DILLON CONSULTING

City of Guelph

Feasibility Study Report

College Avenue Cycling Improvements

April 2023

Table of Contents

Figures

Tables

Appendices

Acronyms, Abbreviations, and Initialisms

AAA – All Ages and Abilities

EA – Environmental Assessment

EIS – Environmental Impact Study

EMP – Environmental Monitoring Plan

GRSPP – Grand River Source Protection Plan

LID – Low Impact Development

m – Metres

MCEA – Municipal Class Environmental Assessment

MUP – Multi-Use Pathway

OHA – Ontario Heritage Act

ROW – Right-of-Way

SAR – Species at Risk

TMP – Transportation Master Plan

WHPA – Wellhead Protection Area

Executive Summary

The City of Guelph (City) retained Dillon Consulting Limited (Dillon), in partnership with Mobycon, to complete a feasibility study for All Ages and Abilities (AAA) cycling facilities on College Avenue from Janefield Avenue to Dundas Lane. This report documents the study process, findings, the recommended conceptual design, and next steps.

This study builds on the recommendations of the Guelph Transportation Master Plan (TMP, 2022), which identifies the College Avenue study corridor as a component of the City's "Cycling Spine Network." The Cycling Spine Network consists of "All Ages and Abilities" (AAA) cycling facilities that will provide access to major destinations throughout the network and support the City's mode share target of 10 percent of all daily trips in Guelph to be made by bike.

Design options for cycling facilities were developed and assessed to determine the feasibility and preferred approach to implement AAA facilities along the corridor. Potential impacts to the natural, socio-economic, cultural, and engineered environments were considered as part of the assessment.

Based on the evaluation of the design options, a hybrid approach was selected as preferred for College Avenue, with cycle tracks from Janefield Avenue to Edinburgh Road, and protected bike lanes from Edinburgh Road to Dundas Lane. This hybrid option prioritizes cyclist comfort in the western portion of the corridor, where several elementary schools are located. In the more physically constrained eastern portion of the corridor, which includes the University of Guelph and numerous mature trees, cycle tracks provide an appropriate level of cyclist comfort while limiting changes beyond the existing edge of roadway.

The proposed works are exempt from the Ontario *Environmental Assessment Act* (EAA). Despite being exempt from the EAA, this Feasibility Study approximately followed the MCEA process, including consultation with agencies, Indigenous communities, stakeholders, and the public throughout the study for transparency.

It is recommended the improvements to the College Avenue study corridor be divided into two segments. The segment from Caledonia Street to Dundas Lane is to be completed first, followed by the segment from Janefield Road to Caledonia Street.

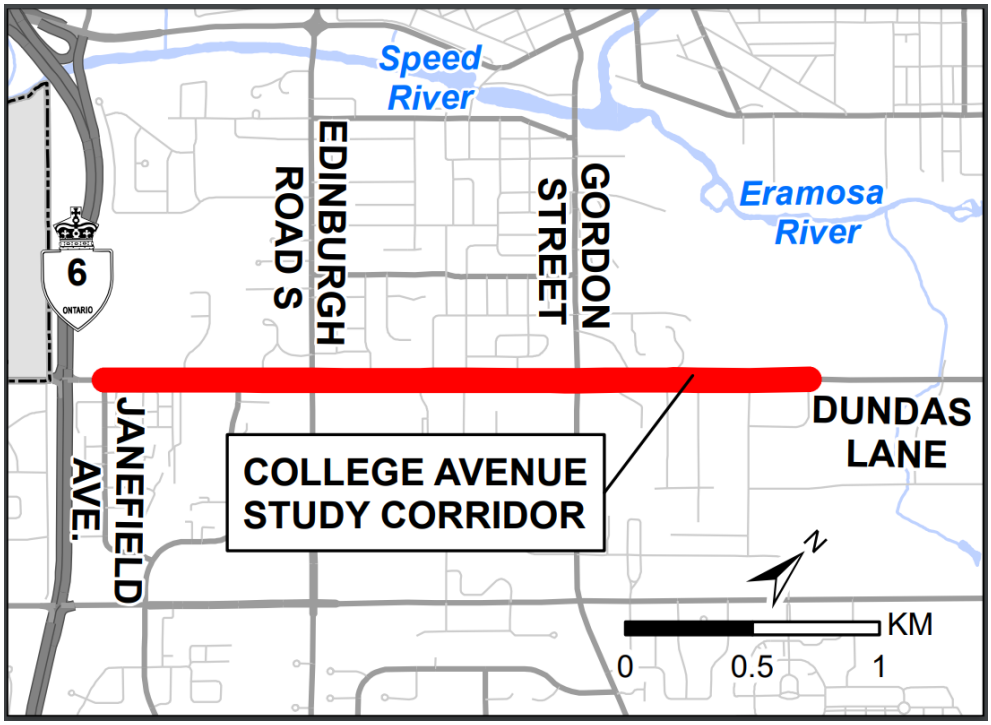
Based on the conceptual design, the estimated capital cost to construct the project is $9.8 million, not including property acquisition.

Overall, minimal environmental impacts are anticipated based on the conceptual design. Potential for minor property impacts has been identified immediately west of Vanier Drive (north side) and at proposed protected intersections. Consultation with impacted property owners should be completed during detailed design when the area of impact has been accurately determined. Other potential impacts and mitigation, as well as commitments for future studies, consultation, and anticipated approvals, are outlined in this report.

1.0 Introduction

The City of Guelph (City) retained Dillon Consulting Limited (Dillon), in partnership with Mobycon, to complete a feasibility study for All Ages and Abilities (AAA) cycling facilities on College Avenue in Guelph, Ontario. The study limits extend from Janefield Avenue to Dundas Lane, as shown in **Figure 1**.

Figure 1: Project Location



This study originates from a funding proposal to the Investing in Canada Infrastructure Program (ICIP). The original proposal put forward by the City and approved was to meet the ICIP program objectives of facilitating public transit. College Avenue is an important east-west corridor for first/last mile trips that support transit. It connects major schools and residential lands to the University of Guelph and its transit terminal.

The project limits do not extend west of the Hanlon Expressway due to low population density and lack of key destinations or transit stops. To the east of Dundas Lane, future plans will extend the cycling network to the east and connect with the Guelph Innovation District development planned for the east side of Victoria Road.

This report documents the study process used to determine whether implementation of AAA cycle facilities within the study corridor is feasible. As outlined in **Section 1.2** the project is not subject to the Municipal Class Environmental Assessment (MCEA, 2023); however, this study approximately followed the MCEA planning and design process. The study process included:

- An examination of the existing transportation, natural environment, socio-economic, and cultural heritage conditions;
- Development and evaluation of alternative design options;
- Consultation on the recommended design option; and
- Identification of anticipated impacts, mitigation measures, and next steps.

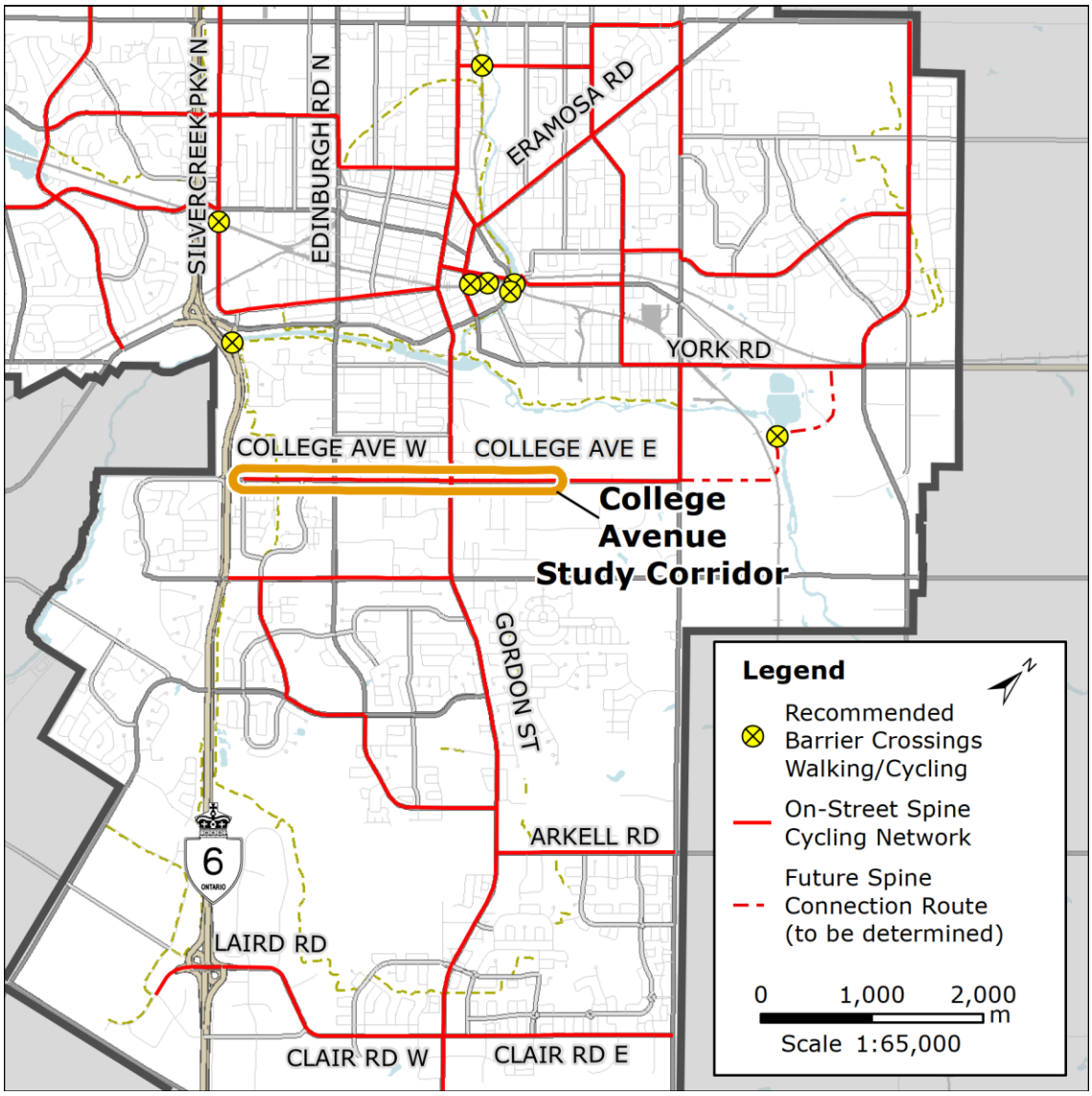
1.1 Study Purpose and Objectives

Through completion of the Guelph Transportation Master Plan (TMP, 2022), the College Avenue study corridor has been identified as a component of the City's priority "Cycling Spine Network" (**Figure 2**). The Cycling Spine Network is intended to consist of AAA cycling facilities that will:

- Provide access to major destinations throughout the network; and
- Support the City's mode share target of 10 percent of all daily trips in Guelph to be made by bike.

Providing AAA cycling facilities on College Avenue will connect users to major Guelph destinations, including the University of Guelph.

Figure 2: Cycling Spine Network and Study Corridors (adapted from Guelph TMP)



College Avenue has existing on-street cycling lanes, but they do not meet AAA cycling facility design requirements. This study applied industry standards, guidelines, and best practices to develop and assess design options for AAA cycling facilities within the existing, often constrained, road right-of-way (ROW).

Key objectives of this study included:

- Create the foundations of a coherent, well-connected AAA cycling network;
- Determine the feasibility of providing physically separated space for all ages and abilities of cyclists on College Avenue in a fiscally responsible way;

- Balance the needs of pedestrians, cyclists, transit users, goods movement, and drivers;
- Address the TMP goal to increase the percentage of individuals cycling throughout Guelph, with a focus on the inner suburbs and the University of Guelph area;
- Implement the Official Plan policies calling for an accessible transportation system that meets the needs of all members of the community, including safe and comfortable cycling facilities; and
- Minimize impacts to the existing and future natural, social-economic, and built environments.

1.2 Exemption from the Environmental Assessment Process

Based on the nature of the proposed works, this project is exempt from the Ontario *Environmental Assessment Act* (EAA). Under the MCEA (2023), this project is considered "reconstruction where the reconstructed road will be for the same purpose, use, and vehicular capacity, and will be at the same location as the existing road." This type of project is exempt from the EAA in accordance with activity 21 in Appendix 1, Table A (Municipal Road Projects) of the MCEA.

At the outset of this study, it was unclear what the MCEA requirements would be, if anything. As such, the City of Guelph opted to approximately follow the MCEA planning and design process for traceability and transparency purposes. The City issued project notices and collected feedback from stakeholders and the public throughout the study.

Going forward, the City will be responsible for addressing any concerns raised with respect to the project, as appropriate. The City will also be responsible for obtaining any required permits, approvals, and authorizations for this project as it moves towards construction.

2.0 Consultation and Engagement

This section provides an overview of consultation and engagement completed throughout the study.

Further information on activities, comments, responses, and how feedback influenced the designs is provided in the Engagement Summary Report (**Appendix A**, Dillon, December 2022). Consultation and engagement for this project was bundled with coincident projects on Gordon Street and Eramosa Road under the Guelph Protected Cycling Network Study. The Engagement Summary Report documents the results for all three study corridors, including overarching feedback as well as comments specific to each corridor.

A detailed summary of comments received throughout the study regarding College Avenue specifically, and how they were addressed by the project team, is provided in **Appendix B**.

2.1 Early Engagement Activities

2.1.1 Walking Workshop

At the beginning of the study, a walking workshop was held with staff from key departments at the City and the consulting team to become familiar with the existing conditions of the study corridors. The workshop was held on September 27, 2021. During the workshop, staff and consultants walked key sections of the three corridors and discussed challenges, opportunities, and ideas. Comments and responses regarding how they were addressed, where applicable, are outlined in **Appendix B**.

2.1.2 Key Informant Interviews

Key informant interviews were held early in the study to establish open lines of communication, answer questions, get initial feedback, and discuss the community engagement process. Interviews were held with the following key stakeholder groups:

- The Guelph Coalition for Active Transportation (GCAT; December 15, 2021);
- The University of Guelph (December 15, 2021);
- The Guelph Cycling Club (January 17, 2022); and

- The City of Guelph Accessibility Advisory Committee (February 15, 2022).

The stakeholder groups provided input regarding the study and communication methods, and offered to support with advertising engagement opportunities as well as encouraging participation. The University of Guelph indicated separation of cyclists from vehicular traffic with a physical barrier is important, and that pedestrian and cyclist safety at intersections should be a focus. The University also noted construction-related disruptions to connectivity should be limited, particularly during the fall and winter. The Accessibility Advisory Committee expressed safety concerns regarding the combination of different transportation modes including pedestrians with disabilities on multi-use paths.

Concerns raised by these stakeholders were considered by the project team during the assessment of design options as documented in **Section 4.0**.

2.2 Routine Engagement

Notifications for this study were completed in consultation with City staff and in accordance with the typical approach for communications on MCEA studies in Guelph. While the recommended solution for College Avenue is exempt from the MCEA process, the EA process was followed for consistency and transparency.

2.2.1 Contact List

The study contact list was compiled through a screening of impacted stakeholders in consultation with City staff. The contact list is included in the Engagement Summary Report (**Appendix A**) and includes the following groups:

- Elected officials;
- Provincial ministries;
- City staff;
- Indigenous Communities;
- Local agencies and institutions;
- Community and advocacy groups;
- Employment/business organizations;
- Accessibility advocates;
- Senior and youth groups;

- Immigration organizations; and
- Equity seeking groups.

Notifications were sent to the contact list to provide information and advertise opportunities to get involved as the study progressed. Notifications were also sent to individuals who signed up for the mailing list on the project webpage.

2.2.2 Social Media

The City used its social media pages on Facebook and Twitter to promote the study and notify followers about upcoming meetings and engagement opportunities throughout the study.

2.2.3 Project Webpage

A dedicated webpage for the overall Protected Cycling Network Study (including College Avenue, Gordon Street, and Eramosa Road) was hosted on the City's website (https://guelph.ca/cyclingnetwork). This project page contains information and communications including timelines, background documents and resources, study process and funding, and details on engagement activities. The website was updated throughout the study.

A dedicated page on the City's community engagement platform, 'Have Your Say', was also created for the study (https://www.haveyoursay.guelph.ca/cycling-network-study). This page served as the main hub for engagement and a one-stop location for information and communications about the study.

2.3 Notice of Commencement

A Notice of Commencement was developed to introduce the study objectives and provide an initial opportunity for engagement. The Notice included a link to the project website where recipients could find more information about the study and participate in the 'Map the Routes' survey described below.

The Notice of Commencement was first published in the local newspapers and posted on the project webpage during the week of December 2, 2021. The Notice was distributed to the study contact list during the week of December 2, 2021, and was re-sent to contacts not originally included in the study contact list on April 19, 2022 along

with the project update newsletter (**Section 2.4**). A copy of the Notice of Commencement is included in the Engagement Summary Report (**Appendix A**).

2.3.1 Map the Routes Survey

An online survey was used early in the study to gather feedback from the community on existing challenges and opportunities for the College Avenue corridor. The survey included an interactive map where participants could use pins to identify key destinations, safety concerns, accessibility issues, important connections, design ideas, and other comments or concerns.

The map survey was available from November 30, 2021 to January 10, 2022. A total of 22 comments regarding the College Avenue corridor were placed on the map. Comments and responses regarding how they were addressed, where applicable, are outlined in **Appendix B**.

2.4 Project Update Newsletter

A Project Update Newsletter was circulated in April 2022 to provide an update on input received from the Notice of Commencement and Map the Routes survey. The newsletter also summarized how the input was being used to inform the development of alternative design options. The newsletter was distributed to the study contact list and posted on the project webpage.

2.5 Stakeholder Follow-up Meetings

Following the development and evaluation of design options, follow-up meetings were held with the stakeholders that were interviewed at the beginning of the study (**Section 2.1.2**):

- The City of Guelph Accessibility Advisory Committee (July 5, 2022);
- The University of Guelph (July 21, 2022);
- GCAT (week of July 18, 2022); and
- The Guelph Cycling Club (week of July 18, 2022).

The purpose of the follow-up meetings was to share the conceptual designs and collect feedback prior to the Public Open House. The following comments were received regarding the conceptual design for College Avenue:

- Consideration should be given to providing 'Share the Road' signs for segments where cycle track is to be installed as some riders may continue to use the road;
- Consideration should be given to providing signage indicating distances to next signalized intersection in order to reduce mid-block crossings;
- Design must ensure that delivery trucks can continue to access the MacDonald Street parking lot; and
- University of Guelph is to be involved in the development and review of the detailed design of cycling facilities adjacent to the university.

2.6 Public Open House

A Public Open House was held on July 27, 2022 to gather feedback on study progress to date and the preferred conceptual design. To advertise the event, a Notice of Consultation was circulated to the study contact list and published in local newspapers as well as the project website.

Approximately 45 people attended the in-person event. Materials were also posted online for two weeks prior to and following the in-person event for a total of one month. This provided additional opportunities for review and comment.

Overall, participants expressed support for the safety improvements created by the conceptual design. This includes separation between cyclists and vehicular traffic, protected intersections, and trail connections. Participants expressed concerns about how to exit the protected bike lanes to make a left turn at non-signalized intersections, and connections to roads that currently do not have bike lanes.

Comments and responses regarding how they were addressed, where applicable, are outlined in **Appendix B**. Comments and concerns regarding the preferred conceptual design will be reviewed further during the future detailed design stage.

2.7 Engagement with Indigenous Communities

The City communicated with the following Indigenous communities via email and telephone throughout the project:

- Mississaugas of the Credit First Nation;
- Six Nations of the Grand River; and
- Haudenosaunee Confederacy.

Communications with Indigenous communities included sending notifications via email for engagement opportunities, offering to meet and discuss the study, and sending the Stage 1 Archaeological Assessment Report for review and comment. No concerns were raised by Indigenous communities regarding the study or the Archaeological Assessment Report. Mississaugas of the Credit First Nation and Six Nations of the Grand River expressed interest in being involved in the recommended Stage 2 Archaeological Assessment. Indigenous engagement communication logs are included in **Appendix A**.

2.8 Notice of Correction

Towards the completion of the study, it was determined that the project is exempt from the MCEA process, as noted in **Section 1.2**. A Notice of Correction was first issued on December 1, 2022 to inform residents and community members of this change (**Appendix C**). The Notice was posted on the project 'Have Your Say' webpage and in local newspapers in December 2022, and was circulated to the study contact list in March 2023.

3.0 Existing Conditions

The following sections provide an overview of existing conditions within and adjacent to the study corridor.

3.1 Engineered Environment

3.1.1 Transportation

3.1.1.1 General Overview

Within the study limits, College Avenue is an urban arterial road that ranges from 2 to 3 lanes and has a posted speed limit of 50 kilometres per hour. College Avenue features three lanes, a centre two-way left turn lane, from Janefield Avenue to Edinburgh Road and from Lang Way to East Ring Road. The remainder of the corridor is two lanes wide, with the exception of left turn lanes at intersections with Edinburgh Road and Gordon Street. The corridor has a linear horizontal alignment and a gentle rolling vertical alignment, with relatively steep slopes toward the west as well as between MacDonald Street and Dundas Lane.

There are numerous private accesses directly onto College Avenue between Scottsdale Drive and Gordon Street. There are also several higher volume University of Guelph entrances from Smith Lane to East Ring Road. The presence of numerous driveways, particularly high-volume driveways, is a safety concern for cyclists.

There is no on-street parking permitted along the corridor.

3.1.1.2 Active Transportation Facilities and Network

College Avenue includes sidewalks on both sides of the roadway for the length of the corridor. On-street painted bike lanes are provided on both sides of the roadway for the length of the corridor with a width of 2 metres (m) from Centennial Road/Janefield Avenue to Edinburgh Road and a width of 1.8 m from Edinburgh Road to beyond Dundas Lane.

Cycling facilities intersecting with College Avenue currently exist on Gordon Street and East Ring Road, both of which consist of painted bike lanes.

3.1.1.3 Planned Future Transportation Conditions

The Guelph TMP (2022) sets out goals for the future share of trips by the various transportation modes throughout the City and in particular areas. This is described further in **Section 3.3.3**.

Based on 2016 Transportation Tomorrow Survey (TTS) data, 3 percent of individuals in Guelph travel by bicycle. The TMP aims to increase the percentage of trips taken via bicycle to 10 percent city-wide, 3 percent in the outer suburbs, 5 percent in the inner suburbs, and 15 percent around the University of Guelph and downtown. These targets emphasize the importance of cycling improvements throughout the city, and particularly along cycling spines.

Future transportation network changes in and near the study area have been identified within the City's 2022 TMP, the 2012 Cycling Master Plan, and the 2021 Guelph Transit Future Ready Action Plan. The TMP identifies College Avenue as part of the Cycling Spine Network. Gordon Street, which intersects College Avenue, is also identified as part of the Cycling Spine Network.

East of the study area, the City intends to urbanize and widen College Avenue to continue the Cycling Spine Network to Victoria Road. The intent is for the timing of those works to be aligned to support the Guelph Innovation District land developments east of Victoria Road.

As outlined in the City's 2012 Cycling Master Plan, upgrades to the following routes intersecting College Avenue are planned:

- Scottsdale Drive (painted bike lane)
- Edinburgh Road (physically separated lane to the south; shared use lane to the north)
- Caledonia Street (signed bike route).

The locations of these intersecting routes are illustrated in Schedule 1 of the Cycling Master Plan, which is included in **Appendix D**.

The recommended cycling facility types for connecting routes may need to be revisited due to evolving best practices. It is recommended that intersection upgrades and proper transitions at intersecting cycle routes be considered as part of facility design to create safe and intuitive movements for cyclists.

Quality Transit Network

The Guelph TMP recommends a "Quality Transit Network" (QTN), which identifies corridors for operational improvements as well as transit priority measures. The TMP indicates that the segment of College Avenue between the Hanlon Expressway and Gordon Street may be widened to four lanes as part of the QTN. Two roads that intersect the study corridor are also designated as part of the QTN: Edinburgh Road South and Gordon Street.

The TMP recommends a staged approach to implementing the QTN, where first service frequency is increased and performance for all routes is optimized. In cases where buses continue to experience significant delays following this first stage, transit priority measures such as signal timing adjustment or queue jump lanes at intersections are to be implemented. The third stage involves road widening/lane conversion to create dedicated transit lanes, where warranted.

This study assessed the feasibility of, and preferred approach for, implementing AAA cycling facilities within the existing College Avenue study corridor. Further studies would be required to consider the needs of transit, if and when transit operations indicate a need for transit priority.

3.1.1.4 Collision History – Vulnerable Road User Safety

Locations and causes of collisions involving pedestrians and cyclists within the study limits were reviewed as part of the cycling facility design process. In the five-year period of the data (2016-2020), there were 5 collisions involving cyclists and 9 collisions involving pedestrians, all resulting in non-fatal injuries and property damage. The collisions and causes can be summarized as follows:

- Cyclist-related:
  - Turning vehicle and cyclist going straight through (3); and
  - Bus pulling over and cyclist going straight through (2).
- Pedestrian-related:
  - Turning vehicle failed to yield right-of-way to crossing pedestrian (5);
  - Pedestrian "crossing without right-of-way" and "running onto roadway," an indication of pedestrian crossing demand (3); and
  - Speeding (1).

To alleviate the risks and severity of these collisions, a dedicated cycling facility separate from motorized traffic, compact protected intersection design, and a lower design speed for College Avenue are recommended. Additional safety improvements should consider:

- Reviewing pedestrian accessibility to bus stops across the street at uncontrolled intersections; and
- Adding pedestrian crossings and crossrides at strategic locations.

3.1.2 Water Resources

3.1.2.1 Drainage and Stormwater Management

Drainage and stormwater management conditions are documented in the Existing Drainage Conditions and Low Impact Development (LID) Opportunities Memo (**Appendix E**; Dillon, March 2023).

The College Avenue corridor is an urban cross-section with relatively steep slopes toward the west as well as between MacDonald Street and Dundas Lane. A vertical sag is present at Lang Way. The section from Janefield Avenue to MacDonald Street is serviced by a trunk storm sewer as well as local sewers. The section from MacDonald Street to Dundas Lane is serviced by local sewers.

Anticipated challenges for installing LID measures along College Avenue include the presence of both mature and small diameter trees, and overhead utility infrastructure (i.e. hydro and light poles) within the grassed boulevard adjacent to the road.

3.1.2.2 Source Water Protection

The Grand River Source Protection Plan (GRSPP; February, 2022) was reviewed to identify source protection policies that apply to the College Avenue study corridor. The applicable Schedules from the GRSPP are included in **Appendix F**.

The entire study corridor is within Wellhead Protection Area (WHPA)-B, as illustrated in Schedules D and E of the GRSPP. A WHPA is defined in Volume I Appendix A as “an area that is related to a wellhead and within which it is desirable to monitor drinking water threats.” WHPA-A is within the closest proximity to the wellhead, whereas WHPA-B is less closely related to the wellhead.

The GRSPP assigns Vulnerability Scores, which categorize the relative vulnerability of a particular area to contamination. Areas with higher scores are considered more vulnerable, with 10 being the highest score. West of Gordon Street, the study corridor has a Vulnerability Score of 8, with the exception of a small portion east of Janefield Avenue that has a score between 2 and 6 (Schedule D). East of Gordon Street, the study corridor is a mixture of Vulnerability Scores between 2 and 8 (Schedule E).

3.1.3 Utilities

Existing utility infrastructure within the study areas was reviewed at a high level as part of this study, with the review documented in the Utilities Existing Conditions Memo (**Appendix G**; Dillon, February 2022). The following utilities were confirmed within the study area:

- Alectra Utilities (electric);
- Bell (telecommunications);
- Enbridge (gas); and
- City underground water, storm, and sanitary services.

Overhead utility pole lines are located on the north side of the College Avenue between Janefield Avenue and Edinburgh Road, and on the south side between Lynwood Avenue and the east study limits. The segment between Lynwood Avenue and Edinburgh Road has poles on both sides. Based on setbacks, it should be feasible to construct the recommended AAA cycle facilities with only minor impacts to the overhead utility pole lines.

Bell and Enbridge infrastructure is located under the boulevards on both sides of the roadway. Of particular importance is the presence of a high-pressure 2 S YJ 1900kPa Enbridge gas pipeline located within the north boulevard from immediately west of Watson Lane to the eastern study limits.

Underground water, storm and sanitary services extend across the entire ROW width, inclusive of the boulevard, west of Edinburgh Road and east of Smith Lane. Between Edinburgh Road and Smith Lane, services are predominantly located within the boulevards.

3.2 Natural Environment

In general, the College Avenue study corridor is highly urbanized, with natural features limited to street trees and other vegetation. Existing natural environment conditions are documented in the Environmental Impact Study (EIS; **Appendix H**; Dillon, December 2022); key findings are summarized in the following sections.

3.2.1 Aquatic Ecosystems

There are no watercourses within the College Avenue study limits.

3.2.2 Terrestrial Ecosystems

Given the urbanized character of the study corridor, the study area for the EIS was limited to the significant deciduous woodland located on the south side of College Avenue between McGilvray Street and Smith Lane. Delineation of this woodland, known as Brown's Woods, was completed in July 2022. The dripline generally coincides with the back of the existing sidewalk. The northern portion of the woodland was also checked for the presence of Butternut and assessed for potential Species at Risk (SAR) habitat. While no Butternut or SAR bird habitat was discovered, Brown's Woods may provide nesting habitat for migratory birds and bats protected under the *Endangered Species Act*.

3.3 Socio-Economic Environment

A Socio-Economic and Land Use Existing Conditions Memo (**Appendix I**; Dillon, October 2022) was prepared as part of this study. The memo documents existing socio-economic and land use characteristics, provincial and municipal planning policy, and future development within a one kilometre study area surrounding the study corridor. The memo also documents existing and planned transportation conditions, which are summarized in **Section 3.1.1**.

3.3.1 Relevant Planning Policies

The study area is subject to the following relevant provincial and municipal planning policies. Applicability of these policies to the current project are highlighted with the Socio-Economic and Land Use Existing Conditions Memo.

- Provincial Policy Statement (Ministry of Municipal Affairs and Housing);
- A Place to Grow: Growth Plan for the Greater Golden Horseshoe (Province of Ontario);
- City of Guelph Official Plan; and
- City of Guelph Transportation Master Plan.

3.3.2 Community Demographics

According to 2016 Statistics Canada Census Profiles, Guelph Census Subdivision has a population of 131,794, which is an 8.3 percent increase from the 2011 population. The median age in Guelph is 38.3 years. A total of 35,060 households are owned, while 17,030 are rented (Statistics Canada, 2017).

In 2016, a total of 60,400 households held a postsecondary certificate, diploma, or degree. Approximately 66 percent of the population was employed, with 4 percent unemployed and 30 percent not in the labour force. The median total income (before tax) of households during the same period was $37,540. This was below the Canadian average income of single earner households over the same period, reinforcing the importance of providing equitable transportation in the city.

3.3.3 Commuting Patterns

As a component of the 2022 Guelph TMP Update, work was completed to identify current and potential future mode share throughout the city using Census, Transportation Tomorrow Survey (TTS), and Streetlight™ data. Current city-wide mode choice base on the 2016 Census data, as well as the target mode choice for portions of College Avenue, are presented in **Table 1**.

Table 1: City of Guelph Mode Choice Based on 2016 Census Data Compared to Target Mode Shares for College Avenue

Mode Choice	Percentage of Individuals Currently Using the Mode	Target Mode Share Percentage: Janefield Avenue to Gordon Street	Target Mode Share Percentage: Gordon Street to Dundas Lane
Walking	5.9	20	20
Cycling	1.6	5	15
Public Transit	7.1	15	25
Automobile	84.5	60	40

3.3.4 Existing Land Use and Future Development

The University of Guelph is a key land use on College Avenue, spanning from Edinburgh Road in the west to Dundas Lane at the eastern study limit. There are a number of elementary and secondary schools toward the western limit of the study area, as well as generally low-density residential dwellings throughout. Between Janefield Avenue and Scottsdale Drive, the residential properties primarily back onto College Avenue. East of Scottsdale Drive, properties front onto College Avenue.

The Official Plan (City of Guelph, 2021) provides for the following land uses along College Avenue:

- Low to High Density Residential;
- Reserve Lands;
- Open Space and Park;
- Neighbourhood Commercial Centre;
- Significant Natural Areas & Natural Areas; and
- Major Institutional.

East of the study area, the Guelph Innovation District Secondary Plan provides for future development east of Victoria Road.

There are no current development proposals being considered within the study area.

3.4 Cultural Environment

3.4.1 Archaeological Resources

A Stage 1 Archaeological Assessment (**Appendix J**; LHC Heritage Planning & Archaeology Inc., 2022) was completed as part of this study to assess the archaeological potential of the College Avenue study corridor. The study area included lands within ten metres of the College Avenue road ROW.

The study found that the following portions of the study area exhibit archaeological potential and therefore require Stage 2 archaeological assessment prior to any ground disturbing activities:

- South side of College Avenue between Edinburgh Road and Smith Lane;
- Both sides of College Avenue between Gordon Street and the University Centre entrance; and
- Both sides of College Avenue between MacDonald Street and Lang Way.

The Stage 1 Archaeological Assessment Report was entered into the Ontario Public Register of Archaeological Reports on May 11, 2022.

3.4.2 Built Heritage and Cultural Heritage Resources

A Cultural Heritage Report (**Appendix K**; LHC Heritage Planning & Archaeology Inc., 2023) was completed as part of this study to identify built heritage resources and cultural heritage landscapes within the study area. The Cultural Heritage Report also includes an assessment of potential impacts to built heritage and cultural heritage resources; the results of that assessment are summarized in **Section 5.4**. The study area for the Cultural Heritage Report included lands within 40 metres of the College Avenue road ROW.

The report identified the following built heritage resources and cultural heritage landscapes within the study area:

- One property located at 204 College Avenue West designated under Section 29 Part IV of the *Ontario Heritage Act* (OHA);

- Three properties (2 located north of College Avenue/Edinburgh Road and College Avenue/East Ring Road, 1 located at Gordon Street/College Avenue) listed on the Municipal Heritage Register under Section 27 Part IV of the OHA;
- Twenty properties included on the Couling Architectural Inventory (neither listed nor designated, but part of a known inventory); and
- Portions of two cultural heritage landscapes (Brooklyn and College Hill Heritage Conservation District, University of Guelph Cultural Heritage Landscape).

4.0 Alternative Design Options

4.1 Key Elements of AAA Cycle Facility Design

All Ages and Abilities (AAA) cycle facilities should be designed to meet the recommendations outlined in **Table 2**.

Table 2: Recommended Elements of AAA Cycle Facility Designs

Design Element	Recommended Condition
Comfortable Cycle Facility Width and Separation from Vehicular Traffic	• Facility widths should be designed in accordance with the recommendations of Ontario Traffic Manual (OTM) Book 18. • Cycling facilities should be physically separated from motor vehicles. The extent of horizontal and vertical separation required is dependent on adjacent motor vehicle speeds and volumes.
Cycling Access to Key Destinations	• Safe, accessible cycling facilities should be provided between key destinations along both sides of the corridor. • Crossing locations should be clearly delineated, with cyclist priority provided over vehicular traffic.

Steep Sections Should be Limited or Avoided	• Road elevation change should generally be less than 5 percent to allow for sustained cycling speeds and reduced weaving.
	• Steeper segments should be limited to:
	  ○ Less than 500 m in length, for grades between 5 and 7 percent;
	  ○ Less than 150 m in length (about a block), for grades between 7 and 8 percent; and
	  ○ Less than 30 m in length, for grades above 8 percent.

Design Element	Recommended Condition

Enhanced Rider Safety	• Risks associated with conflicts with motor vehicles should be reduced through:
	  ○ Minimizing the operating speed differential between vehicles and cyclists, particularly at intersections and entrances;
	  ○ Reducing the number of contraflow conflicts with turning vehicles; and
	  ○ Implementing mitigation measures to limit the number of right hook conflicts (i.e. through restricting right on red).
	• Risks associated with cyclist conflicts with transit vehicles should be reduced through physical separation of operating spaces.
	• Risks associated with conflicts with pedestrians should be reduced through:
	  ○ Separation of cyclists and pedestrians, particularly where high volumes of either are anticipated;
	  ○ Minimizing the operating speed differential between cyclists and pedestrians on shared facilities; and
	  ○ Avoiding sudden path narrowing.
	• Facility should be designed and maintained to be clear of obstructions, including:
	  ○ Surface debris (i.e. leaves);
	  ○ Surface inlet catch basins and gutters; and
	  ○ Snow/ice, to enable all season operation of the facility.

Cohesion	• Consistent design throughout the corridor.

4.2 Development of Design Options

Four design options were developed and assessed to determine the feasibility of implementing AAA cycle facilities within the College Avenue study limits:

- Option 1: Protected Bike Lanes;
- Option 2.1: Multi-Use Pathway, One Side;
- Option 2.2: Multi-Use Pathways, Both Sides; and
- Option 3: Cycle Tracks.

Additional details about each of the design options is provided in the following sections.

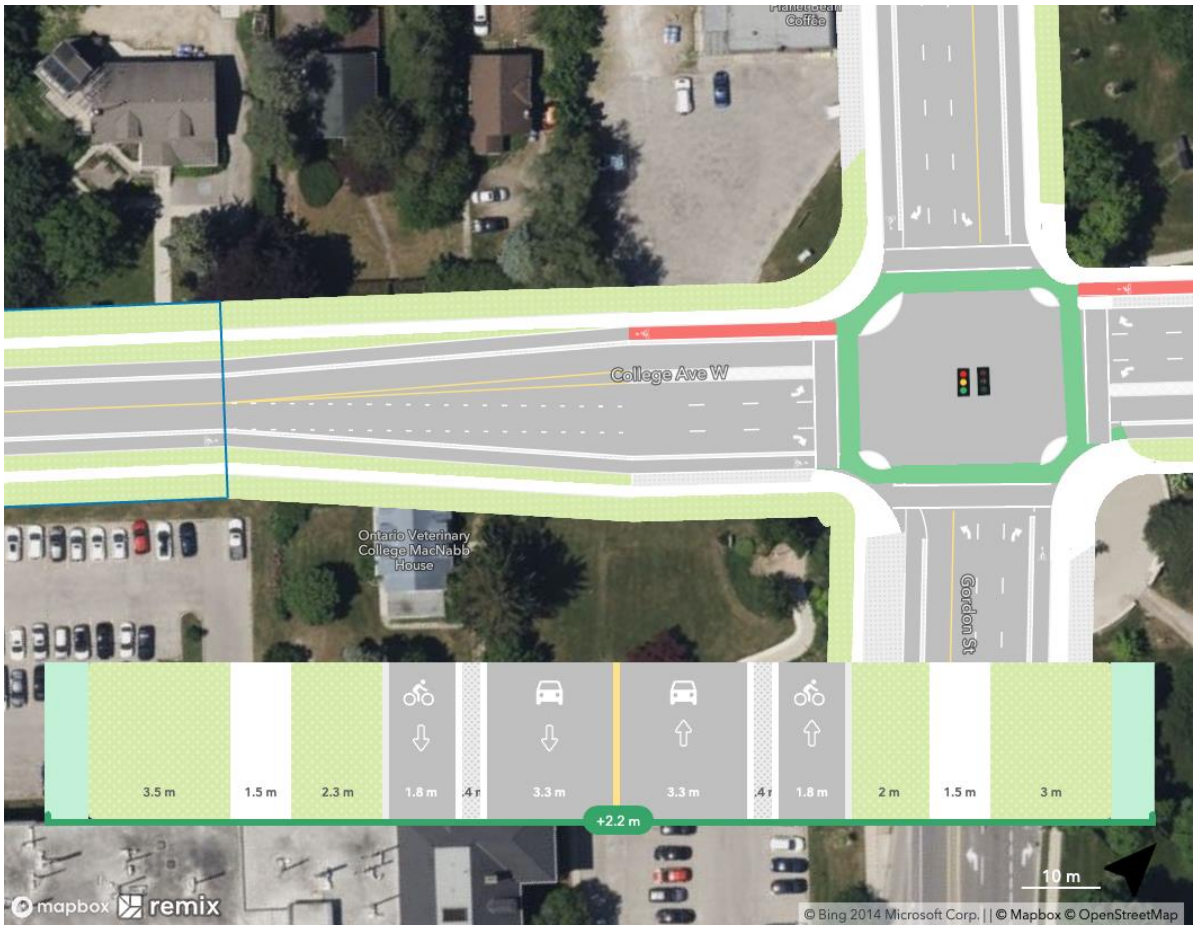
4.2.1 Option 1: Protected Bike Lanes

Protected bike lanes are one-way, on the same level as the roadway, with physical separation between people riding bikes and motor vehicle traffic. Physical separation may include the use of painted buffers, curbs, bollards, and planter boxes.

As illustrated in **Figure 3** and **Appendix L**, Option 1 for College Avenue generally includes the following elements, which are intended to be implemented between the existing curbs:

- 1.8 to 2.2 m wide bike lanes on either side of the roadway. Narrower 1.8 m lanes were used for the majority of the corridor while wider lanes were used where additional space was available to be reallocated from vehicle lanes or the removal of painted medians.
- 0.4 to 1.5 m wide physical separation between cyclists and vehicles depending on the available space. Breaks in the barrier would be provided at entrances and could be made mountable.
- 3.3 m wide vehicular through lanes with 3.0 to 3.3 m wide turn lanes.

Figure 3: Design Option 1 Example, College Avenue at Gordon Street



Implementation of Option 1 would allow sidewalks and boulevards to be left as-is. Retrofitted protected intersections would be implemented at key junctions using pre-cast islands at the corners to create vertical protection. Some intersections would require curb realignment on certain approaches to maintain the desired width and number of vehicle lanes while also accommodating separated cycling facilities.

4.2.2 Option 2: Multi-Use Pathways

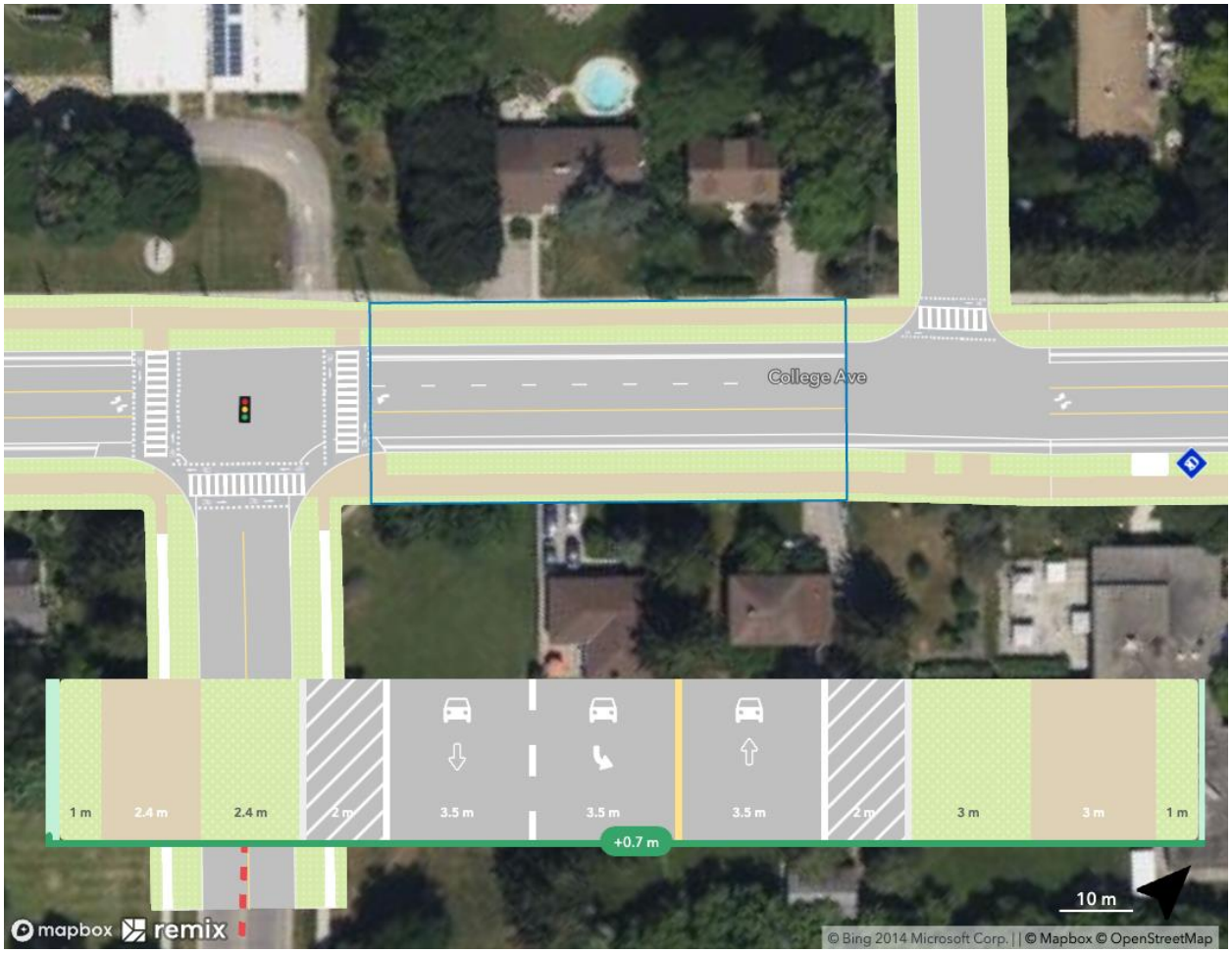
Multi-use pathways (MUPs) are two-way shared pedestrian and cycling facilities, physically separated from motor vehicle traffic. They are most often located similarly to a sidewalk, but are wider to accommodate both pedestrians and cyclists.

Two options were developed that include MUPs. Option 2.1 involves implementation of a single MUP on the south side of College Avenue, while Option 2.2 involves implementation of MUPs on both sides of College Avenue. Space for the MUPs would be obtained through removal and reallocation of space from the existing sidewalks, landscaped boulevards, and vehicular lanes.

As illustrated in **Figure 4** and **Appendix L**, design Options 2.1 and 2.2 for College Avenue generally include the following elements:

- 3.0 m wide MUP on one side (Option 2.1) or 2.4 to 3.0 m wide MUPs on both sides (Option 2.2) for the entire length of the corridor. Narrower MUPs were applied where mature trees or other streetscape elements such as hydro poles restricted facility width.
- 0.5 m to 4.0 m horizontal separation provided between cyclists and vehicles behind the curb by hardened or landscape boulevard. Separation of 1 m was generally proposed throughout the corridor, with narrower buffers applied only in constrained locations.
- 3.5 m wide vehicular through lanes, with 3.3 m wide turn lanes as per existing conditions.

Figure 4: Design Option 2.2 Example, College Avenue between Scottsdale Drive and Lynwood Avenue



Efforts were made to minimize the need for curb realignment. In some locations, streetscape elements such as utility poles, streetlights, and trees would need to be removed or relocated to accommodate the MUPs.

Due to the nature of MUPs and the mixing of pedestrians and cyclists, Dutch-style protected intersections are not necessary for the MUP options. All signalized intersections were treated with crosswalks and cross-rides at all approaches, while unsignalized intersections were treated with crosswalks and cross-rides on College Avenue only.

Attempts were made to provide sufficiently wide (1.5 m) platforms for transit users boarding and alighting vehicles. In some cases this was not possible due to constraints in

achieving sufficient MUP widths. As such, some transit stops would require transit users to wait on the MUP, creating conflicts with cyclists and other pedestrians.

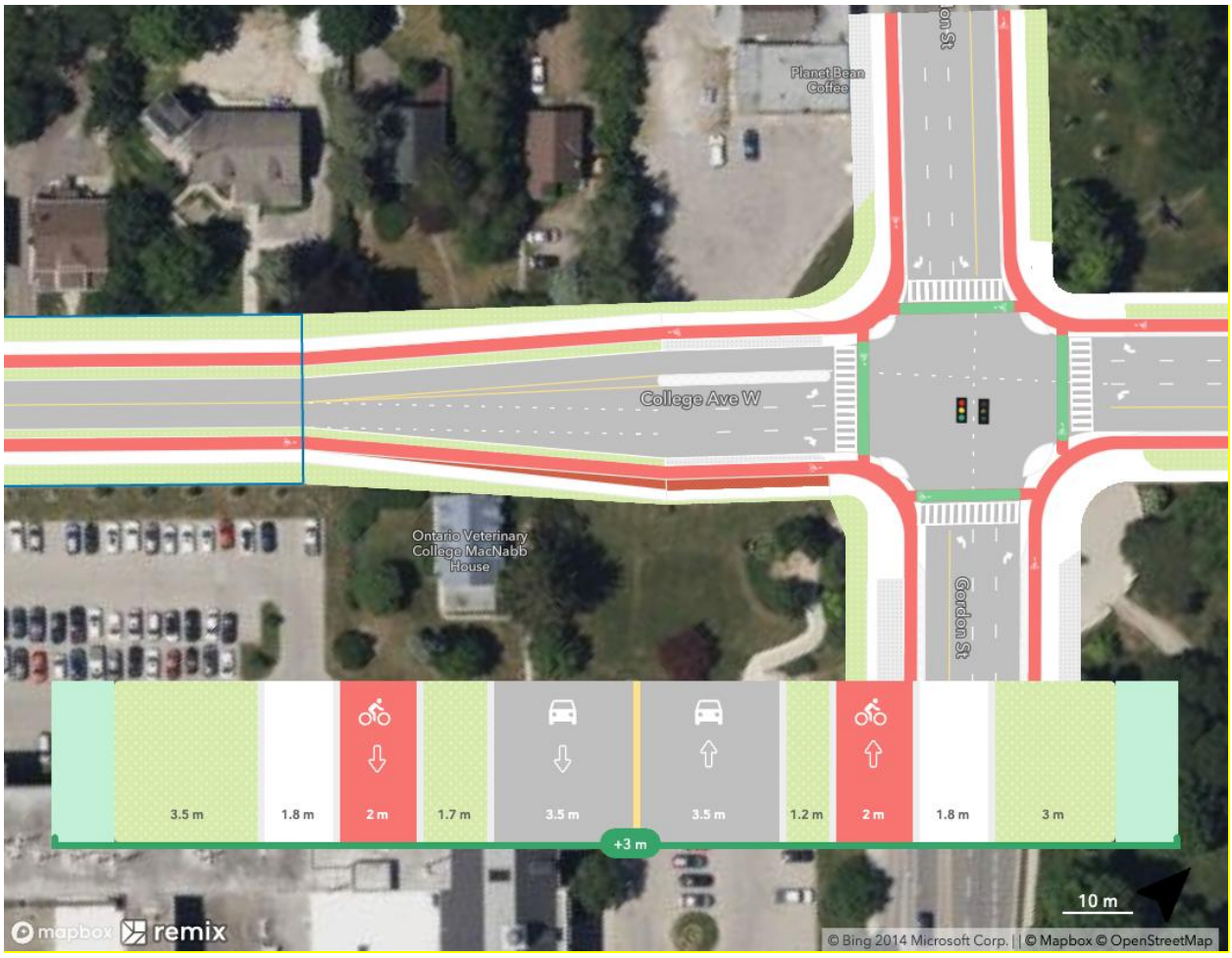
4.2.3 Option 3: Cycle Tracks

Cycle tracks accommodate cyclists only and are located above road grade – often within the boulevard. This provides both horizontal and vertical separation between vehicular and cyclist traffic.

As illustrated in **Figure 5** and **Appendix L**, Option 3 for College Avenue generally includes the following elements, which would require relocation of the existing curbs on both sides of the roadway:

- 2.0 m wide cycle tracks on both sides of the roadway.
- Minimum 0.3 m wide physical separation between cyclists and vehicles provided by curb and gutter and a narrow maintenance strip. For the majority of the corridor, a minimum buffer of 1 m is achieved.
- Existing 1.5 to 1.8 m wide sidewalks.
- 3.5 m wide vehicular through lanes with 3.3 m wide turn lanes.

Figure 5: Design Option 3 Example, College Avenue at Gordon Street



In many segments, space for cycle tracks is available within the existing boulevard. In more constrained segments, curb realignment allows for the reallocation of space from the existing painted bike lanes and the narrowing of some vehicular lanes. Protected intersections are applied at major intersections.

4.3 Evaluation of Design Options

The design options described in **Section 4.2** were evaluated to compare their alignment with AAA design principles and impacts on the engineered, natural, socio-economic, and cultural environments, as well as anticipated costs.

A summary of the comparative evaluation of design options is provided in **Table 3**. Letter grades were used to compare each option's alignment with the ideal condition. A letter grade of 'A' indicates that the solution is most closely aligned with the ideal condition, whereas a letter grade of 'F' indicates unacceptable negative impacts. The full evaluation tables are included in **Appendix M**.

Options 1 (protected bike lanes) and 3 (cycle tracks) scored the highest in the comparative evaluation, primarily because they are most closely aligned with AAA design requirements and the TMP. Key constraints within the corridor are discussed in **Section 4.4**, and the resulting preferred design option is presented in **Section 5.0**.

Table 3: Evaluation Summary

Category	Option 1: Protected Cycling Lanes	Option 2.1: Multi-Use Pathway, One Side	Option 2.2: Multi-Use Pathways, Two Sides	Option 3: Cycle Tracks
AAA Design Requirements (Pre-Screening)	Grade: B • Option meets the majority of requirements of AAA cycling facility design. • Design includes both cycle and pedestrian facilities that meet current width guidelines. • Cycling access provided on both sides of the corridor and is horizontally but not vertically separated from vehicular traffic. • Locations where the protected cycle lane crosses in front of transit stops will require special treatment.	Grade: D • Option meets more than half of the requirements for AAA cycling facility design. • Cycling access provided on one sides of the corridor and is horizontally and vertically separated from vehicular traffic. • Primary issues are associated with cycling access only being provided to one side of the corridor, conflicts with pedestrians, and cyclists and vehicles travelling in opposing directions on the same side of the roadway.	Grade: D • Option meets more than half of the requirements for AAA cycling facility design. • Cycling access provided on both sides of the corridor and is horizontally and vertically separated from vehicular traffic. • Primary issues are associated with conflicts with pedestrians, and cyclists and vehicles travelling in opposing directions on the same side of the roadway.	Grade: A • Option meets the majority of requirements of AAA cycling facility design. • Design includes both cycle and pedestrian facilities that meet current width guidelines. • Cycling access provided on both sides of the corridor and is horizontally and vertically separated from vehicular traffic. • Locations where the cycle track crosses between the sidewalk and transit stops will require special treatment.

Category	Option 1: Protected Cycling Lanes	Option 2.1: Multi-Use Pathway, One Side	Option 2.2: Multi-Use Pathways, Two Sides	Option 3: Cycle Tracks
Engineering **(Safety, Operations, and Infrastructure)**	Grade: C • Option requires coordination of clearing operations to prevent snow from the roadway blocking the cycle lane. • Narrowed vehicular lanes may result in additional delay if emergency vehicles need to navigate between vehicles on either side of the roadway. • Block-by-block phasing could be used to limit traffic and property access impacts at any given time during construction. • Requires modification to existing roadway to install raised concrete barriers. • Waste collection vehicles will be separated from curbside waste collection sites by a minimum of 2.2m and at some waste collection sites, collection staff will be required to cross the concrete barrier to pick up cans and boxes.	Grade: A • Option frees up an additional 3.4m of space between curbs, which can be reallocated to provide additional auxiliary lanes where required. • Combined facility on only one side of the corridor results in reduced overall cyclist and pedestrian capacity. • Option has anticipated impacts to 17 hydro poles and above approximately 6m of Enbridge high pressure pipeline which will require coordination. • No other impacts to road alignment, or waste collection, are anticipated.	Grade: B • Option frees up an additional 3.4m of space between curbs, which can be reallocated to provide additional auxiliary lanes where required. • Option has anticipated impacts to 33 hydro poles and potential for Bell conduit impacts due to 240m overlap with proposed facility. • Facility will be above approximately 19m of Enbridge high-pressure pipeline which will require coordination.	Grade: B • Option would result in space constraints where the proposed facility is primarily located immediately behind the curb from Gordon Street to Lang Way and will require specialized winter maintenance processes. • Longer temporary closures of existing cycling facilities are anticipated. • Option has anticipated impacts to 18 hydro poles and potential for Bell conduit impacts due to 130m overlap with proposed facility. • Facility will be above approximately 55m of Enbridge High Pressure Pipeline which will require coordination. • The construction process would require road narrowing and catch basin relocations. Construction adjacent to University would need to be scheduled for summer months.

Category	Option 1: Protected Cycling Lanes	Option 2.1: Multi-Use Pathway, One Side	Option 2.2: Multi-Use Pathways, Two Sides	Option 3: Cycle Tracks
Natural Environment	Grade: A • Option has no anticipated impacts to existing trees, vegetation or landscaping and no changes to existing boulevard widths.	Grade: B • Option has potential impacts to mature trees along the south side of College Avenue between Janefield Avenue and Edinburgh Road and between Gordon Street and Trent Lane. • South side of the right-of-way total width of greenspace is reduced by 1.5m.	Grade: D • Option has potential impacts to shrubbery along the College Avenue frontage of the "President's Residence," immediately east of Lynwood Avenue. • Potential impacts to mature trees along the south and north side College Avenue between Janefield Avenue and Edinburgh Road and between Gordon Street and Trent Lane. • Right-of-way on both sides to be reduced by 1.5m and it is unlikely that adequate boulevard space will exist on the north side to accommodate mature street trees along the length of the boulevard.	Grade: C • Option has potential impacts to mature trees along the south and north side College Avenue between Janefield Avenue and Edinburgh Road and between Gordon Street and Trent Lane. • Minimal increases in hard surfaces but a reduction in the average width of green surfaces between hard surfaces.

Category	Option 1: Protected Cycling Lanes	Option 2.1: Multi-Use Pathway, One Side	Option 2.2: Multi-Use Pathways, Two Sides	Option 3: Cycle Tracks
Socio-Economic Environment	Grade: A • Option fully aligns with Transportation Master Plan policies that identify the need for AAA cycling facilities on College Avenue. • 22 comments received in support of protected cycle lanes.	Grade: D • Option does not align with Transportation Master Plan as it removes cycling facilities along the north side of the roadway. • Replacement of existing sidewalk with multi-use pathway reduces the available pedestrian movement capacity on that facility.	Grade: C • Option partially aligns with Transportation Master Plan. Multi-use Pathways are not considered AAA when the facility runs through busy pedestrian areas. • Replacement of existing sidewalk with multi-use pathway reduces the available pedestrian movement capacity on that facility.	Grade: B • Option fully aligns with Transportation Master Plan policies that identify the need for AAA cycling facilities on College Avenue. • 8 comments received in support of cycle tracks.
Cultural Environment	Grade: A • No impacts to cultural heritage properties or lands with archaeological potential anticipated.	Grade: B • No impacts to specific cultural heritage properties anticipated. • Approximately 2700m^2 of land with archaeological potential will be impacted.	Grade: C • Potential impact to cultural heritage landscape along 358 Gordon Street. • Approximately 3200m^2 of land with archaeological potential will be impacted.	Grade: B • Potential impact to cultural heritage landscape along 358 Gordon Park. • Approximately 2000m^2 of land with archaeological potential will be impacted.

Category	Option 1: Protected Cycling Lanes	Option 2.1: Multi-Use Pathway, One Side	Option 2.2: Multi-Use Pathways, Two Sides	Option 3: Cycle Tracks
Anticipated Cost[1]	Grade: D • Estimated capital infrastructure cost of $5.4 million. • Largest anticipated increase in winter maintenance costs due to specialized clearing requirements to ensure cycle lanes are not blocked by snow moved off of driveways. • Barriers require regular repair.	Grade: A • Estimated capital infrastructure cost of $2.1 million. • Minor increase in winter maintenance costs. • Asphalt pathways have greater maintenance requirements and shorter lifespans than concrete sidewalks.	Grade: C • Estimated capital infrastructure cost of $3.6 million. • Minor increase in winter maintenance costs. • Asphalt pathways have greater maintenance requirements and shorter lifespans than concrete sidewalks.	Grade: D • Estimated capital infrastructure cost of $9.6 million. • Winter maintenance budget for active transportation facilities along the corridor will be doubled. • Asphalt pathways have greater maintenance requirements and shorter lifespans than concrete.
Conclusion	**Grade: A** Option meets AAA design requirements and aligns with the Transportation Master Plan as well as public input. Would require additional winter maintenance considerations and results in increased maintenance costs. Requires modifications to existing roadway to install barriers and modifications to waste collection services.	**Grade: B** Option meets more than half of AAA design requirements and is preferred in terms of engineering criteria and anticipated costs. However, it does not align with Transportation Master Plan as it removes cycling facilities along north side and reduces pedestrian capacity on south side.	**Grade: C** Option meets more than half of AAA design requirements. However, it is anticipated to require significant utility relocations, impact existing shrubbery and mature trees, and reduce overall pedestrian capacity.	**Grade: A** Option is most closely aligned with AAA design requirements and aligns with the Transportation Master Plan. Would impact approximately 18 hydro poles and requires coordination with gas due to 55m high-pressure line overlap. Potential impacts to mature trees.

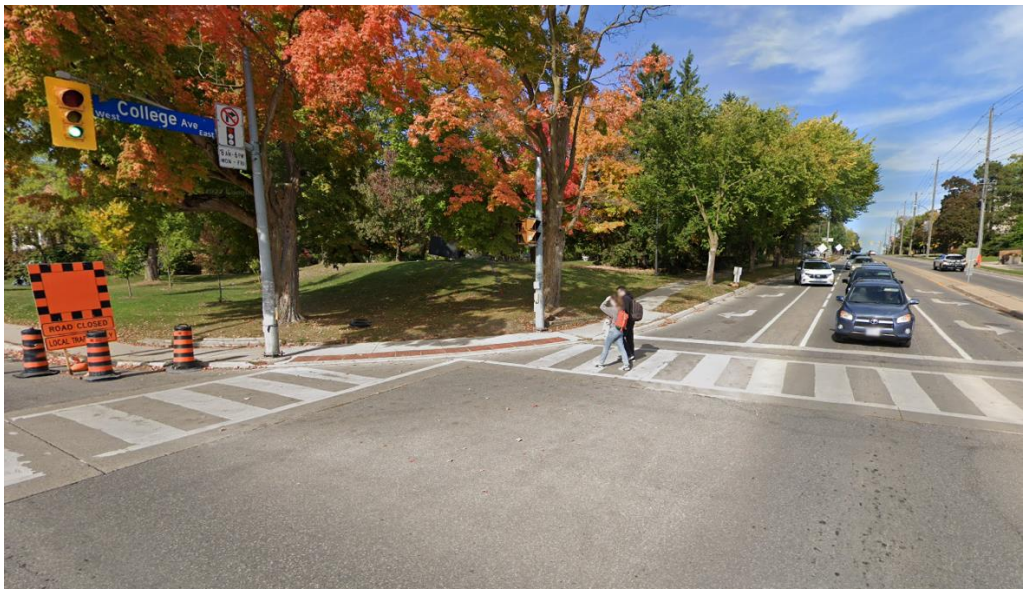
[1] Capital cost estimates in this table are high-level functional cost estimates. A more detailed cost estimate was completed for the preferred design option (**Section 5.2**).

4.4 Key Constraints

The College Avenue study corridor has relatively few constraints overall, particularly from Janefield Avenue to Edinburgh Road. With existing 2m wide existing painted cycle lanes, wide boulevards, and a relatively wide right-of-way throughout most of the corridor, there is plenty of space available for cycling facilities. Utility poles and mature trees present challenges in some locations, but facilities can typically weave around streetscape elements where necessary due to wide existing boulevards and curb realignment for some options.

The key constraints encountered along the College Avenue corridor are at the major intersections with Edinburgh Road South and Gordon Street. A lack of space at the corners presented challenges for the MUP and cycle track alternatives. Utility poles, traffic signals, and mature trees are located in constrained spaces near the property line as seen in the example provided in **Figure 6**. Relocation or removal of these features, or curb realignment, would be needed to construct cycle tracks or MUPs at these locations. Further study will be needed in detailed design to determine the impacts at these locations.

Figure 6: Photo of College Avenue at Gordon Street, Looking East



Constraints were also encountered along College Avenue from Lang Way to East Ring Road. Vehicle lanes could not be narrowed enough to accommodate a protected buffer for the cycling lane within the existing curb-to-curb width. As a result, it is recommended that the centre turn lane be removed for part of this section, leaving one through lane in each direction and space for wide cycling lane buffers. To accommodate left turn lanes, curb realignment is recommended at the intersections to fit a protected cycle lane and buffer of sufficient width.

Transit stops were another challenge when developing design options for College Avenue. It is important to maintain access to transit for all users and this was considered when developing each option. Due to the characteristics of the different facility types and space constraints, maintaining easy access to transit vehicles while minimizing conflicts was not always possible. This is particularly relevant for protected cycle lanes, which are on the same level as the roadway and physically separated from vehicular traffic. To mitigate conflicts between users, the protected cycle lanes were raised to sidewalk height at transit stops, as described in **Section 5.1**.

Another design consideration is the future transit improvements associated with the designation of a portion of College Avenue, as well as Edinburgh Road South and Gordon Street, as part of the QTN in the TMP (2022). As noted in **Section 3.1.1.3**, this study assessed the feasibility of, and preferred approach for, implementing AAA cycling facilities within the existing College Avenue study corridor. Further studies would be required to consider the needs of transit, if and when transit operations indicate a need for transit priority.

5.0 Preferred Design Option

This study has determined AAA cycle facilities can implemented on College Avenue from Janefield Avenue to Dundas Lane. The preferred design option for College Avenue is a combination of Option 1 (protected cycle lanes) and Option 3 (cycle tracks). Cycle tracks will be provided from Janefield Avenue to Edinburgh Road, and protected bike lanes will be provided easterly to Dundas Lane.

A rendering illustrating the conceptual design of the cycle tracks in the west segment of the study area is provided in **Figure 7**. A rendering from the east segment of the study area, showing protected bike lanes and a raised bike crossing at a transit stop, is provided in **Figure 8**

Figure 7: Rendering of College Avenue between Janefield Avenue and Edinburgh Road

Figure 8: Rendering of College Avenue at MacDonald Street

The hybrid option prioritizes cyclist comfort in the western portion of the corridor where several elementary schools are located and existing boulevards are wider. In the more constrained eastern portion of the corridor, which includes the University of Guelph and numerous mature trees, protected bike lanes provide an appropriate level of cyclist comfort while limiting construction impacts beyond the existing edge of roadway.

5.1 Major Features of the Conceptual Design

The conceptual design drawings are included in **Appendix N**. Key features of the recommended design include the following:

Protected Intersections: A protected intersection is a Dutch-inspired design treatment that provides physically separated spaces for cyclists, pedestrians and vehicles. The intent is to improve safety and comfort for all users by minimizing potential conflict points. Cyclists will complete left turns through a two-stage process that involves travelling counter-clockwise outside the vehicular lanes and parallel to pedestrians. "Right on red" turn restrictions can be considered to further reduce conflicts.

Protected intersections are proposed at Scottsdale Drive, Edinburgh Road, Gordon Street, and East Ring Road. Design treatments at all intersections are to be reviewed during detailed design. Special attention is required at protected intersections, which should include the following details:

- Sufficient cyclist queueing space (minimum 1.8 m) should be provided so cyclists do not block the bike lane while waiting to cross the street;
- Cross-rides should be set back by a sufficient distance (ideally one car length) to improve driver visibility of cyclists and reduce turn conflicts; and
- Medians should extend beyond the crosswalk and cross-ride to provide pedestrians and cyclists with a protected refuge in case they cannot cross the entire width of the street in one light cycle.

Raised Cycling Facilities at Transit Stops: Protected bike lanes will be ramped up to curb height where they cross in front of a transit stop (**Figure 8**). This will provide a level, accessible connection across the bike lane for transit riders. Pavement markings, signage, and tactile strips will be used to communicate pedestrian priority and to communicate to individuals with visual impairment that they are moving outside the limits of the sidewalk or transit platform.

Improved Trail Connections: Existing pedestrian crossovers at Silvercreek Trail and Winegard Walk will be modified to include enhanced pavement markings, signage, and cycle facility connections.

5.2 Estimated Capital Cost

Based on the conceptual design, the estimated capital cost to construct the project is $9.8 million, not including property acquisition. This cost estimate includes high-level estimates to upgrade the existing signalized intersections at Scottsdale Drive, Edinburgh Road, Gordon Street, and East Ring Road to protected intersections. The Class 'C' cost estimate for the recommended design is included in **Appendix O**. Additional notes are included within the cost estimate for reference.

5.3 Additional Design Considerations

The following sections outline additional considerations that should be incorporated into the detailed design for the corridor.

5.3.1 Stormwater Management

Opportunities may exist to include Low Impact Development (LID) measures within grassed boulevards when the corridor is reconstructed. Preliminary identification of opportunities/locations for LID measures is included in **Appendix E**. Opportunities to incorporate LID measures within the study corridor should be explored through the ongoing Stormwater Management Master Plan update.

In general, it is anticipated that sufficient, conflict-free space for LID measures will exist in various segments of the study area. As the project is located in a source water protection area, infiltration based LIDs may not be desirable. Filtration LID measures may be more suitable, which pass surface runoff through a filter medium. The treated stormwater is then collected by a perforated underdrain that outlets to a storm sewer, or natural outlet. Any filtration alternative would require impermeable lining to prevent infiltration, or a gate/valve that could prevent runoff from entering the feature during winter months. Enhanced grassed swales, bioretention cells, permeable hardscapes, tree root support systems, subsurface sand filters, and rain gardens are examples of LID filtration features that can treat surface runoff through filtration.

5.3.2 Auxiliary Lane Requirements

The current study did not consider opportunities to change the number of existing vehicular lanes. Prior to detailed design, it is recommended that traffic analysis be completed to confirm the need for right and left turn lanes at each of the proposed protected intersections. Turn lanes impact both intersection size and safety.

5.3.3 Cycling Supportive Design Features

The following cycling-supportive design features should be incorporated into the detailed design for College Avenue:

- Bike racks;
- On-street tool kits;
- Pedestrian level lighting;
- Bike signals;
- Street trees; and
- Pavement markings and signs.

5.4 Impacts and Mitigation

The anticipated impacts and recommended mitigation measures for the project, based on the conceptual design, are summarized in **Table 4**. Overall, minimal environmental impacts are anticipated. Mitigation measures outlined in **Table 4** are to be incorporated into the future detailed design and construction phases.

Table 4: Anticipated Impacts and Recommended Mitigation Measures

Category	Environmental Feature	Impacts and Mitigation
Natural Environment	Street trees	Construction activities have potential to impact trees in the area of impact. A tree survey and inventory within the proposed municipal right-of-way should be completed during detailed design, including documentation of trees with a diameter at breast height of 10 centimeters or greater. A Landscape Plan is to be prepared following detailed design. This Landscape Plan should incorporate planting of native trees within the boulevard, where possible.
	Brown's Woods	A 10 m vegetation protection zone is required for Woodlands under Section 4.1.3.6.5 of the City of Guelph Official Plan (2021). If there is encroachment into Brown's Woods and Butternut trees are found and are to be injured or killed, following registration and submission of a notice Butternut impact form under *O.Reg 830/21*, compensation plantings or payment to the Species at Risk Conservation Fund will be required.

Category	Environmental Feature	Impacts and Mitigation
	Wildlife	The establishment of buffers from natural heritage features is expected to minimize potential impacts to wildlife, including potential SAR habitat within the study area. Strategies to mitigate impacts to general wildlife prior to and during construction are provided within the EIS included in **Appendix H**.
	General	An Environmental Monitoring Plan is to be developed and carried out through the duration of construction activities on-site to review that the erosion and sediment control measures operate effectively and to monitor the potential impact, if any, upon the natural environment.

Category	Environmental Feature	Impacts and Mitigation
Water Resources	Drainage and stormwater management	Minimal increase in impervious surface area is anticipated. West of Edinburgh Road, the road width is being reduced to provide space for cycle tracks within the boulevard. This reduction in road width will require existing catch basins to be relocated to the proposed curb and gutter alignment. East of Edinburgh Road, the cycle facilities will primarily be located within the existing roadway width. Some increase in impervious area is anticipated at protected intersections; capacity of the existing storm sewer to capture the increased impervious area will need to be assessed during the detailed design phase. Opportunities to incorporate LID measures within the study corridor should be explored through the ongoing Stormwater Management Master Plan update. Preliminary identification of opportunities and potential locations for LID measures is included in **Appendix E**.
	Source water	Potential for impacts to source water due to construction activities within sensitive areas throughout the study corridor. A groundwater study should be completed during detailed design to determine potential impacts, mitigation measures, and permitting requirements (if any).

Category	Environmental Feature	Impacts and Mitigation
Socio-Economic Environment	Property impacts	Potential property impacts have been identified west of Vanier Drive and at proposed protected intersections. Opportunities to reduce property impacts should be explored during detailed design. Consultation with impacted property owners should be completed during detailed design when the area of impact is confirmed.
	Construction-related disruptions	Implementation of the cycling facilities will cause localized disruptions during construction, including lane closures on College Avenue and at intersections, as well as noise, vibration, and dust. Traffic control measures are required to follow Ontario Traffic Manual – Book 7. Noise control measures including timing restrictions and standard mitigation measures should be developed during detailed design and incorporated into the construction contract in accordance with the local noise by-law. If public complaints are received during construction, they should be addressed as required. Construction adjacent to the University of Guelph should be limited to months when the school is not in session. Construction timeframes should be discussed with, and agreed to, by the University.

Category	Environmental Feature	Impacts and Mitigation
Cultural Environment	Built heritage resources and cultural heritage landscapes	No direct impacts to known or potential cultural heritage resources are anticipated. Potential for vibration impacts and accidental impacts is low; however, the location of all identified built heritage resources and cultural heritage landscapes outlined in **Appendix K** should be considered in decisions regarding construction laydown. Locations of heritage properties should be clearly marked on all project mapping and workers should be made aware of heritage properties in the vicinity of their workspace. As design and construction of the cycling facilities progresses, design should continue to avoid encroachment onto the heritage properties identified in **Appendix K**. Should it be determined that there is no other technically feasible location for infrastructure, encroachment should be minimized. Significant changes to design in the vicinity of the heritage properties listed in **Appendix K** should be reviewed for potential impacts to the cultural heritage value or interest or heritage attributes of identified cultural heritage resources.

Category	Environmental Feature	Impacts and Mitigation
	Archaeological resources	Potential for impacts to archaeological resources within portions of the study area that retain archaeological potential (**Appendix J**). Within these areas, Stage 2 test pit surveys at 5 m intervals are required in accordance with Section 2.1.2 of the Standards and Guidelines for Consultant Archaeologists (Ministry of Heritage, Sport, Tourism and Culture Industries, 2011). Should deeply buried archaeological materials be encountered during construction, all work must cease, and a professionally licenced archaeologist shall be consulted to assess the cultural heritage value and significance of any such archaeological deposits.
Engineering	Utilities	Coordination with affected utilities is required during detailed design when impacts are known.

5.5 Implementation Plan

This section summarizes the recommended phasing for construction of the project. Further details are presented in the Implementation Phasing Memo (**Appendix P**; Dillon, March 2023). The memo presents the project limits and phasing for the College Avenue study corridor as part of a larger program of construction including AAA cycling improvements on Gordon Street and Eramosa Road.

It is recommended the improvements to the College Avenue study corridor be divided into two segments, both of which would be constructed in advance of the facilities on Gordon Street and Eramosa Road. The segment from Caledonia Street to Dundas Lane is to be completed first, followed by the segment from Janefield Road to Caledonia Street.

An important consideration in the recommended phasing is to include the intersection reconstructions within each phase. This approach provides for safe continuity of the facilities through complex intersections, and offers safe transition points to the existing on-street facilities.

6.0 Recommended Future Work

This section summarizes work that is recommended to be completed as the project advances through the detailed design stage prior to construction.

6.1 Additional Recommended Studies

The following additional studies are recommended to be completed prior to construction:

- Complete a detailed topographical survey of the corridor within 5 m of the right-of-way mid-block and within 10 m of the right-of-way at protected intersections at a minimum;
- Review public comments regarding the conceptual design and adjust the design where appropriate to address concerns;
- Conduct a Tree Inventory and develop a Tree Protection Plan for lands within the proposed municipal right-of-way, including documentation of trees with a diameter at breast height of 10 centimeters or greater;
- Explore opportunities to incorporate LID measures within the study corridor through the ongoing Stormwater Management Master Plan update;
- Conduct a geotechnical and groundwater study ahead of detailed design to determine potential impacts, mitigation measures, and permitting requirements (if any) to minimize source water impacts as well as to inform design of LID measures;
- Stage 2 archaeological assessment is required within portions of the study area that retain archaeological potential, including consultation with First Nations;
- Significant changes to the design in the vicinity of the heritage properties listed in **Appendix K** (if any) should be reviewed for potential impacts to the cultural heritage value or interest or heritage attributes of identified cultural heritage resources;
- A lighting study should be completed to assess and confirm that existing streetlight light levels are sufficient to meet cyclist and pedestrian needs;
- Updated utility information should be compiled and reviewed as a component of detailed design. A minimum Subsurface Utility Engineering investigation with level of Accuracy Level B is recommended.

- A traffic impact study should be completed ahead of the detailed design of protected intersections to confirm vehicular lane requirements and assess the need and feasibility of implementing right on red turn restrictions;
- Detailed design of AAA cycling infrastructure should include consideration for multiple design vehicle types, including recumbent bicycles; and
- An investigation into pedestrian and cyclist crossing demand at the intersection of College Avenue and Caledonia Street/Smith Lane should be completed to determine if a signalized crossing or intersection is warranted.

6.2 Consultation

The following consultation activities are recommended to be completed as the project proceeds through detailed design:

- Engage with the University of Guelph starting at the 30 percent design level, particularly on matters related to property impacts, streetscaping, and construction access;
- Consult with impacted property owners regarding required property acquisition;
- Engage the Indigenous communities contacted as part of this study prior to conducting further archaeological work to determine their level of interest and involvement; and
- Consult with affected utility companies during detailed design when utility impacts are known.

6.3 Anticipated Permits and Approvals

It is anticipated that the following approvals will need to be obtained prior to construction start:

- A letter from the Ministry of Citizenship and Multiculturalism indicating that the required archaeological assessment report(s) have been entered into the Ontario Public Register of Archaeological Reports is required prior to any ground disturbance; and
- The requirement for an Environmental Compliance Approval from the Ministry of the Environment, Conservation and Parks should be confirmed during detailed design.

6.4 Construction Monitoring

Construction monitoring requirements should be developed during detailed design once project specific details are determined and in accordance with any permits, approvals, licenses, or authorizations obtained prior to construction. If, during detailed design or construction, changes are required to identified mitigation measures, they should be implemented through provisions in the construction contract as administered by the contract administrator.