCM District Plan. Direct access to Conservation Drive and Beaver Creek Road should be controlled by consolidating access through side streets. Access management also improves pedestrian and cyclist safety by limiting the conflict points between motor vehicles, cyclists and pedestrians.

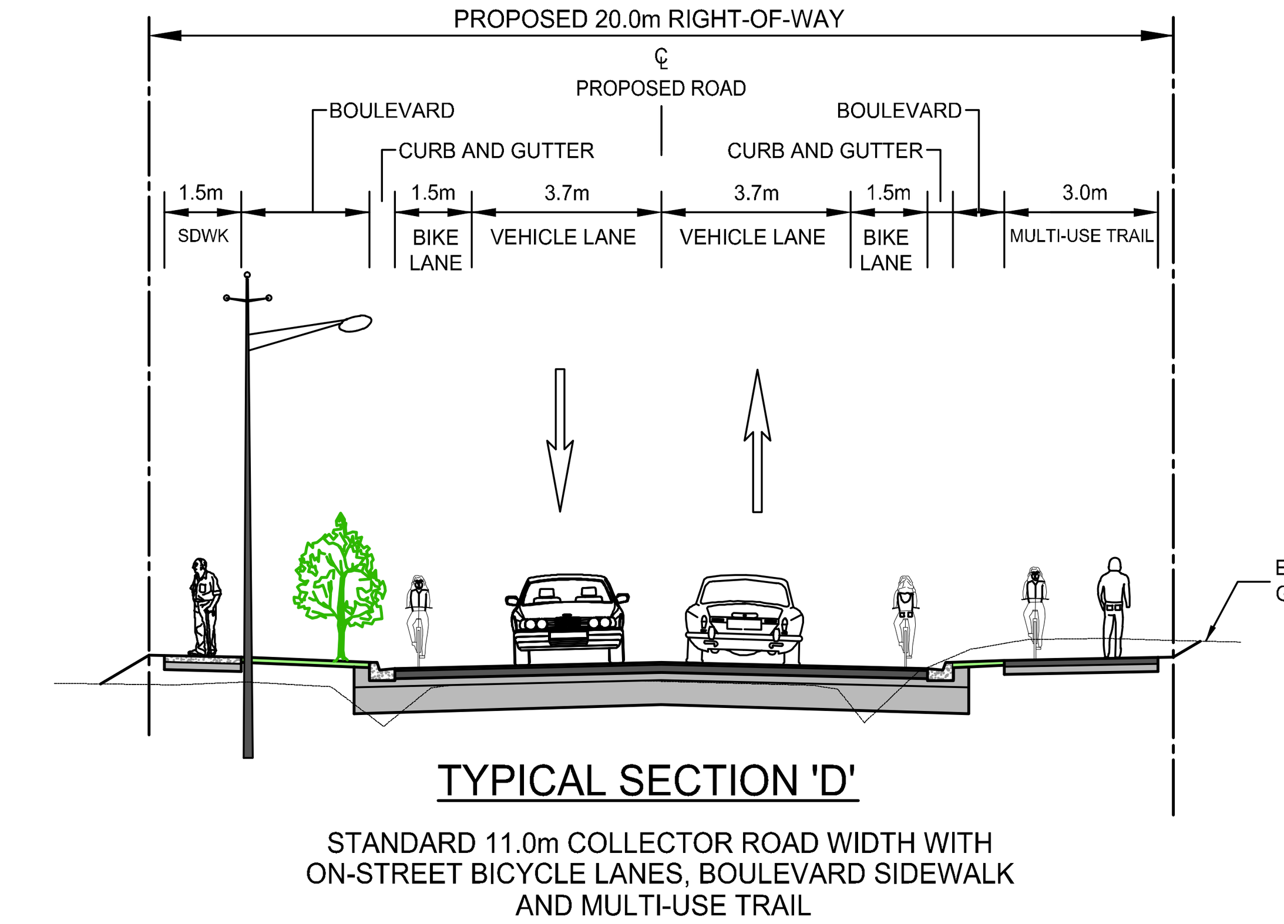
Conservation Drive was identified as a future transit corridor in the BCM study. The locations of future transit stops will be determined through coordination with Grand River Transit.

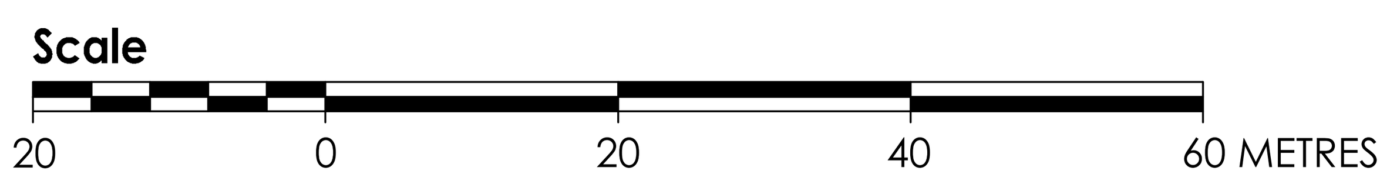
Proposed intersection enhancements have been incorporated including left turn lanes from Conservation Drive at Erbsville Road. Unlike Alternative 3, provision for future intersections will not be included in Alternative 4. Future intersection configurations will need to be confirmed with the individual developments, and any enhancements to Conservation Drive deemed to be necessary will be implemented at the developers cost. Improvements on Erbsville Road are excluded from this study as Erbsville Road falls under the Region of Waterloo's jurisdiction, and as such, intersection improvements beyond what is presented in this study will remain the responsibility of the Region. The Region has indicated that they have no immediate plans to upgrade Erbsville Road within the Study Area.

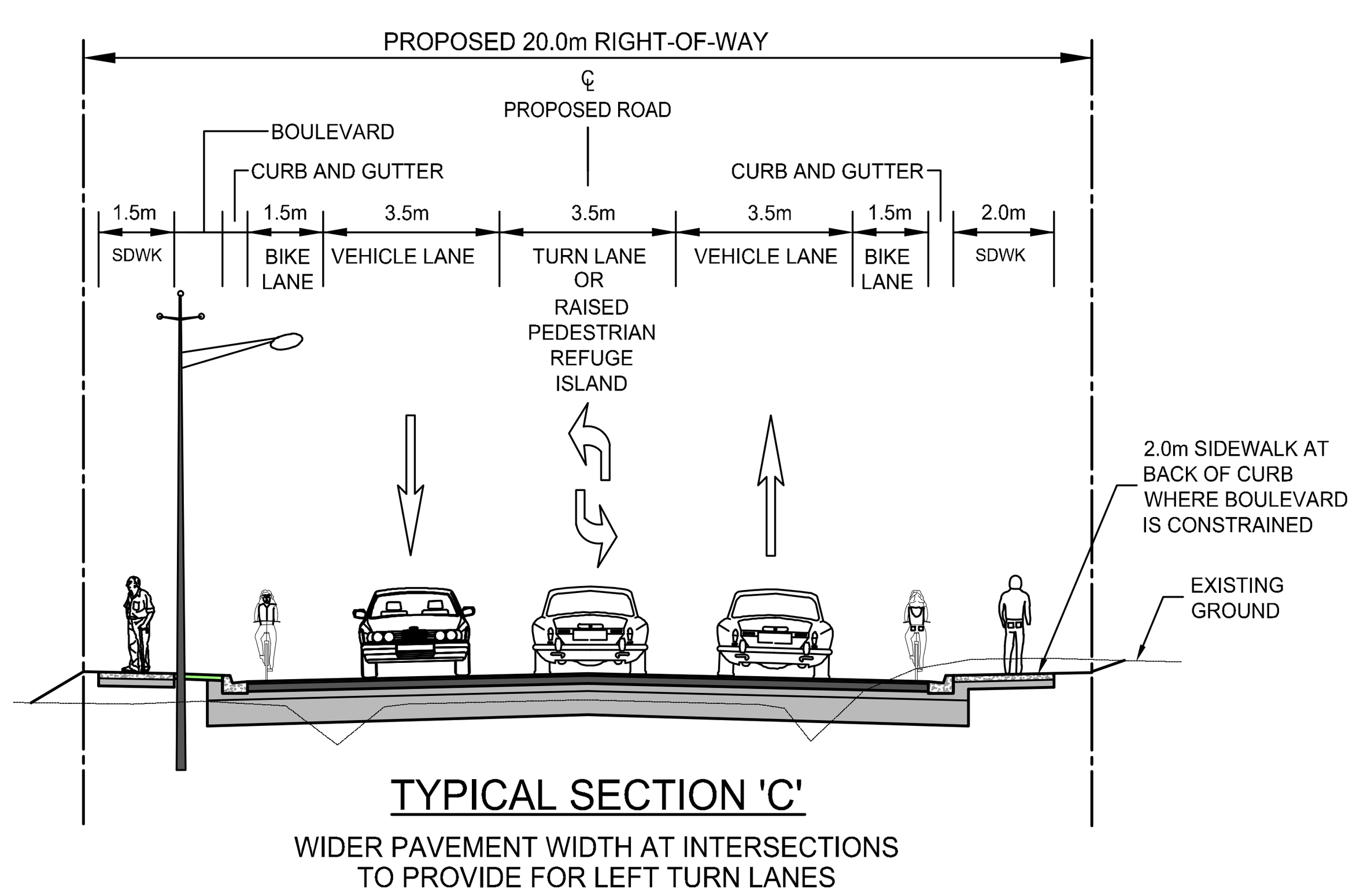
Refer to Figure 4-13 for an overview of the design components of Alternative 4, and refer to Appendix G.4 for detailed drawings.

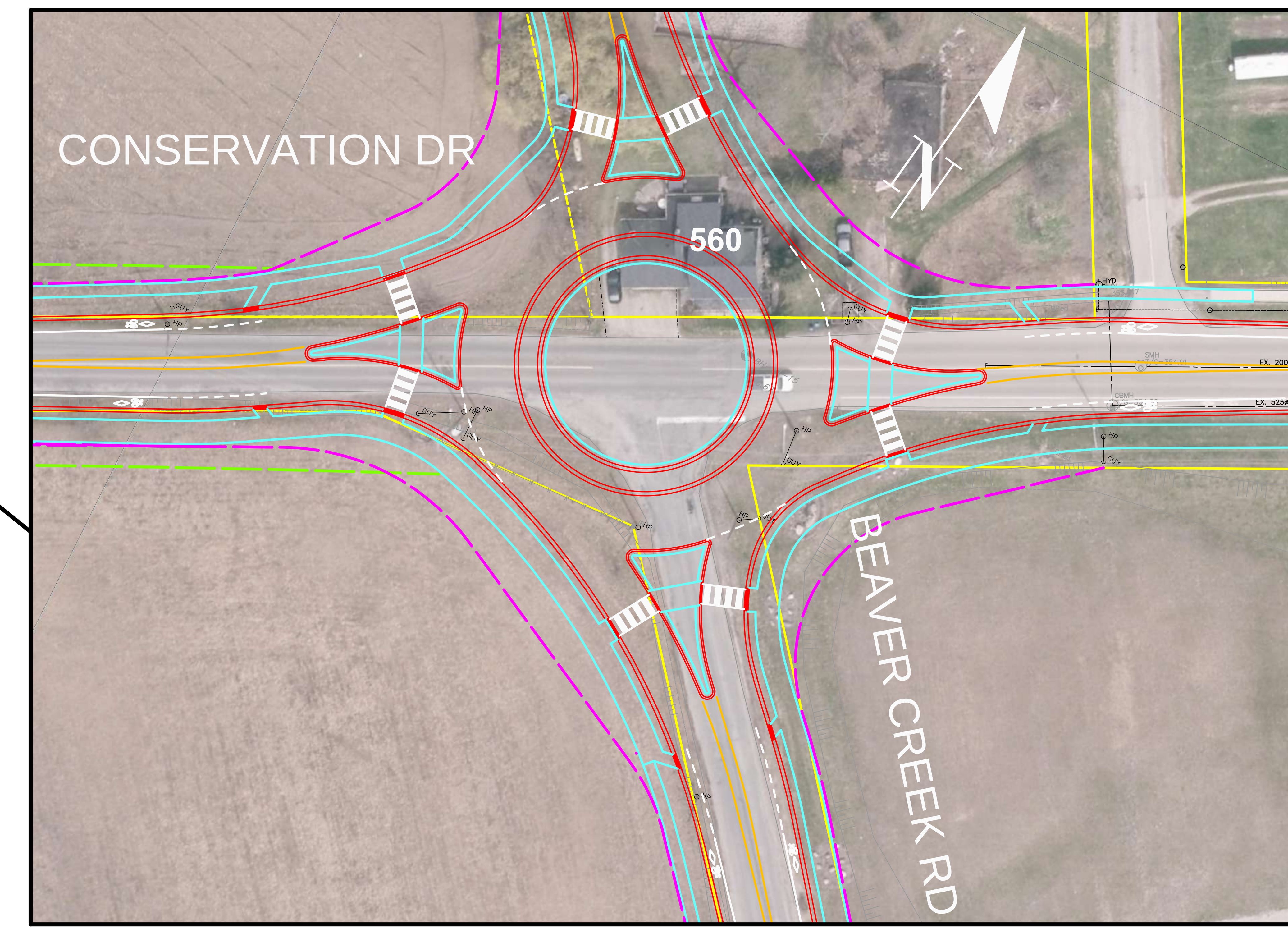






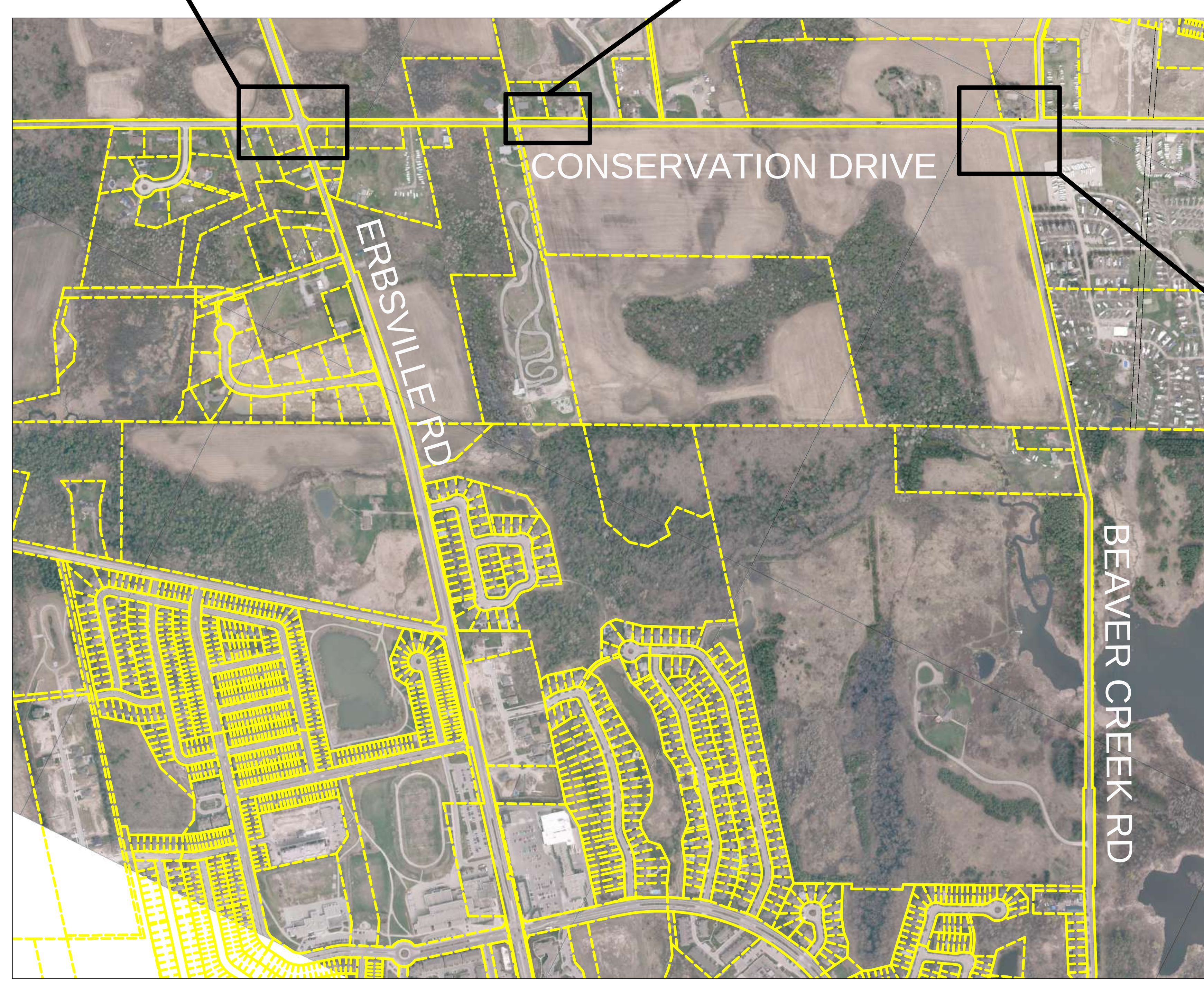






LEGEND

- EXISTING RIGHT-OF-WAY
- EXISTING LOT LINE
- PROPOSED RIGHT-OF-WAY
- ULTIMATE RIGHT-OF-WAY (WATERLOO OFFICIAL PLAN)
- PROPOSED CURB
- PROPOSED 1.5m SIDEWALK
- 3.0 MUT — PROPOSED MULTI-USE TRAIL (WIDTH AS INDICATED)
- PROPOSED ON-STREET BIKE LANE
- FUTURE CURB



KEY MAP

NTS

Stantec

20m RIGHT-OF-WAY WITH 11.0m PAVEMENT WIDTH, ON-STREET BICYCLE LANES, BOULEVARD SIDEWALK AND MULTI-USE TRAIL (SECTION C & D) ROUNDABOUT AT CONSERVATION DRIVE AND BEAVER CREEK ROAD

Client/Project

CITY OF WATERLOO

BEAVER CREEK RD. & CONSERVATION DR. UPGRADES AND EXTENSION OF MUNICIPAL SERVICES CLASS EA

Figure No.

4-13

Title

TRANSPORTATION ALTERNATIVE 4

4.4.6 Opinion of Probable Cost

To address the economic impact of the transportation alternatives, an opinion of probable cost was prepared and is provided in Table 4-13. The opinion of probable cost is intended to be Class C, accurate to -20% to + 35%. Additional details regarding the opinion of probable costs are provided in Appendix H.

Table 4-13: Transportation Opinion of Probable Cost Summary

Alternative	Item	Cost
Alternative 1:	Construction (incl. contingency)	$5,027,000
	Utility Impact Relocation	$550,000
	Property Acquisition	$2,073,000
	Engineering & Contract Administration	$503,000
	Total	$8,153,000
Alternative 2:	Construction (incl. contingency)	$4,766,000
	Utility Impact Relocation	$550,000
	Property Acquisition	$1,681,000
	Engineering & Contract Administration	$477,000
	Total	$7,474,000
Alternative 3:	Construction (incl. contingency)	$5,294,000
	Utility Impact Relocation	$550,000
	Property Acquisition	$1,695,00
	Engineering & Contract Administration	$530,000
	Total	$8,069,000
Alternative 4:	Construction (incl. contingency)	$5,272,000
	Utility Impact Relocation	$550,000
	Property Acquisition	$2,137,000
	Engineering & Contract Administration	$528,000
	Total	$8,487,000

Table 4-13 indicates the direct construction costs for all of the alternatives are within approximately 13% of each other ranging from $4.7 million to $5.3 million. The remainder of the estimated costs is related to the estimated property cost and utility relocation costs.

4.4.7 Evaluation of Servicing Alternatives

Alternatives 1 through 4 were evaluated based on the criteria described in Section 2.5. A rank of five (5) was considered most preferred and one (1) was the least preferred. A summary of the evaluation is provided in Table 4-14 and Appendix G.4 can be referenced for additional details.

Table 4-14: Evaluation of Transportation Alternatives

Criteria	Category Weighting	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Natural Environment					
Impact on Terrestrial System	3	3	3	3	3
Impact on Aquatic System	3	3	3	3	3
Impact to Wildlife	3	3	3	3	3
Regulatory Considerations	1	3	3	3	3
Social Environment					
Impact to Property	2	1	3	3	2
Visual Impact	2	3	3	3	3
Potential for Noise	2	3	3	3	3
Community Impact During Construction	2	2	2	2	2
Archaeological and Cultural Heritage Impact	2	1	4	2	2
Technical					
Capacity and Level of Service	3	1	1	4	5
Operations and Maintenance	1	3	3	3	3
Consistency with Planned Upgrades and Planning Policies	2	3	3	4	5
Constructability	1	3	3	3	3
Safety	3	3	3	3	5
Economy					
Capital Cost	6	2	4	3	2
Operating and Maintenance Cost	4	3	3	3	4
Overall Rating		**98**	**120**	**121**	**128**

Note: Overall rating based on sum of each criteria weighting multiplied by the rank score for that item.

Table 4-14 indicates the preferred alternative for transportation upgrades is Alternative 4.

5.0 PREFERRED SERVICING PLAN

5.1 WATER SERVICING

New watermains are recommended within the Study Area to service future growth and provide additional looping in the existing distribution system. All watermains are within the existing road right-of-way and are consistent with long-term planning for the distribution system. The recommended infrastructure is shown on Figure 5-1 includes the following:

- Installing a 300 mm watermain along Conservation Drive between Beaver Creek Road and Erbsville Road
- Installing a 300 mm connection along Conservation Drive between existing watermains near the intersection with Rideau River Street
- Installing a 300 mm watermain along Beaver Creek Road between Laurelwood Drive and Conservation Drive
- Installing a 300 mm connection along Erbsville Road from Regal Place to Conservation Drive

The proposed area will operate as part of Waterloo Zone 5 and service pressures are expected to range between 354 kPa and 569 kPa. Available fire flows are expected to be greater than 290 L/s along the recommended watermains providing looping to the area (as noted above) when assuming a minimum residual pressure of 140 kPa. Available fire flows within proposed development areas are likely to be lower than 290 L/s as a result of additional headlosses to convey water through local watermains.

Detailed staging is to be evaluated at time of development specific to proposed phasing to ensure adequate flows are available throughout each development stage. A preliminary review indicates that servicing is unlikely to be adequate for proposed employment lands until all recommended upgrades noted above are constructed, including the connection on Erbsville Road between Regal Place and Conservation Drive.

It can be noted that these upgrades were reviewed in conjunction with the Lakeshore PS remaining online as noted in Section 3.0. Additional analysis is recommended during detailed design to confirm the proposed infrastructure sizing for the above noted watermains based on the outcome of the Staging and Implementation Plan for Consolidating Pressure Zones in North-Central Waterloo (Stantec, ongoing). Adjustments to the pumping station (i.e., pumping controls or replacement of pump/impeller, etc.) or building design modifications to reduce the recommended fire flow for proposed development could also be considered should increasing the size of watermains result in negative water quality impacts and/or significant capital cost increase.

The opinion of probable cost associated with the preferred water servicing upgrades is $2,680,000, and the final cost will be further refined as part of the detailed design phase.

Stantec

Legend

- Proposed Watermain
- Existing Watermain

Notes

1. Coordinate System: NAD83 UTM zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.

July 2015
165640041

Client/Project

CITY OF WATERLOO
BEAVER CREEK ROAD & CONSERVATION DRIVE
UPGRADES AND EXTENSION OF MUNICIPAL SERVICES

Figure No.

5-1

Title

Preferred Water Servicing Upgrades

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Revised: 2015-07-30 By: kbuchanan

5.2 SANITARY SERVICING

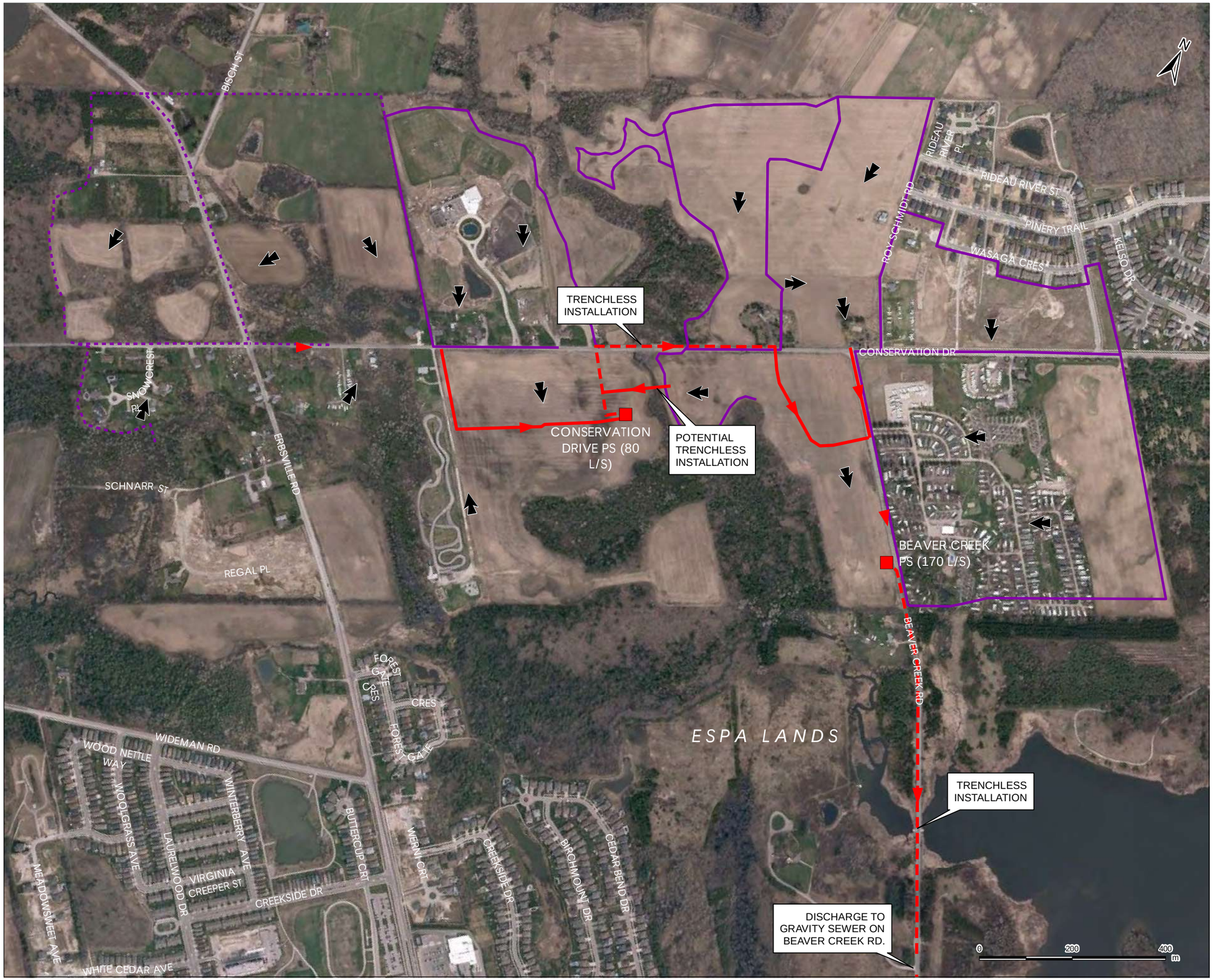
As outlined in Section 4.2.6, Sanitary Servicing Alternative 2 is the preferred concept. Alternative 2, as shown in Figure 5-2, includes servicing areas west of Erbsville Road with a gravity sewer starting at Snowcrest Place. The gravity sewer from Snowcrest Place would discharge into a gravity sewer west of Beaver Creek and south of Conservation Drive. Gravity sewers associated with development would discharge to a new sewage pumping station (100 L/s capacity) west of Beaver Creek and south of Conservation Drive. A forcemain would then carry flows along Conservation Drive (by trenchless methods) under the tributary on Conservation Drive and discharge into a gravity sewer west of Beaver Creek Road. From Beaver Creek Road and Conservation Drive, a gravity sewer would convey flows to a new pump station on Beaver Creek Road (180 L/s). From the Beaver Creek Road PS, a forcemain would be constructed to convey flows south on Beaver Creek Road to an existing gravity sewer.

Alternative 2 may require localized low lift pump stations from Area 15 and Area 8 (Figure 4-4), based on available contour information and dependent on ultimate grading plans associated with development. However under Alternative 2, Area 8 would be able to drain by gravity to the Conservation Drive PS with a trenchless crossing of Beaver Creek as a potential servicing option. Alternative 2 results in less impacts on existing residents, reduces installation costs and dewatering requirements due to shallower gravity sewer installations, and reduces the potential impact on environmentally sensitive areas. The opinion of probable cost for the preferred sanitary servicing design concept is $12,520,000, and the final cost will be further refined as part of the detailed design phase.

5.3 STORMWATER SERVICING

As outlined in Section 4.3.6, the stormwater servicing Alternative 3 is the preferred option. Alternative 3, as shown in Figure 5-3, includes directing flows from SWM facilities adjacent to Beaver Creek Road within the developing areas to a storm sewer under the road right-of-way. This sewer will outlet to a ditch along the east side of the road and convey flows to the Laurel Creek Reservoir. Specific details must be determined in conjunction with the final Beaver Creek Road design, however, they will generally include the following:

- Ditch length of approximately 300 m
- The grade on the ditch generally varies between 0.5 to 1.0%
- Ditch trapezoidal configuration with 4 m bottom width, 3:1 side slopes and a minimum depth of 1.0 m. The total width of the ditch varies depending on road grade and existing ground surface elevation, but could be up to 18 m
- Bottom 0.3 m of swale to be rip rap lined; remainder to be grassed
- Beaver Creek Road east boulevard to be reverse-graded to direct major system flows to the ditch
- Ditch to connect to the Laurel Creek Reservoir at normal summer operating level, with allowance for drainage during lower seasonal operating levels



Stantec

Legend

- Sanitary Drainage Area
- Sanitary Drainage Area to be Refined as Development Proceeds
- Proposed Sanitary Pumping Station
- Proposed Gravity Sewer
- Proposed Forcemain
- Property Acquisition Required

Notes

1. Coordinate System: NAD83 UTM zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.

December 2015
165640041

Client/Project

CITY OF WATERLOO
BEAVER CREEK ROAD & CONSERVATION DRIVE
UPGRADES AND EXTENSION OF MUNICIPAL SERVICES

Figure No.

5-2

Title

Preferred Sanitary Servicing Upgrades

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Revised: 2015-12-10 By: kbuchanan

Alternative 3 has a standard approval process, simplified construction methodologies, low capital costs, standard maintenance requirements, and minimal impact to existing aquatic habitat.

In addition, Alternative 3 provides an opportunity to allow separation between the pedestrian/ cycling trail and Beaver Creek Road. A minor revision to the road cross section would place the ditch immediately adjacent to the road, and the trail could be located east of the ditch if that is a more desirable configuration.

The opinion of probable cost for the preferred stormwater servicing design concept is $433,000. The final cost will be further refined as part of the detailed design phase. As part of the final design process, several design refinements are possible/expected based on more detailed information that will be available at that time. In order to guide future design work, the following principles should be followed:

- Undertake consultation with GRCA during the design process (i.e., prior to permit application submission) to address site-specific conditions and recognize any programming initiatives within the Conservation Area
- Locate the storm sewer outfall to the proposed ditch as far downstream (closer to Laurel Creek) as possible to minimize vegetation/habitat disruption
- Minimize the ditch footprint to the extent possible to limit the impact to natural areas (including assessing the potential to allow some flows to spill into the wetland/floodplain areas)
- Deploy erosion and sediment control practices to protect the adjacent natural areas
- Incorporate restoration opportunities into the design to offset any losses due to the ditch footprint
- Include naturalization opportunities of the ditch (native plantings, wetland seed mixes, etc.) in the design of the channel

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Revised: 2015-07-30 By: kbuchanan

July 2015
165640041

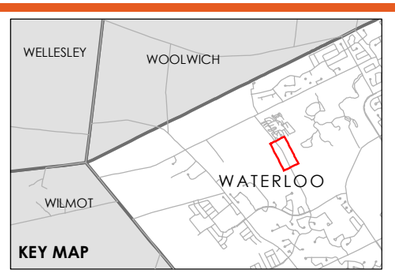
Stantec

Legend

- Proposed Storm Sewer
- Proposed Ditch

Notes

1. Coordinate System: NAD83 UTM zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2015.
3. 2014 orthoimagery © City of Waterloo.



Client/Project

CITY OF WATERLOO
BEAVER CREEK ROAD & CONSERVATION DRIVE
UPGRADES AND EXTENSION OF MUNICIPAL SERVICES

Figure No.

5-3

Title

Preferred Stormwater Servicing

5.4 TRANSPORTATION SERVICING

As outlined in Section 4.4.7, the preferred transportation solution is Alternative 4. Alternative 4 includes a 20 m ROW with 11 m pavement width, on-street bicycle lanes, boulevard sidewalk and multi-use trail. Figure 5-4 can be referred to for an overview of the preferred transportation alternative and Appendix J for the detailed Preferred Transportation Alternative Drawings.

The key components of the preferred roadway improvement design include:

- Minor realignment of Conservation Drive at specific locations to avoid direct impacts to residential structures. Improvements to Conservation Drive west of Erbsville Road will be limited to the section between Erbsville Road and Snowcrest Place. These improvements include upgrades to an urban cross-section including concrete sidewalk along the south side of Conservation Drive to accommodate pedestrian traffic from the 12 local residences.

- Improvements to the Conservation Drive at Erbsville Road intersection include a left turn lane at Erbsville Road to accommodate the anticipated increased demand from westbound left turning traffic. An eastbound left turn lane will be included to mirror the westbound geometric Improvements. Improvements to Erbsville Road are not included in this study.

- Improvements to Conservation Drive between Erbsville Road and Beaver Creek Road include a typical urban two-lane cross-section providing delineated on-street bicycle lanes, concrete sidewalk along the north boulevard and asphalt multi-use trail along the south boulevard. Subtle changes to the road alignment have been incorporated in order to avoid impacts to existing residential structures. The preferred design concept also includes changes to the vertical profile to allow for improvement of the sight distances, in particular the area of the Creekside Church access and immediately west of the Beaver Creek Road intersection.

- The preferred design concept for the Conservation Drive at Beaver Creek Road intersection includes a roundabout. The Beaver Creek Meadows District Plan Study identified this intersection as a future community hub with a mix of commercial and medium density residential. The roundabout option provides a significant opportunity to establish a safer intersection while providing for the anticipated future development and associated traffic growth. The proposed urban improvements on Conservation Drive east of the intersection will transition to suit the existing rural section in place.

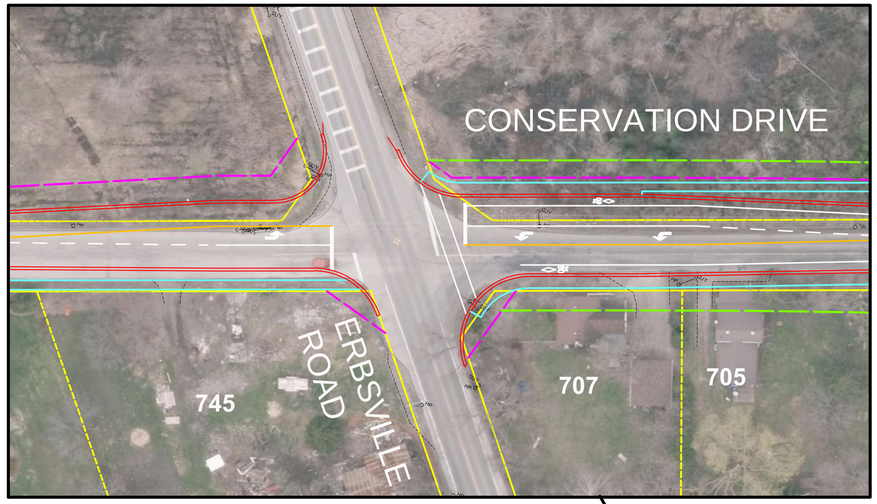
- Improvements to Beaver Creek Road under the preferred design concept will be similar to Conservation Drive. Full urbanization will continue up to the Laurel Creek conservation lands. The concrete sidewalk on the west side of Beaver Creek Road will terminate at the last residential parcel adjacent to the conservation lands where pedestrian traffic will continue along the multi-use trail

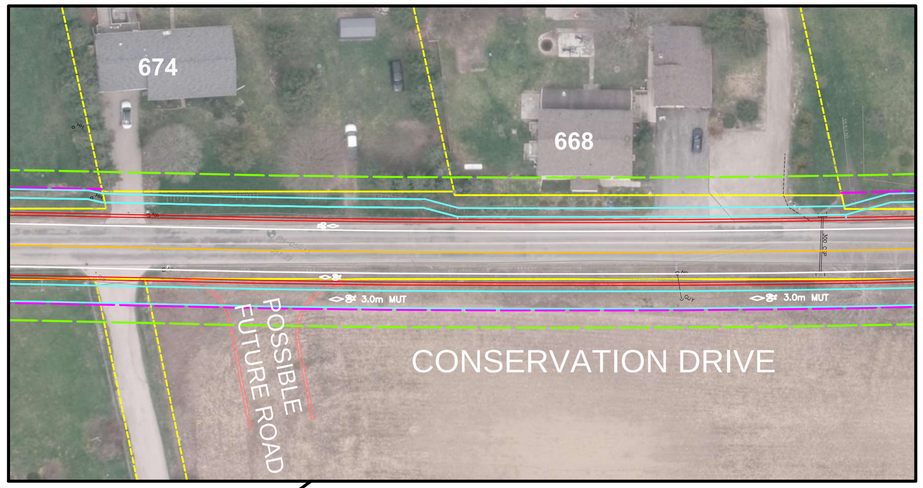
on the east side of Beaver Creek Road. The width of Beaver Creek Road through the environmentally sensitive conservation lands will be reduced by eliminating the delineated on-street bicycle lanes. The reduction in the road width will minimize impacts to the marsh and reservoir areas. Cyclists would be encouraged to use the multi-use trail through the reservoir low lands. Improvements south of the reservoir will reintroduce the delineated bicycle lanes and pedestrian sidewalk and will transition to suit the existing urban section in place.

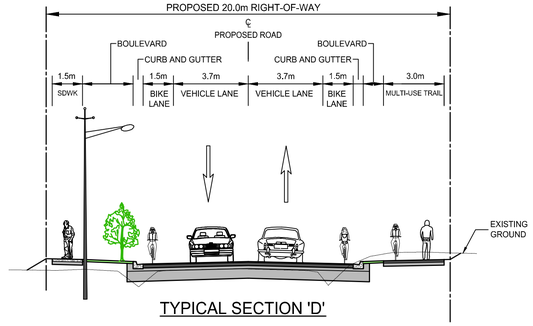
The following provides an overall summary of the outcomes of the preferred design concept:

- Provides much needed safety improvements within the study limits through increased clear zone distances to utility poles and improving vertical sight lines
- Reduces the potential number of injury collisions in the corridor as compared to the Do-Nothing Alternative
- Provides operational improvements at existing intersections for both current and future traffic demands
- Allows for the addition of future local side street intersections. The addition and final location of local side street intersections will be largely driven by future development. Single-lane roundabouts may be considered at these locations depending on the traffic needs
- Increases active transportation and in particular room within the roadway corridor for future transit needs
- Provides continuous on-street cycling lanes along both sides of Conservation Drive and a continuous link through a mix of on-street cycling lanes, sidewalk and/or multi-use trail on Beaver Creek Road; neither of these currently exists within the current Study Area
- It is recognized that while the preferred design concept would have the least number (23) of properties impacted, it would require the greatest area (1.88 hectares) of property to be acquired, mainly due to the roundabout which will directly impact an existing residential structures

The opinion of probable cost for the preferred transportation alternative is $8,487,000, and the final cost will be further refined as part of the detailed design phase.





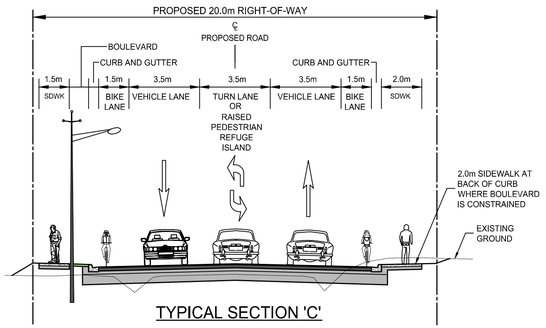


TYPICAL SECTION 'D'

STANDARD 11.0m COLLECTOR ROAD WIDTH WITH ON-STREET BICYCLE LANES, BOULEVARD SIDEWALK AND MULTI-USE TRAIL

Scale

20 0 20 40 60 METRES

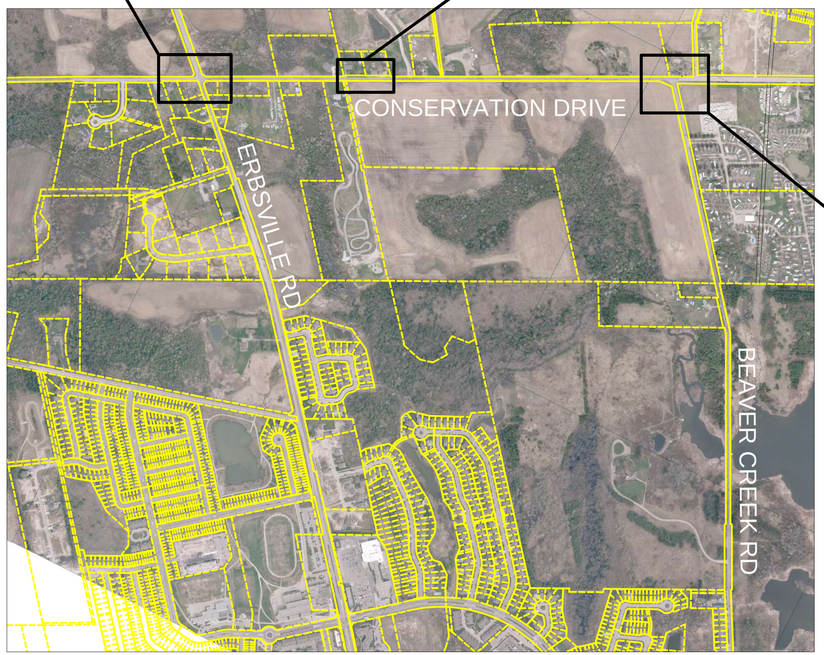


TYPICAL SECTION 'C'

WIDER PAVEMENT WIDTH AT INTERSECTIONS TO PROVIDE FOR LEFT TURN LANES

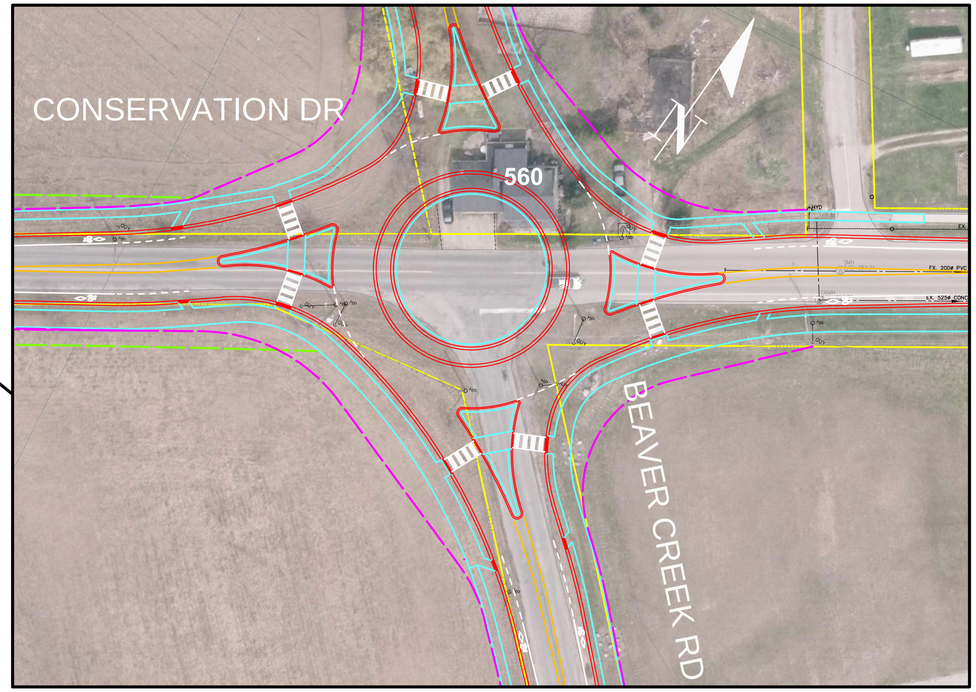
LEGEND

- EXISTING RIGHT-OF-WAY
- EXISTING LOT LINE
- PROPOSED RIGHT-OF-WAY
- ULTIMATE RIGHT-OF-WAY (WATERLOO OFFICIAL PLAN)
- PROPOSED CURB
- PROPOSED 1.5m SIDEWALK
- PROPOSED MULTI-USE TRAIL (WIDTH AS INDICATED) — 3.0 MUT
- PROPOSED ON-STREET BIKE LANE
- FUTURE CURB



KEY MAP

NTS



Stantec

20m RIGHT-OF-WAY WITH 11.0m PAVEMENT WIDTH, ON-STREET BICYCLE LANES, BOULEVARD SIDEWALK AND MULTI-USE TRAIL (SECTION C & D) ROUNDABOUT AT CONSERVATION DRIVE AND BEAVER CREEK ROAD

Client/Project

CITY OF WATERLOO

BEAVER CREEK RD. & CONSERVATION DR. UPGRADES AND EXTENSION OF MUNICIPAL SERVICES CLASS EA

Figure No.

5-4

Title

PREFERRED TRANSPORTATION SERVICING

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2019/10/17 by: bladek, A1

5.4.1 Major Features of Preferred Design Alternative

This section provides a detailed explanation of the preferred transportation design alternative for the proposed Conservation Drive and Beaver Creek Road improvements.

The information provided in this section should also be reviewed in conjunction with the other sections of this ESR. Changes may occur during the detailed design phase to reflect new information brought forward or discovered at that time, however, the changes should not significantly alter the intent of the recommended undertaking or its various components.

5.4.1.1 Design Criteria

The existing posted speed limit for Conservation Drive and Beaver Creek Road is 50 km/hr and 60 km/hr respectively within the Study Area. Given the rolling topography along Conservation Drive combined with the uncertainty of the location of future local intersections, it is recommended that a design speed of 60km/hr be implemented to better ensure stopping sight distances along Conservation Drive can be provided when developing the future intersection locations. The geometric design standards for the proposed roadway improvements follow the recommendations of the Transportation Association of Canada (TAC) guidelines and City of Waterloo guidelines for a 60 km/hr design speed. Other design criteria elements are summarized in Section 4.4.2 of the ESR.

5.4.1.2 Typical Cross-Sections

Typical cross-sections for the Preferred Design Alternative are provided in Appendix J along with the roadway layout plans and profiles. In general, the roadway cross-sections comply with the recommendations found in the City of Waterloo's Design Guidelines. Some of the key cross-section features of the proposed improvements are as follows:

- 3.7 m travel lanes will be used for the entire length of the study area, with narrower 3.5 m lane widths at intersection where turn lanes are included
- 3.0 m multi-use trail wherever possible, with reductions to 2.5 m in select locations to accommodate specific constraints and obstructions
- 1.5 m wide concrete sidewalks elsewhere where applicable
- Raised curb and gutter throughout the project limits at both sides of the roadway
- Installation of new guiderail protection on approaches to all culvert and bridge crossings, as well as retaining walls where required to accommodate grade differentials between the proposed roadway and adjacent properties
- An Official Plan ROW width of 26 m for Conservation Drive east of Erbsville Road as shown on the preferred alternative design drawings. The corridor for Conservation Drive is proposed to be 20 m to accommodate the proposed road

reconstruction while the ultimate lands required to make up the 26 m ROW are expected to be dedicated as development progresses. The ultimate 20 m Official Plan ROW for Beaver Creek Road is to be acquired through purchase or dedication prior to commencing road reconstruction.

5.4.1.3 Alignment and Grade

The horizontal centerline alignment of the Conservation Drive corridor generally follows the existing centreline alignment with slight modifications crossing Erbsville Road and mid-block between Erbsville Road and Beaver Creek Road to avoid impacting existing residential structures. The alignment modifications were accomplished by introducing long back-to-back curves with a radius of 2,000 m that would not impact the design speed or normal cross-fall of the roadway.

The horizontal centerline alignment of the Beaver Creek Road corridor follows the existing centreline alignment from Beaver Creek Road to the southerly limit of the study area.

The vertical centerline alignment of the roadways through the project limits will generally be maintained with improvements and/or modifications, where possible, to improve sight distances, in particular on Conservation Drive at the Creekside Church access and east of Beaver Creek Road. The design profile will consider potential negative impacts to adjacent properties and/or driveway accesses and minimize cut/fill quantities. A preliminary design profile is provided along with the roadway layouts and typical cross section in Appendix J.

A typical roadway cross-fall with normal 2.0% crown will be maintained over the length of the roadway within the Study Area with exception of the slight curve on Beaver Creek Road where a reverse crown will be implemented to meet TAC standards. Where possible the standard grade and cross-fall requirements recommended in the design criteria will be adhered to in the detailed design.

Particular care and attention will be required during the detailed design phase to provide reasonable grading transitions at existing driveways. The preliminary profile design has been developed to address these concerns.

5.4.1.4 Intersections

Conservation Drive at Wilmot Line: There are currently no proposed changes for the intersection at Conservation Drive and Wilmot Line. The roadway infrastructure on Conservation Drive at Wilmot Line is in good condition and current and future traffic volumes do not warrant any upgrades within the City's ROW. Wilmot Township currently does not have any plans to upgrade or pave Wilmot Line at Conservation Drive. Wilmot Line is to be investigated through other studies such as the West Waterloo Integrated Multi-Modal Transportation Study (City of Waterloo) and in consultation with the Region of Waterloo and Wilmot Township.

Conservation Drive and Snowcrest Place: There are no proposed functional changes for the intersection at Conservation Drive and Snowcrest Place. The east leg of the

intersection from Snowcrest Place to Erbsville Road will be reconstructed and will include curb and gutter on both sides of Conservation Drive with a standard 1.5 m wide concrete sidewalk on the south side to service pedestrians from Snowcrest Place.

Conservation Drive and Erbsville Road: The intersection at Conservation Drive and Erbsville Road will be partially reconstructed to accommodate the changes in intersection operation on Conservation Drive. The proposed shift in the Conservation Drive alignment will result in an encroachment on lands on the north of the existing Conservation Drive ROW. Sidewalk is not being included on the north side of Conservation Drive immediately east and west of Erbsville Road since there will be limited pedestrian demand along the north side on Conservation Drive in this area. Sidewalks and/or multi-use trails have been included along the south side of Conservation Drive. The proposed intersection lane configuration is as follows:

- West Leg – Conservation Drive:
    - One 3.5 m wide eastbound through lane
    - One 3.5 m wide eastbound left turn lane
    - One 3.5 m wide westbound through lane
    - 1.5 m wide sidewalk on the south side (Snowcrest Place to Erbsville Road)
- East Leg – Conservation Drive:
    - One 3.5 m wide westbound through lane
    - One 3.5 m wide eastbound through lane
    - One 3.5 m wide westbound left turn lane
    - 2.0 m wide sidewalk on the south side (transitions to 3.0 m MUT travelling east)

There are no proposed changes to the north and south legs of Erbsville Road. Potential improvements will be confirmed at the detailed design stage and in concert with other studies and in consultation with the Region of Waterloo, including the possibility of a future roundabout to enhance traffic calming and safety.

Conservation Drive and Beaver Creek Road: The intersection at Conservation Drive and Beaver Creek Road is proposed to be a single lane roundabout intersection. The existing west, south and east legs will be reconstructed with minor alignment changes to suit the typical geometric roundabout requirements. A proposed north leg of the intersection will be constructed for access to future development. The existing Roy Schmidt Road ROW immediately east of Beaver Creek Road will be permanently closed with the construction of the roundabout and will connect to future internal streets as proposed in the BCM District Plan. Consideration for a future widening to 2 lanes within the roundabout has been included in the proposed ROW acquisition.

A 1.5 m wide sidewalk is proposed on the north side of Conservation Drive and west side of Beaver Creek Road and a 3.0 m wide multi-use trail is proposed for the south side of

Conservation Drive and east side of Beaver Creek Road approaching the intersection with designated pedestrian crossings at all four legs of the intersection.

5.4.1.5 Entrances and Access

The existing entrances along Conservation Drive and Beaver Creek Road within the project limits will generally be maintained, with some modifications to accommodate the proposed roadway improvements and improvements to the entrances themselves.

Entrances will be reviewed in greater detail and specific design needs confirmed during the detailed design phase of the project, along with driveway treatments, earth retaining structures and grading/grade matching.

5.4.1.6 Cyclist and Pedestrian Facilities

Previous sections of this ESR have outlined in detail the City of Waterloo's commitment to providing enhanced cyclist and pedestrian facilities within the study area in accordance with the City and Region of Waterloo's Official Plan and related studies.

In addition to the provision of a multi-use trail and sidewalk, the proposed improvements should include designs for an inviting streetscape, which is a key element in creating a walkable community that is comfortable, safe and inviting for pedestrian use and which encourages people to walk wherever and whenever possible.

The detailed design of the corridor should consider and assess the potential for zones of high pedestrian activity as well as commercial areas and zones with intermodal connections, for example bus stop locations, and the development of streetscape plans that include design features such as street trees, enhanced pathways and/or sidewalk designs, entry features and connections to adjacent trail systems and other soft landscaping features.

In addition to this, one of the most critical considerations is the provision of accessible facilities within and adjacent to the corridor that promote personal safety and encourage use by all potential users including the less ambulatory and the visually impaired.

The detailed design of the roadway and related facilities within the corridor shall also incorporate the use of tactile surfaces, ladder markings, grading and suitable slopes consistent with emerging trends associated with the application of the Accessibility of Ontarians with Disabilities Act (AODA) and related provisions to satisfy those needs.

5.4.1.7 Structures

Further to the assessments of the existing structures outlined in Section 4.4.1.3, the following recommendations will be considered in conjunction with the proposed road improvements.

Laurel Creek Reservoir (ID # RS-65): The Laurel Creek Reservoir Structure is a reinforced concrete culvert located under Beaver Creek Road and conveys flows from

Beaver Creek into the Laurel Creek Reservoir. The existing structure extends beyond the existing embankments on Beaver Creek Road into the reservoir. Modifications to the structure will not be required to accommodate the widening of Beaver Creek Road. The North Waterloo Scoped Watershed Study (NWSSS) identified this crossing as an area for enhancing the movement of wildlife. The existing structure remains submerged through the period when the reservoir is in use; therefore modifications to the structure to enhance wildlife movement would not be feasible. Instead, a dry wildlife culvert crossing with wildlife funnel walls is being proposed north of the existing culvert location providing terrestrial wildlife a linkage under Beaver Creek Road. Given the anticipated timing of the Beaver Creek Road improvements, the recommended works identified in the current condition report, and as recommended in the NWSSS, could be included in the City's road reconstruction contract.

Equalization Culvert (ID # RS-67): This round corrugated steel plate culvert is located on Conservation Drive, approximately 100 m east of Erbsville Road and conveys flows from the low area north of Conservation Drive south to a seasonal watercourse which outlets to Laurel Creek approximately 300 m south of Conservation Drive. The preferred design alternative will require extending the existing culvert to accommodate the road widening. Given the anticipated timing of the Conservation Drive improvements, replacement of the existing culvert is recommended with the work being incorporated into the City's road reconstruction contract. Included in the culvert replacement design will be consideration for enhancements to wildlife accessibility. The main function of the culvert is to convey water under Conservation Drive during wetter seasonal conditions. The area north of the culvert crossing is generally in a natural state with no defined water course, while the area on the south side of Conservation Drive is a landscaped side yard to a residential structure. The detailed design could consider the installation of partially buried elliptic culvert lined with natural substrate; however, the net capacity of the culvert must not be increased given the potential for downstream flooding with the use a larger culvert. The existing culvert has minimal cover which will also limit the replacement culvert size.

Beaver Creek Culvert (ID # RS-68): The corrugated steel pipe arch culvert structure is located under Conservation Drive approximately 150 m west of Beaver Creek Road. The culvert structure conveys Beaver Creek flows from north of Conservation Drive southward to Laurel Creek. The preferred design alternative will require the construction of a larger structure to accommodate regional flood levels. Incorporating a larger structure will provide for the ability to include a terrestrial wildlife crossing, including wildlife funnel walls, as identified in the NWSSS. Given the anticipated timing of the Conservation Drive improvements, the recommended works outlined in the current condition report and the NWSSS would be moved forward and incorporated into the City's road reconstruction contract.

5.4.1.8 Geotechnical Report

A geotechnical investigation and report was completed and is included in Appendix I of this ESR. A pavement condition evaluation was completed with existing conditions evaluated based on visual surface observations and exploratory boreholes drilled to various depths

within the study limits. The current City of Waterloo standard pavement design for a major collector road classification was determined to be suitable based on current soil conditions.

Recommendations for excavation for site servicing and structural foundations were provided with the understanding that more specific testing may be required during the detailed design stage.

A contamination overview study was not undertaken since the study area is largely rural and agricultural with no history of industrial activity. Additional testing is recommended should any areas of concern arise during the detailed design stage.

5.4.1.9 Utilities

The following provides a brief description of the existing utilities and anticipated impacts as the project moves forward:

Hydro

A majority of the existing Waterloo North Hydro (WNH) poles will need to be relocated to accommodate the proposed layout for the preferred design alternative along Conservation Drive and Beaver Creek Road. WNH will also be required to upgrade their service on Beaver Creek Road from single-phase to three-phase to accommodate anticipated development needs.

Hydro guying easements may be required in isolated areas. As such, there may be additional property impacts as a result of pole relocation requirements that have not been identified as part of the scope of this study and will be confirmed through coordination with WNH during the detailed design stage.

Once the geometrics for the proposed preferred alternative are finalized, WNH should be instructed to develop a preliminary layout of the new relocated and/or adjusted pole line with guying requirements detailed fully, thereby allowing any and all property requirements to accommodate the hydro relocations to be incorporated into the overall property acquisition process for this project.

WNH work should also be completed prior to the start of construction where possible and coordinated with the other utility service providers to avoid any potential “constructor” issues under the Occupational Health and Safety Act and Regulations for Construction Projects, or scheduling delays.

Natural Gas

There is no existing Union Gas plant within the project limits. Union Gas has advised that gas servicing will be provided in conjunction with future development following the reconstruction of Conservation Drive and Beaver Creek Road.

Telephone, Cable TV and Fibre-Optic Cables

Bell Canada has confirmed the presence of existing infrastructure along Conservation Drive and Beaver Creek Road which was determined to be predominantly direct buried residential distribution cables.

As part of the consultation with WNH, Bell and Rogers (if applicable) must be contacted to confirm decisions on where their infrastructure should be relocated and any needs or opportunity for system expansion.

Telecommunications relocation work should also be completed prior to the start of construction where possible and coordinated with the other utility service providers.

Illumination

Street lighting currently does not exist on Conservation Drive and Beaver Creek Road. The City has requested that street lighting be included in the hydro design through the sections of roadway being reconstructed. Adequate street lighting is essential for safe operations of the intersections, as well as the adjoining roadway sections to ensure that proper sight distances are provided to vehicles, cyclists and pedestrians.

It is anticipated that the illumination of a two-lane roadway section can be implemented on one side of the roadway. As such, the location of new lighting may be coordinated with the relocation of the WNH poles, subject to determination of layout and completion of a street lighting analysis.

5.4.1.10 Property Requirements

The proposed improvements within the Study Area will generally be completed prior to development; therefore, property acquisition is expected to focus on the lands required to compete the desired roadway and municipal servicing infrastructure identified in the preferred alternative, with the ultimate Official Plan ROW expected to be acquired through future development dedications. A review of the general property requirements to accommodate the proposed works, excluding any specific requirements for alternative location of existing utilities and hydro/ telecommunications lines was undertaken. The extent of preliminary property requirements is illustrated on the figures included in Appendix J.

The approximate grading limits are illustrated on the accompanying plans and will be subject to refinement during the detailed design phase of the project. Additional property requirements may result from utility relocation planning and design requirements, the most

likely of which would be limited to hydro guying easements associated with the relocation of WNH plant.

The breakdown of approximate property requirements is as follows:

- Private Residential Property – 1.27 Hectares
- Agricultural – 0.22 Hectares
- Commercial – 0.03 Hectares
- Institutional Property – 0.02 Hectares
- Conservation Lands – 0.34 Hectares
- Temporary Grading Easements – Hectares (TBD)
- Utility Easements – Unknown (TBD)

The cost of the required lands was estimated to be $ 2,137,000. It should be noted that some property may be acquired through dedication by development which could reduce the overall property acquisition cost.

5.5 CONSTRUCTION TIMING AND STAGING

The City's current capital program has scheduled the commencement of construction in 2016. The Project may be phased with initial work being completed on Beaver Creek Road from the southerly project limit to Conservation Drive and west along Conservation Drive to the Beaver Creek crossing with an anticipated completion for late 2017. The balance of the work along Conservation Drive west of the Beaver Creek Crossing would be completed in 2018.

Given this timeline, the project design will commence immediately following the completion of the ESR and culminate in the completion of property impact plans and reference plans for negotiation of property impacts with the respective property owners to permit utility relocation work, followed by municipal servicing and road reconstruction.

5.5.1 Construction Staging and Temporary Traffic Conditions

A construction staging plan must be prepared during the detailed design phase of the project and the management of traffic and provision of temporary traffic provisions must be assessed in conjunction with the development of the construction details and the planned approach to the work including permitting requirements and timing restrictions.

All plans for construction staging must consider the potential impacts on vehicular/cyclist traffic and pedestrians at all times during the construction contract. Detouring of traffic and closure of lanes and road segments must also be identified and communicated effectively with the public to ensure an efficient completion of the construction work and at a reasonable cost without significant impacts to area properties.

5.6 PRELIMINARY OPINION OF PROBABLE COST

The preliminary estimated cost for the Beaver Creek Road and Conservation Drive Upgrades and Extension of Municipal Services is presented in Table 5-1. The opinion of probable cost is intended to be Class C, accurate to -20% to + 35%.

Table 5-1: Preferred Alternatives Preliminary Opinion of Probable Cost Summary

Preferred Alternative	Item	Cost
Water Servicing	Construction (incl. contingency)	$2,435,000
	Engineering & Contract Administration	$244,000
	Sub-Total	$2,680,000
Sanitary Servicing	Construction (incl. contingency)	$11,381,000
	Engineering & Contract Administration	$1,139,000
	Sub-Total	$12,520,000
Stormwater Management	Construction (incl. contingency)	$393,000
	Engineering & Contract Administration	$40,000
	Sub-Total	$433,000
Transportation	Construction (incl. contingency)	$5,272,000
	Utility Impact Relocation	$550,000
	Property Acquisition	$2,137,000
	Engineering & Contract Administration	$528,000
	Sub-Total	$8,487,000
Total Costs (Excluding HST)		$24,120,000

6.0 MITIGATION MEASURES

An overview of mitigation measures for implementing the preferred alternatives to minimize impacts to natural and cultural heritage features is provided in the following sections. This information is to be used in preparing the final detailed design plans, construction timing, agency approvals and on-going monitoring to ensure that the features identified within this report are protected, maintained, restored and enhanced (where applicable) through the implementation of the preferred alternative. It can be noted that during detailed design, the appropriate environmental oversight agencies, cultural and heritage oversight agencies, utilities, and stakeholders will be coordinated with to confirm potential impacts and recommended mitigation measures, as well as obtain the necessary approvals and permits.

6.1 ENVIRONMENTAL MEASURES

The following summarizes the recommended mitigation and enhancement measures, and suggested application, to minimize and mitigate the potentially adverse environmental impacts associated with the planning, design and construction of the proposed preferred alternatives.

6.1.1 General Mitigation Measures

6.1.1.1 Vegetation Removal

Where vegetation removal is proposed, the following mitigation measures will be applied:

- As appropriate, and prior to construction, the limits of vegetation clearing will be staked in the field. The Construction Contractor will ensure that no construction disturbance occurs beyond the staked limits and that edges of sensitive areas adjacent to the work areas are not disturbed. Regular monitoring of the limits of clearing will be implemented to ensure the objective of minimal disturbance. Should monitoring reveal that clearing occurred beyond defined limits, mitigation action will be taken that could include rehabilitation of the disturbed area to pre-disturbance conditions at the direction of a qualified ecologist (with enhancement of any disturbed areas).

- To the extent practical, tree and/or brush clearing and grassland removal will be completed prior to, or after, the core nesting season for migratory birds (April 1 to August 31). Should clearing be required during the breeding bird season, prior to construction, surveys will be undertaken by a qualified biologist to identify the presence/absence of nesting birds or breeding habitat. If a nest is located, a designated buffer will be marked off within which no construction activity will be allowed while the nest is active. The radius of the buffer will range from 5 to 60 m, depending on the species. Buffer widths are based on the species' sensitivity and on buffer width recommendations that have been reviewed and approved by Environment Canada.

- Prior to the start of construction activity, the topsoil/seedbank will be stripped and preserved; material will be reapplied in suitable rehabilitation areas post construction.

- All disturbed areas of the construction site will be re-vegetated to pre-disturbance conditions as soon as conditions allow.

- All seeding and/or replanting of disturbed areas will use species native to Waterloo Region (or returned to agricultural operations) following construction.

- An invasive species removal plan should be developed as part of the final design outlining recommendations for the removal of invasive species, particularly the removal of Phragmites found along the ROW on Conservation Drive.

6.1.1.2 Sediment and Erosion Control Measures

In order to minimize erosion and the introduction of sediment into significant natural features during grading and construction activities, erosion and sediment (E&S) control measures will be implemented prior to the initiation of any construction.

Erosion susceptibility in this area is relatively low. Due to the flat topography of the area, there are no steep or elongated slopes that would accelerate runoff during a storm event. As such, the risk of erosion and resulting sedimentation within downstream natural features is limited, although not absent. As such, standard erosion and sediment controls will be installed during construction to minimize potential impacts.

The proximity of adjacent significant natural features increases the risk of sedimentation within a construction area. As such, all significant natural features identified within 30 m of any proposed construction area are at higher risk of sediment transfer and erosion from grading and topsoil removal.

E&S control measures will be installed to minimize erosion impacts adjacent to significant natural features, as appropriate. The following measures/guidelines will be implemented, as required, during the construction of the alternatives:

- Sediment control measures, which may include perimeter silt fencing, mud mats (access roads), check dams (rock or straw bales), and sediment bags (dewatering).

- Silt barriers (e.g. fencing) will be erected along wetland and woodland community edges located within 30 m of construction areas to minimize potential sediment transport to the significant natural features. These barriers will be regularly monitored and properly maintained during and following construction until soils in the construction area are re-stabilized with vegetation.

- Specific E&S control measures will be selected, located and sized by an engineer during the detailed design stage to ensure proper functioning of these measures. All E&S controls will be installed prior to construction and will be inspected daily or immediately following a rain event during construction and weekly following construction until the site is stabilized to ensure their effectiveness at protecting the adjacent significant natural features.

6.1.1.3 Dewatering

Site specific geotechnical investigations to be completed prior to construction activities will provide further details related to geologic conditions. Dewatering requirements will be re-assessed as part of the geotechnical investigations.

If groundwater is encountered during excavations, good construction practices will be used, such as minimizing the length of time that the excavation is open and monitoring seepage into the excavation. Should pumping be required to dewater excavated areas, water will be directed into the nearest drain or spread across the buildable area greater than 30m from any natural feature and appropriate energy dissipation techniques will be used to reduce the potential for erosion and scouring. Discharge piping will be free of leaks and will be properly anchored to prevent bouncing and snaking during surging. The rate of discharge will be monitored to ensure no erosion or flooding occurs. If energy dissipation measures are found to be inadequate, the rate of dewatering will be reduced or ceased until satisfactory mitigation measures are in place. Any dewatering in excess of 50,000 L/day will be subject to a Permit to Take Water (PTTW).

In order to mitigate any impacts to significant natural features during dewatering activities, the following measures will be implemented, as required and necessary:

- The area to be used for dewatering will be clearly marked with flagging and/or snow-fencing prior to work commencing.

- During site preparation, silt fencing will be included to retain sediments on site so they do not enter any significant natural feature. All dewatering sediment control structures will be inspected immediately prior to and following the commencement of pumping activities with on-going inspection to be undertaken by the contractor while pumping occurs. Any repairs or maintenance will be completed as necessary to ensure the continuous functions of these protection measures.

- All water pumped during dewatering activities will be directed greater than 30m from significant natural features and not directly into wetlands.

- The use of sediments bags (or filter rings) will be used as appropriate to filter out suspended sediment prior to discharge. Any sediment bags or filter rings will be monitored during pumping to ensure their efficacy, with any clogging or failures to be rectified immediately.

- After the staging area and dewatering work area is no longer required, any remaining disturbed soils will be returned to pre-disturbance conditions and/or reseeded.

Further dewatering recommendations will be reviewed upon the completion of the detailed engineering design.

6.1.2 Potential Impacts to Wetlands

For all significant wetlands the following mitigation measures are recommended:

- The boundaries of all wetlands within 30 m of the proposed construction area will be flagged/staked in the field by a qualified ecologist prior to construction to assist with the demarcation of the construction area, to ensure construction activities avoid these sensitive areas as feasible, and to assist with the proper field installation of E&S controls.

- Silt barriers (e.g. fencing) will be erected along the edge of all wetland boundaries where they are located within 30 m of construction areas (including staging and laydown areas). These barriers will be monitored daily during construction and after periods of high precipitation and bi-weekly following construction and properly maintained during and following construction until soils in the construction area are re-stabilized with vegetation.

- In the event of accidental damage to trees, or unexpected vegetation removal, these disturbed areas will be restored to pre-existing conditions through the seeding or planting of species native to the area. Any trees damaged during construction would be inspected by a qualified arborist and appropriate measures implemented at their direction.

- Inspectors will ensure construction vehicles and personnel stay within the construction envelope, thereby limiting the disturbance of natural vegetation.

- All fuel storage or refueling activities will occur greater than 30 m from all wetlands. In the event of an accidental spill, the MOECC Spills Action Centre should be contacted and emergency spill procedures implemented immediately.

6.1.3 Potential Impacts to Woodlands

The following mitigation measures are recommended:

- Clearly delineate work area using erosion fencing to avoid accidental damage to trees.

- The erosion fencing should be placed as far away as possible from the significant woodland and be placed no closer to the significant woodland than the drip-line.

- Erosion and sediment control structures should be monitored regularly to ensure that they are fully functional especially before and after major rainfall events. Should erosion and sediment control measures not be functional, they should be immediately repaired.

- Instruct workers on the importance of avoiding entrance to the demarcated area.

- Inspectors will ensure construction vehicles and personnel stay within the construction envelope, thereby limiting the disturbance of natural vegetation.

- All maintenance activities, vehicle refueling or washing, as well as the storage of chemical and construction equipment will be located more than 30 m from significant woodlands. In the event of an accidental spill, the MOECC Spills Action Centre should be contacted and emergency spill procedures implemented immediately.

- Tree pruning will be minimized to the greatest extent possible and any tree limbs or roots that are accidentally damaged by construction activities will be pruned using proper arboricultural techniques.

- Accidental damage to trees, or unexpected vegetation removal, may require re-planting of similar, native species. If re-planting is required, the City of Waterloo will be consulted on the appropriate action(s) to be taken.

- To the extent practical, pruning will be avoided during leaf fall, typically between September to November.

- Construction activities within 30 m of significant woodlands should occur during daylight hours to avoid excessive noise and/or light disturbances to wildlife.

- As appropriate and prior to construction the limits of tree pruning will be marked in the field. The Construction Contractor would ensure that no construction disturbance occurs beyond the marked limits;

- To the extent practical, tree pruning will be completed prior to or after the breeding season for migratory birds (April 1 to August 31). Should pruning be required during the breeding bird season, prior to construction, surveys will be undertaken to identify the presence/absence of nesting birds by a qualified biologist. If a nest is located, a designated buffer will be marked off within which no construction activity will be allowed while the nest is active. The radius of the buffer width ranges from 5 to 60 m depending on the species. Buffer widths are based on the species sensitivity and on buffer width recommendations that have been reviewed and approved by Environment Canada;

- One (1) year post-pruning a certified arborist must undertake an evaluation of the health of the pruned trees.

6.1.4 Mitigation of Impacts to Potential Significant Wildlife Habitat

6.1.4.1 Turtle Nesting and Overwintering Habitat

The mitigation strategy will include:

- Avoid construction during sensitive periods when turtles are emerging from their overwintering habitat to nest (April/May) or re-entering hibernacula in the fall (late September to early October)

Any fuel storage and activities with the potential for contamination will occur in properly protected and sealed areas.

- Construction workers will be made aware of the potential occurrence of turtles in construction zones and on access roads, and will avoid interaction with any observed individuals to the extent possible

- Should turtles be found within the construction area, the use of standard care protocols for the removal of species will be used with instructions for the contractor to contact the appropriate ecological staff if a rare species specimen has been identified within the construction area

- Should a turtle nest be encountered during construction, a buffer will be established and the nest will be protected from construction activities (such as with a wire cage) and monitored until the nest is no longer active

- Post-construction monitoring for disturbance will be conducted for 1 year within significant turtle nesting features within 30 m of proposed construction activities.

- Report the findings of all monitoring programs to MNR upon completion of the post-construction monitoring work

- If a permanent disturbance has been noted within this wildlife habitat, the MNR will be contacted to determine whether additional mitigation measures will be needed

6.1.4.2 Blandings Turtle Mitigation

Although evidence of nesting was not found for Blanding's Turtle, it has been noted that this species does use habitat near the Study Area. As a result, the following additional mitigation measures should be put in place to protect this species. These mitigation measures should be carried out for wetland features in the Study Area.

There is potential for Blanding's Turtles to enter the project location while moving through upland areas (agricultural fields) between wetlands or to access nesting habitat, which may increase the risk of disturbance, accidental injury or mortality during construction. In particular, construction and equipment operation within 30 m of core wetlands (Category 2 habitat) could have the potential to impact the species. As such, mitigation measures are recommended below to avoid any potential harm to the species resulting from construction.

Sensory disturbance to Blanding's Turtles may occur during all phases of the project as a result of increased on-site human activities (e.g. site preparation, maintenance activities). However, sensory disturbances would be most intense during the construction period, with access requirements significantly reduced during operation. Timing restrictions on heavy construction during the nesting season are recommended to reduce sensory disturbance to nesting females, as described below:

- Prior to construction the entire work area will be walked and staked, and construction limits within potential Blanding's Turtle habitat will be isolated with exclusion fencing (e.g. silt fencing). This will ensure that no turtles enter the construction area during construction activities as a means of avoiding disturbance and potential mortality.

- Fencing is to be installed upon commencement of construction (prior to construction activities) and will be monitored and maintained in-place until the end of construction activities at any given site (i.e. not to be removed prior to November 1). Where construction activities are planned over several seasons, all exclusion fencing will be inspected and maintained prior to April 1st of the following year to ensure proper functioning.

- Fencing installed prior to April 1 may be completed without a biological inspector; fence installation conducted after April 1 will be monitored by a biological inspector to ensure no Blanding's Turtles have entered the work area or are disturbed by fence installation.

- Temporary silt fencing should be used to delineate the work zone near the identified habitat and exclude turtles. This fencing should be tied in and buried 10 to 20 cm to prevent turtles from moving around or under the fencing into the work zone, and will be installed according the MNR's guidance document 'Reptile and Amphibian Exclusion Fencing' (July 2013). The recommended height of fencing is 50 to 60 cm and adjusted in consideration of topography. To deter digging it is recommended that the fence be buried 10 cm below grade with an additional 10 cm horizontal lip ('keyed in') on the species side.

- The construction contractor must ensure that no construction disturbance occurs beyond the staked/fenced limits.

- A daily survey of the isolated work area (i.e. prior to construction each day) will occur to ensure no turtles have entered the area.

- No in-water work (culvert replacement or new culvert installation) will occur during the over-wintering period of Blanding's Turtle (November 1 to April 1).

- A pre-construction survey will be conducted at each replacement or new culvert location in order to characterize the channel morphology, hydrological condition and vegetation composition within and along the channel.

- The person(s) carrying out the construction will be provided with a description to enable identification of the animal.

- If an individual is observed during the course of construction, person(s) must cease carrying out the construction and allow the animal a reasonable amount of time to leave the area before continuing.

- If a reasonable amount of time has been provided to allow the animal to move on, the person(s) must take careful measures (e.g. carry gently by hand) to relocate the animal to a nearby location that is suitable and safe for the animal.

- If a nest or nesting animal is encountered during construction, the person(s) must cease carrying out the construction and the MNR will be contacted immediately for further direction. A 5 m buffer should be applied to the nest site, or 30 m to a nesting female, and maintained until the MNR provides additional direction. Turtle nests should not be touched as it can damage eggs.

- If an injured or dead animal is encountered, the animal will be protected from any further harm and the MNR will be contacted immediately for further direction;

- If possible, construction should occur in the appropriate timing window. For turtles the most sensitive time is when they are moving to and from nesting areas, which is generally April 30 to June 30. Observing this timing window is less critical than fencing off the construction area and excluding the animal.

6.1.5 Aquatic Habitat, Fisheries and Water Quality

The mitigation strategy will include:

- Minimize the footprint of any required culvert extensions associated with road widening during the design process to minimize the length of watercourse (fish habitat) affected by culvert/bridge extensions.

- Ensure sufficient fish passage is provided during and post construction through all culvert replacements or extensions where direct fish habitat exists.

- The use of open bottom culverts should be considered where feasible to mitigate impacts to aquatic habitats.

- Countersink and backfill any new or extended culverts with natural substrate (bed material), ensuring that a low flow channel is maintained through natural substrate material to allow for fish passage.

- Restore vegetation and aquatic habitat (substrate) to pre-construction conditions, ensuring that any habitat features (pools, riffles, structure) are restored or enhanced.

- Opportunities to enhance riparian vegetation through the planting of other hanging grasses, shrubs and trees will improve stream cover, reduce temperature impacts, and provide allochthonous inputs (food source for various fish species.

- Minimum two (2) years of post-construction monitoring to ensure the success of rehabilitation efforts.

- Ensure appropriate erosion control measures are installed and maintained throughout all phases of construction to protect exposed surfaces, control run-off and minimize the deposition of silt or suspended sediments within downstream habitats.

- Worksite isolation and dewatering plans should be prepared to identify appropriate isolation methods, siltation controls and dewatering measures to be implemented.

- Any pumped water resulting from dewatering activities should be discharged to settling areas or through filter media before entering the surface water bodies.

- Utilize suitable backfill material along banks and footings.

- Stage construction activity to minimize the frequency and duration of any in-water work, as much as feasible.

- Re-vegetate all disturbed areas as soon as possible following disturbance to stabilize the area and minimize erosion potential.

- Restore riparian vegetation cover through the planting of overhanging grasses, forbs and shrubs, to provide cover, shade and a source of food (insects).

- Any fish that may occur within isolated work areas should be captured and released in accordance with appropriate MNR protocols. MNR should be consulted to confirm the appropriate fish relocation plan for watercourses.

- Incorporate SWM measures into the design of the new roadways and intersection improvements to maintain pre-development quantity and quality of stormwater run-off.

- Implement provisions during construction for quick and effective spill control, containment and response, ensuring cleanup materials are stored on-site for easy access.

- Implement accurate reporting protocols to ensure quick and accurate reporting of all spills.

- Ensure all equipment entering the water (if deemed necessary) is properly washed and degreased prior to entering the watercourse.

- Ensure refueling stations are located outside of the floodplain and at least 30 m from the watercourse.

- Establish and maintain erosion and control measures throughout all phases of construction.

- Staging of work to avoid spawning and breeding activity.

6.2 ARCHAEOLOGICAL AND CULTURAL HERITAGE MEASURES

Preferred servicing alternatives and upgrades have the potential to directly affect archaeological and cultural heritage resources. This section summarizes the recommended follow-up and mitigation measures to minimize and mitigate potentially adverse archaeological and cultural heritage impacts associated with the planning, design and construction of the proposed preferred alternatives.

6.2.1 Archaeological Mitigation and Protection Measures

Mitigation strategies where potential effects are identified range based on the archaeological potential outlined in the Stage 1 Archaeological Assessment report. A Stage 2 Archaeological Assessment will be required along the preferred routes as part of the detailed design to determine potential effects on archaeological resources. In certain locations the archaeological assessment may need to be coordinated with the MNR so that no effects occur to species of conservation concern and species at risk.

The Stage 2 Archaeological Assessment will include the systematic walking of open ploughed fields at 5 m intervals as outlined in Section 2.1.1 of the MTCS' 2011 Standards and Guidelines for Consultant Archaeologists (Government of Ontario 2011). The MTCS standards further require that all agricultural land, both active and inactive, be recently ploughed and sufficiently weathered to improve the visibility of archaeological resources. Ploughing must be deep enough to provide total topsoil exposure, but not deeper than previous ploughing, and should provide at least 80% ground surface visibility.

Moreover, the Stage 2 Archaeological Assessment will include a test pit survey at 5 m intervals in areas inaccessible for ploughing as outlined in Section 2.1.2 of the MTCS' 2011 Standards and Guidelines for Consultant Archaeologists (Government of Ontario 2011). The MTCS standards require that each test pit be approximately 30 cm in diameter,

excavated to at least 5 cm into subsoil, and have all soil screened through 6 mm hardware cloth to facilitate the recovery of any cultural material that may be present. Prior to backfilling, each test pit will be examined for stratigraphy, cultural features, or evidence of fill.

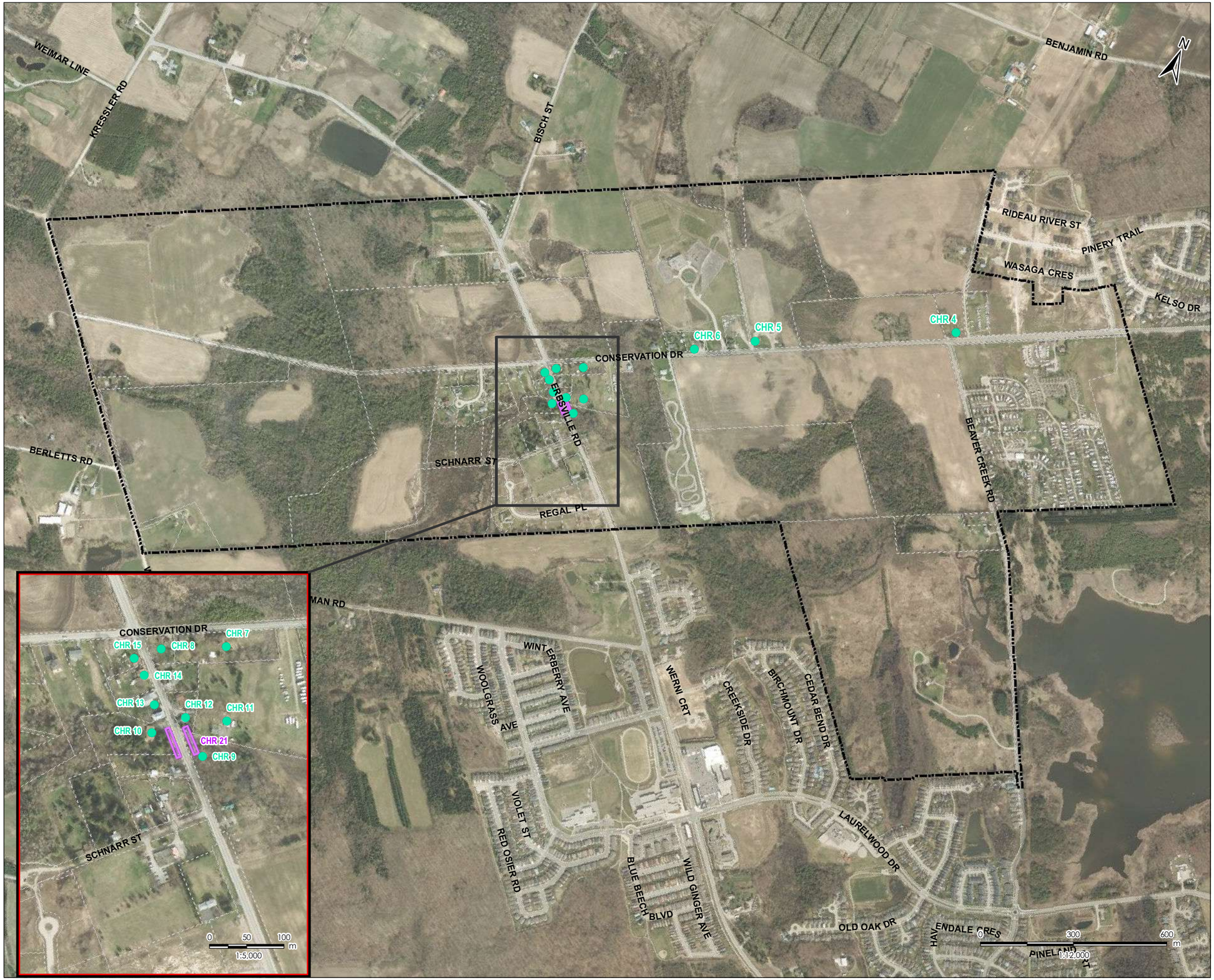
The Stage 2 Archaeological Assessment will also include the property survey of areas throughout the Study Area to confirm previous disturbance. This assessment will take place in commercial or residential lands throughout the Study Area. Test pits will be placed throughout the disturbed areas according to professional judgment as outlines in Section 2.1.8 of the MTCS' 2011 Standards and Guidelines for Consultant Archaeologists (Government of Ontario 2011).

Mitigation measures during construction will be determined based on the outcome of the Stage 2 Archaeological Assessment completed during detailed design.

6.2.2 Cultural Heritage Mitigation and Protection Measures

A total of 21 cultural heritage resources were identified within the Study Area based on the CHER. Where a CHVI was identified and proposed construction activity is positioned within a 50 m buffer zone, an additional assessment is required to determine the impacts on the heritage resources identified and the heritage attributes described. This analysis would be contained within a Heritage Impact Assessment (HIA).

Based on the preferred alternatives selected, 14 built heritage resources are to be included within an HIA during the detailed design as shown on Figure 6-1. It is anticipated that project effects will be related to construction of the project and may include vibration effects and removal of cultural heritage resources. The HIA will include mitigation and protective measures required to minimize the effects of the project on cultural heritage resources.



Stantec

Legend

- Study Area
- Parcel Boundary
- Potential Cultural Heritage Resource
- Potential Cultural Heritage Resource (Laurel Creek Culvert)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.
3. Orthoimagery © First Base Solutions, 2010.

December 2015
165640041

Client/Project

City of Waterloo
Beaver Creek and Conservation Drive
Upgrades and Extension of Municipal Services
Cultural Heritage Evaluation Report

Figure No.

6-1

Title

Heritage Resources where Additional Work is Recommended

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Revised: 2015-12-11 By: bcowper

7.0 STUDY COMPLETION AND CLOSING STATEMENTS

The accompanying study and report are the result of a combined effort and input from various study team members, staff members of the City of Waterloo, developer representatives, agencies, and various members of the public.

This Environmental Study Report will be placed on the public record for a 30 day review period and following the review period, assuming there are no requests for a Part II Order, the study will be deemed completed. Completion of the study will permit the proponent to proceed with the detailed design and construction of the proposed works.