Creation of Cambridge Zone 1W Pressure Zone Environmental Assessment

Project File

Prepared by GM BluePlan for:

Region of Waterloo

Project No. 716015

May 2017

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List of Abbreviations

ADD	Average Day Demand
ANSI	Area of Natural and Scientific Interest
ATRIS	Aboriginal and Treaty Rights Information System
BMP	Best Management Practices
BPCS	Booster Pump and Chloramination Station
Cam 1	Cambridge Pressure Zone 1
Cam 1A	Cambridge Pressure Zone 1A
Cam 1W	Cambridge Pressure Zone 1W
Cam 2E	Cambridge Pressure Zone 2E
Cam 2W	Cambridge Pressure Zone 2W
Cam 3	Cambridge Pressure Zone 3
CHER	Cultural Heritage Evaluation Report
CMH	Cambridge Memorial Hospital
CNR	Canadian National Railway
CPR	Canadian Pacific Railway
DGSSMS	Design Guidelines and Supplemental Specifications for Municipal Services
DWWP	Drinking Water Works Permit
EA	Environmental Assessment
EAA	Environmental Assessment Act
ESA	Environmental Site Assessment
ESR	Environmental Study Report
ET	Elevated Tank
FF	Fire Flow
FUS	Fire Underwriters Survey
GRCA	Grand River Conservation Authority
GRT	Grand River Transit
GIS	Geographic Information System
ha	Hectares
HGL	Hydraulic Grade Line
IUS	Integrated Urban System
km	Kilometers
L/s	Liters per second

LRT	Light Rail Transit
M	Million
m	Meters
max	Maximum
MCEA	Municipal Class Environmental Assessment
MDD	Maximum Daily Water Demand
min	Minimum
MNF	Minimum Nighttime Flow
MNRF	Ministry of Natural Resources and Forestry
MOE	Ontario Ministry of the Environment
MOECC	Ontario Ministry of the Environment and Climate Change
O&M	Operations and Maintenance
PCC	Public Consultation Centre
PHD	Peak Hour Demand
ppm	parts per million
PPS	Provincial Policy Statement
PRV	Pressure Reducing Valve
PS	Pumping Station
PSW	Provincially Significant Wetland
RoW	Region of Waterloo
SCADA	Supervisory Control and Data Acquisition
SOP	Standard Operating Procedure
TCE	Trichloroethylene
TSSA	Technical Standards and Safety Authority
WM	Watermain
WSDOMP	Water Supply and Distribution Operations Master Plan
WSS	Well Supply System
WTP	Water Treatment Plant

Executive Summary

The Region of Waterloo has undertaken a Schedule B Municipal Class Environmental Assessment (Class EA) in support of creating a new Cambridge 1 West Pressure Zone (Cam 1W) through several infrastructure improvements. The new pressure zone is needed to address several opportunities and challenges within a study area generally bounded by Hespeler Road to the east, Highway 401 to the north, and the Grand River to the west.

These opportunities and challenges include:

- Certain areas in Preston experience low water pressure;
- An emergency high water demand incident may result in the mixing of chlorine and chloramine – which is undesirable;
- Improving flow capacity will support water pressure levels and fire flow capacity throughout the study area;
- Enabling the lowering of the Cambridge 1 hydraulic grade line (HGL) will enhance the operation and efficiencies of the Turnbull Reservoir; and,
- Changing of the pressure zone secondary disinfection residual will enable operational flexibility and improve overall security of water supply to the Preston area.

This Class EA study follows the completion of the *Water Supply and Distribution Operations Master Plan* (2013) and *the Implementation Plan for Cambridge Water System Upgrades* (2015) which identified a number of key system and operational issues within Cambridge and proposed a series of upgrades to the Cambridge water system. The improvements recommended in the Implementation Plan that are relevant to this Class EA study include:

1. The need for a new Pressure Reducing Valve (PRV) at the existing Kress Hill Pump Station, which may include yard piping re-configuration to accommodate the new PRV, and full decommissioning of the Kress Hill Pumping Station.
2. Creation of a new Cam 1W Pressure Zone comprising a low lift booster pumping and chloramination station, and supporting trunk watermain to create a new pressure zone, Cam 1W.

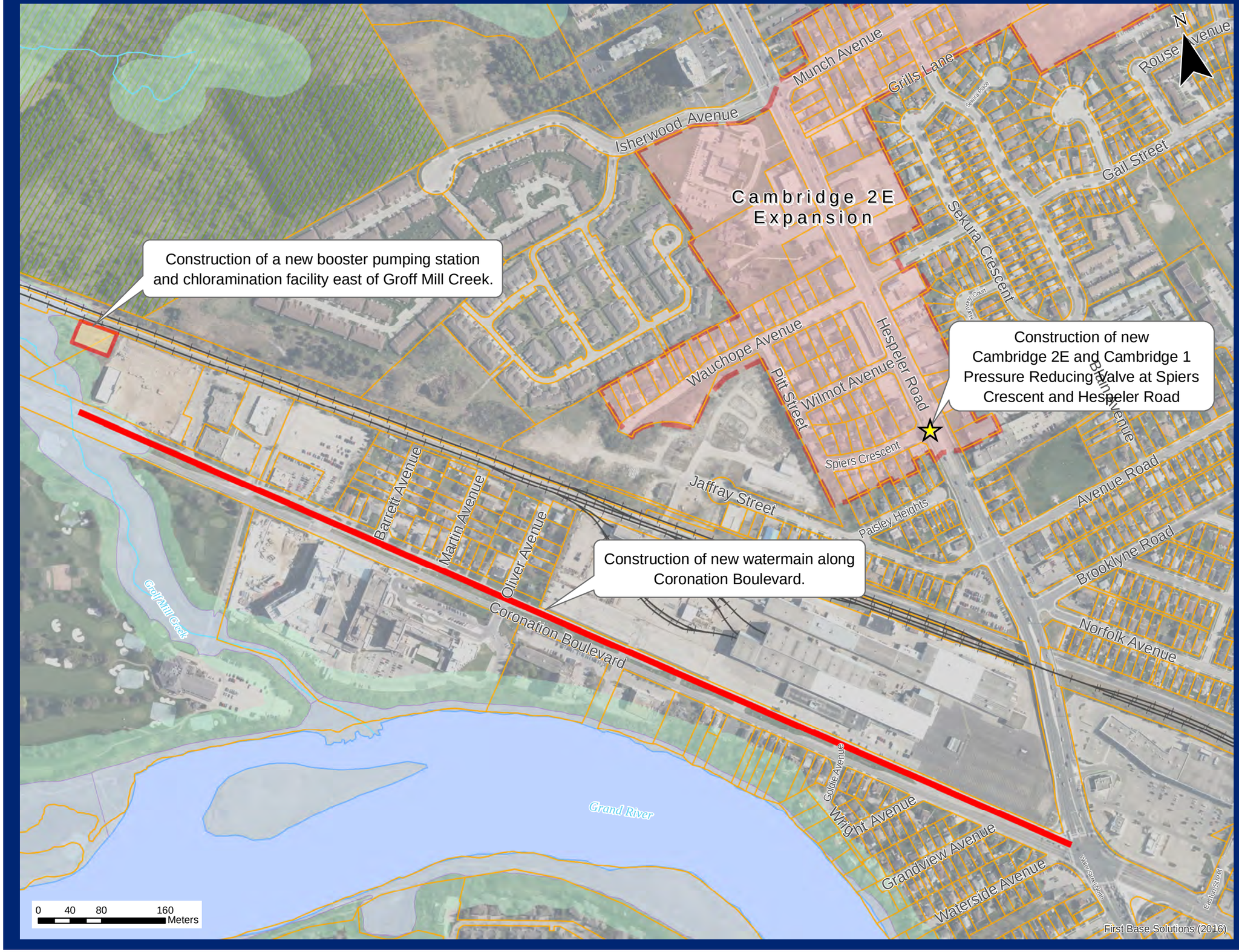
Through completion of the Schedule B Class EA Phase I and Phase II process, this study identified baseline conditions and identified alternative solutions to address the study

area's opportunities and challenges by addressing the operational requirements while also considering the existing natural, social and economic environments. Through a rigorous evaluation process, the Region recommended a number of infrastructure improvements. These improvements will lead to the creation of a new Cam 1W Pressure Zone which reflects the input from public and review agencies.

The recommended improvements included the following:

- **Construction of a new watermain along Coronation Boulevard** to provide redundancy and security of supply to the future Cam 1W Pumping and Chloramination Station and security of supply to the Cambridge Memorial Hospital. The new watermain will be sized to provide peak flows to the pumping station, and will be constructed within the Coronation Boulevard right-of-way adjacent to the existing watermain;
- **Construction of a new booster pumping station and chloramination facility** adjacent to Coronation Boulevard and east of Groff Mill Creek to serve as the primary source of water to the Cam 1W Pressure Zone system;
- **Re-purpose the existing Kress Hill Pumping Station as a PRV station** which will provide system redundancy for Cam 1W and minimize implementation costs while providing operations with additional space, allowing for ease of future inspection and maintenance;
- **Construction of New Cambridge 2E and Cambridge 1 PRV** at Spiers Crescent, which will allow for the implementation of the proposed Cambridge 1 (Cam 1) Pressure Zone boundary adjustment and will strengthen the security of supply within the Cambridge water system; and,
- **Implementation of the New Cambridge 1W Pressure Zone**

Figure 1 illustrates the recommended infrastructure improvements that will establish the new Cam 1W Pressure Zone.



Region of Waterloo

Creation of Cambridge Pressure Zone 1W Class EA

Figure 1

Recommended Infrastructure Improvements

- Railway
- Preferred Alignment
- Preferred Pumping Station Site
- Cam 2E Expansion

Environmental Features

- Creeks
- Rivers
- Grand River Conservation Authority Limits
- Dumfries Conservation Area
- Regulatory Floodplain

BluePlan ENGINEERING

716015-25-W-Preferred Site and Alignment
May 2017
Data Source: Region of Waterloo
Scale: 1:4,560 | NAD 1983 UTM Zone 17N

The proposed Cam 1W operational strategy will utilize the new booster pumping station and chloramination facility as the primary zone supply, drawing water directly from the existing Cam 1 Pressure Zone. The station will raise the operating pressures within the Cam 1W Pressure Zone, addressing low pressure issues and improving fire flow capacity. Further, the new Cam 1W will utilize chloramine for secondary disinfection. This change in secondary disinfection from free chlorine to chloramine will allow the Cam 1W Pressure Zone to be supplied from existing adjacent pressure zones of Cambridge 2W (Cam 2W) and Kitchener 2E (Kit 2E) - both chloraminated zones - without current disinfection residual mixing and water quality issues. The Cam 1W operational strategy also utilizes a new Kress Hill PRV station, replacing the existing Kress Hill Pump Station, and the existing Dundee PRV to provide fully redundant supply to the Cam 1W Pressure Zone. These PRVs will provide enhanced supply security and operational flexibility to the Cam 1W Pressure Zone. In addition to allowing for the implementation of the Cam 1 zone boundary adjustments the new Cam 2E to Cam 1 PRV at Spiers provides additional emergency supply capacity to the Cam 1W booster pumping and chloramination station and new trunkmain.

Chloramination is a proven method for secondary disinfection that has been in place for several years in the majority of the Region's Integrated Urban Water System (IUS), including all of Kitchener, Waterloo, Woolwich, and parts of Cambridge. Similar to chlorinated water, chloraminated water at controlled levels is safe for general use in cooking and drinking, pregnant women, infants and children, and individuals on low-sodium diets. Generally, all users who are sensitive to chlorinated water will be sensitive to chloraminated water. As such, the change to chloramination is not anticipated to affect any new users when compared to chlorinated water. However, existing sensitive users will need to make changes to their current de-chlorination method to account for the de-chloramination process.

During this Municipal Class EA, the Region of Waterloo worked closely with key stakeholders to address and resolve key issues or challenges associated with this study. However, not all issues can be addressed within the context of the Municipal Class EA process since the design of the recommended strategy has been prepared at a conceptual level only. As a result, the Region of Waterloo has identified a list of permits, approvals and commitments as the study moves forward into detailed design and construction.

Documentation of this Schedule 'B' Municipal Class EA study process is contained within this Project File. Key elements of the Class EA process as documented in this report, include:

- Introduction and study background (Section 1)
- Overview of the Municipal Class EA process (Section 2)
- Summary of existing conditions (Section 3)
- Overview of the technical requirements that exist in the study area (Section 4)
- Identification and evaluation of potential strategies and improvements to address the problems and opportunities, and proposed recommended solutions (Section 5 and Section 6)
- Summary of converting the disinfection residual type from free chlorine to chloramine (Section 7)
- Estimated costs of implementing the recommended solutions (Section 8)
- Permits and approvals anticipated in advance of implementing the recommended solutions (Section 9)
- Summary of the Public Consultation and Communication process (Section 10)
- Conclusions and follow-up commitments for the design and construction of the recommended solutions (Section 11)

1 Introduction and Background

1.1 Background

In 2013, the Region of Waterloo completed the Water Supply and Distribution Operations Master Plan and Water Supply Master Plan to develop a water supply and water distribution strategy to support the long-term growth of its Integrated Urban Water System. A key finding of the Water Supply Master Plan was that current and planned local water sources were sufficient to meet demands beyond 2031, and that development of the previously planned Lake Erie based supply was not needed until beyond 2051. As such, the Water Supply and Distribution Operations Master Plan's recommendations focused on capital projects, system modifications, and operational changes to improve, optimize, and strengthen the Integrated Urban Water System.

A second key finding of the Water Supply Master Plan was that there was limited surplus capacity from the Mannheim Water Treatment Plant supply aquifers, and therefore growth beyond 2031 would depend on maximizing the remaining available supply capacity within the Integrated Urban Water System. To achieve this objective, the Water Supply Master Plan supply management strategy focused on maximizing the City of Cambridge supply while limiting flow transfers from the Integrated Urban Water System into Cambridge.

In support of both Master Plans, the Region recommended several system improvements and capital projects for the Cambridge water system and developed an Implementation Plan for the Cambridge water system upgrades. The Implementation Plan identified eight major water system upgrade projects including the creation of a new Cam 1W Pressure Zone.

Project #1	Cam 3 Capacity Upgrades
Project #2	**New Kress Hill PRV**
Project #3	**Creation of New Cam 1 West Pressure Zone**
Project #4	Cam 1 Pressure Zone Change
Project #5	Pinebush Re-Configuration
Project #6	Rahmans Wells Re-Configuration
Project #7	New Hespeler WTP
Project #8	New Cam 2W Booster Pumping Station

The **Creation of New Cam 1 West Pressure Zone** is integral to the overall Cambridge Water System Upgrade Strategy with its completion allowing for the implementation of many of the remaining water system upgrade projects. For the purposes of this Class EA, both Project #2 and Project #3 have been consolidated into a single overall project.

1.2 Study Purpose and Objectives

In support of creating a new Cam 1W Pressure Zone, the Region of Waterloo initiated a Schedule 'B' Municipal Class Environmental Assessment (EA). The Municipal Class EA is a decision-making and planning process that ensures potential effects of a project are identified, documented and managed prior to implementation. As such, the creation of a Cam 1W Pressure Zone has been studied under this standardized planning process.

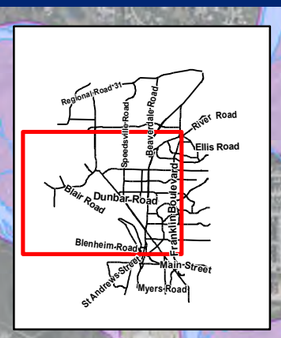
To identify infrastructure requirements and system modifications needed to create the new pressure zone, the following tasks will be undertaken:

- Confirmation of the new pressure zone operational configuration;
- Identifying and sizing of new infrastructure, system modifications, and operational changes;
- Identifying the infrastructure and locations required to support the new pressure zone, including a new Booster Pumping and Chloramination Station (BPCS), trunk watermain alignment, and Pressure Reducing Valves (PRVs); and,
- Preparing the environmental screening report and Project File.

1.3 Project Study Area

Figure 2 illustrates the proposed Cam 1W Pressure Zone and focus areas of infrastructure improvements. The New Cam 1W Pressure Zone will consist of the existing Cam 1 Pressure Zone within the historic Preston area of Cambridge. The new Cam 1W Pressure Zone will be roughly bound by Hespeler Road to the east, Highway 401 to the north, and the Grand River to the west. The southern limit of the pressure zone will be established as part of the Class EA and will be separated from the Cam 1 Pressure Zone by the new Cam 1W BPCS.

The Cam 1W Pressure Zone consists of a mature neighbourhood that comprises many land uses. At the western limit is Conestoga College, to the east is an industrial area, and the remaining land use is generally residential. The low points of the study area are along Speed River and Grand River (including Speedville Road area and Dover Street South, at 273 m), with high points along Kitchener Drive, east of Shantz Hill (at 303 m).



Freeport Elevated Tank

Cambridge Zone 2 (W)

KIT 2 (E)

Kress Hill Pressure Reducing Valve

City of Kitchener
City of Cambridge

Cambridge Zone 2 (E)

H3

Dundee PRV

City of Cambridge
Township of North Dumfries

Coronation - Hespeler Corridor

Turnbull

G4 Well

Cambridge Zone 3

Cambridge Zone 1

Shades Mill

0 0.25 0.5 1 Kilometers

First Base Solutions (2016)

N

Region of Waterloo

Creation of Cambridge Pressure Zone 1W Class EA

Figure 2

Focus Area

- Existing Facilities
- Railway
- Focus Area
- Existing Pressure Zone
- Municipal Boundary

Environmental Features

- Creeks
- Rivers
- Grand River Conservation Authority Limits
- Dumfries Conservation Area
- Regulatory Floodplain

BluePlan Engineering

716015-8-W-Focus Area
May 2017
Data Source: Region of Waterloo
Scale: 1:30,769 | NAD 1983 UTM Zone 17N

The study area includes a number of important features, including:

- Dumfries Conservation Area;
- CN / CP railroad tracks;
- Grand River, creeks, and floodplain;
- Cambridge Memorial Hospital; and
- Frito-Lay Incorporated.

For purposes of this assessment, the study area was comprised of two focus areas where infrastructure improvements were assessed: the existing Kress Hill Pumping Station site and the Coronation-Hespeler Corridor.

1.3.1 Focus Area No. 1 - Existing Kress Hill Pumping Station Site

The existing Kress Hill pumping station site is located along Fountain Street North in Cambridge. It was built to supply Cam 2W from Cam 1; however, it became redundant once the Freeport Elevated Tank went into service and is no longer required. The Kress Hill Pumping Station is currently under consideration to be decommissioned and torn down in order to reduce the amount of facilities managed by the Region. Given the amount of yard piping that will continue to remain in service, it will not be practical to sell off all or part of the existing site for private use, even though the existing facility occupies more land than is necessary to accommodate the new Kress Hill PRV Station.

However, the new PRV Station may benefit from a heated building to house the monitoring and communications equipment, and a dry chamber space to accommodate and maintain the zone boundary valves. There is also potential cost savings to adapt and re-use the existing site infrastructure, including the existing surplus pump station building which maintains these dry, heated spaces, to support the New Kress Hill PRV Station.

1.3.2 Focus Area No. 2 - Coronation-Hespeler Corridor

The *Water Supply and Distribution Operations Master Plan* and *Implementation Plan for Cambridge Water System Upgrades* identified the southern limit of the new Cam 1W Pressure Zone along the Coronation-Hespeler corridor – an area roughly bound by Hespeler Road to the east, the Grand River to the south, Bishop Street to the west, and the existing rail corridor and Isherwood Avenue to the north.

It is within this general corridor that a majority of the new Cam 1W infrastructure would be constructed, including:

- Cam 1W BPCS;
- New Trunk Watermain; and,
- New Cambridge Hespeler Road 2E to Cam 1 PRV.

1.4 Relevant Plans, Studies and Regulations

The following plans, policies and regulations served as the foundation for this Class EA. The documents below identified the need for the creation of a new Cam 1W Pressure Zone and clarified the scope of the study.

1.4.1 Provincial

1.4.1.1 Provincial Policy Statement

The Provincial Policy Statement (PPS) provides policy direction on matters of provincial interest related to land use planning and development. As a key element of Ontario's policy-led planning system, the Provincial Policy Statement sets the policy foundation for regulating the development and use of land. It provides for appropriate development while protecting resources of Provincial interest, public health and safety and the quality of the natural environment.

1.4.1.2 Places to Grow

The Places to Grow Growth Plan for the Greater Golden Horseshoe (2006) provides a 25 year framework for implementing the Province of Ontario's vision for managing growth to 2031. The plan was prepared under the Province's Place to Grow Act, 2005 and includes several guiding principles. The Growth Plan has been amended twice since its release in 2006. The first amendment was released in January 2012 and contains new policies, schedules and definitions that apply in the Simcoe sub-area. The second amendment was released in June 2013 to update and extend the Growth Plan's vision, policies and population and employment forecasts to 2041 to help communities across the region better plan for growth and development in a sustainable way.

1.4.1.3 Water Opportunities and Conservation Act

The Ontario Government passed the **Water Opportunities and Conservation Act** in 2010. The **Act** requires certain municipalities, persons and entities prepare, approve and submit to the Minister of the Environment and Climate Change sustainability plans for municipal water services, wastewater services and stormwater services under their jurisdiction. The Minister may establish performance indicators and targets for these services. The *Act* also authorizes the creation of regulations requiring public agencies to

prepare water conservation plans, achieve water conservation targets, and consider technologies, services and practices that promote the efficient use of water while reducing impacts on Ontario's water resources.

1.4.2 Regional

1.4.2.1 Region of Waterloo Official Plan

The Regional Official Plan (ROP) contains the planning policies needed to direct growth and change in Waterloo Region over the next 20 years. The ROP is a legal document required by the Provincial Planning Act that combines the broad policy and regulatory framework established by the Province of Ontario with the community planning goals, objectives and policies developed by the Region and the seven area municipalities to ensure Waterloo Region is a sustainable and livable community. All future land-use development, transportation and infrastructure within Waterloo Region must conform to the policies, goals and objectives of the ROP.

The ROP recognizes that infrastructure planning and management requires the Region to consider opportunities to reduce the demand for additional infrastructure and to optimize the use of existing infrastructure. In addition, infrastructure can be used to help reshape Waterloo Region's urban form, create healthy, sustainable, safe and accessible communities and maximize the potential to capitalize on economic opportunities. In accordance with the provision of the Municipal Act, the responsibilities for planning and managing infrastructure are shared among the Federal and Provincial governments, the Region, Area Municipalities and other agencies.

Among the key objectives of the ROP is to:

"Manage municipal drinking-water supply systems using a comprehensive, integrated approach that reduces water demand, achieves efficiency of water use and protects, improves or restores the water quality and quantity."

1.4.2.2 Water Efficiency Master Plan (2015-2025)

The Region of Waterloo's Water Efficiency Master Plan is a key component of its overall strategic approach to water conservation planning. The previous Water Efficiency Master Plan update (2007-2015) resulted in significant water savings – 42% ahead of the target for 2011, and exceeded the 2015 target of 8,146 $\mathrm{m}^3/\mathrm{day}$. These water savings resulted in reduced costs, lower greenhouse gas emissions, and contributed to the deferral of large water infrastructure projects.

The 2015-2025 Water Efficiency Master Plan identified new initiatives and program enhancements to improve water efficiency across all sectors, especially given the Region's population growth and increasing water demands.

1.4.2.3 Water Supply and Distribution Operations Master Plan (2013)

The Region of Waterloo's Integrated Urban Water System provides potable water supply to the Cities of Cambridge, Kitchener, Waterloo as well as surrounding communities of Elmira, St. Jacobs and Breslau in the Township of Woolwich, and some parts of the Townships of Wilmot and North Dumfries.

In 2010, the Region initiated an update to the Water Supply and Distribution Operations Master Plan (WSDOMP). This update was completed in 2013 to govern the long-term management of the integrative system that provides many water sources, treatment plants, water storage facilities, and a complex network of water mains. This update resulted in net reduction of $44 million in projected capital spending on water infrastructure over the next 10 years, as compared to the previous Master Plan. This reduction in capital needs resulted primarily from increased water efficiency and a declining trend in municipal water usage throughout the Region.

This updated project also included an assessment of the annual greenhouse gas emissions from all Region water infrastructure. This assessment provided the Region with a baseline greenhouse gas emission inventory, which will allow the Region to quantify the reduction potential of proposed alternatives for infrastructure improvement projects.

1.4.2.4 Implementation Plan for Cambridge Water System Upgrades (2015)

The Implementation Plan was a follow-up study to the "Water Supply and Distribution Operations Master Plan" which identified a number of key system and operational issues within Cambridge and proposed a series of upgrades to the Cambridge water system. The goal of the study was to evaluate and refine the proposed upgrade projects before the Region proceeded with implementation. In order to support the Cambridge Optimization Strategy out to 2031, the following key upgrade projects were proposed for the Cambridge Water System, including projects relevant to this Class EA study **(as illustrated in items 2 and 3 below):**

1. **Cambridge 3 Storage, Transmission, & Supply Upgrades:** Increasing the existing Permit to Take Water at Wells G4/G4A. Also included is potential treatment capacity upgrades on the existing G4/G4A treatment building. Constructing a new elevated storage tank in the Cambridge 3 (Cam 3) Pressure

Zone and upgrades to the existing watermain. Also includes decommissioning of the existing Inverness water storage and rehabilitation and re-configuration of the St. Andrews Pumping Station and storage.

2. **New Kress Hill Pressure Reducing Valve:** New PRV near the existing Kress Hill Pump Station. Also includes yard piping re-configuration to accommodate the new PRV, and full decommissioning of the Kress Hill Pumping Station.
3. **Creation of New Cam 1W Pressure Zone:** A proposed low lift BPCS, and supporting trunk watermain, to separate the proposed Cam 1W Pressure Zone.
4. **Cambridge 1 Pressure Zone Change:** Pressure Zone boundary adjustment along Cam 1/Cam 3 and Cam 1/Cam 2E boundary including new trunk watermains, local watermains, and new PRVs to support the pressure zone boundary adjustment and Cambridge Pressure Zone 1 target HGL. Also includes transfer of Shades Mill WTP to Cambridge 1a and reconfiguration of Middleton PS operational to support the new Pressure Zone 1 target HGL.
5. **Pinebush Re-Configuration:** Re-directing Pinebush WTP discharges to the Cambridge 2E Pressure Zone.
6. **Rahmans Wells Re-Configuration:** Consists of the consolidation of Rahmans (P09 and P15) and G5 wells to a central chlorine dosing facility on the existing Rahmans site. New facility will supply water to Cam 2E Pressure Zones. Also includes the decommissioning of the Rahmans Reservoir and Pump Station
7. **New Hespeler Water Treatment Plant:** Upgrade existing Hespeler well capacity and consolidate treatment to a new water treatment facility.
8. **New Cambridge 2W BPCS:** Consists of new BPCS to support the transfer of flows from Cam 2E to Cam 2W.

1.4.2.5 Region of Waterloo Design Guidelines

The Region of Waterloo's design guidelines and contract specifications facilitate the design and construction of municipal services by consultants and contractors that work in more than one municipality. The Region of Waterloo and Area Municipal Design Guidelines and Supplemental Specifications for Municipal Services are supplemental to the Ontario Provincial Standards and thus take precedence over the related specifications and drawings. The municipal services currently considered are: watermains, sanitary sewers, and storm sewers. The water and sanitary guidelines and specifications apply to distribution and collection only, and do not apply to supply and/or treatment.

2 The Municipal Class Environmental Assessment Process

2.1 Class Environmental Assessment Process

This Class EA study was completed as a Schedule 'B' undertaking in accordance with the requirements of the Municipal Class Environmental Assessment process (October 2000, as amended in 2007, 2011 and 2015). The Class EA process includes public and review agency consultation, evaluation of alternatives, an impact assessment of recommended alternative, and identification of measures to mitigate potential adverse effects.

2.1.1 Environmental Assessment Act

Ontario's *Environmental Assessment Act* (EAA) was passed in 1975 and was proclaimed in 1976.The EAA requires proponents to examine and document the environmental effects that could result from major projects or activities and their alternatives. Municipal undertakings became subject to the EAA in 1981.

The EAA's comprehensive definition of the environment is:

- Air, land or water;
- Plant and animal life, including human life;
- The social, economic and cultural conditions that influence the life of humans or a community;
- Any building, structure, machine or other device or thing made by humans;
- Any solid, liquid, gas, odour, heat, sound, vibration, or radiation resulting directly or indirectly from human activities; and,
- Any part of combination of the foregoing and the interrelationships between any two or more of them, in or of Ontario.

The purpose of the EAA is the betterment of the people of the whole or any part of Ontario by providing for the protection, conservation and wise management of the environment in Ontario (RSO1990, c.18, s.2). An EAA must also ensure that decisions result from a rational, objective, transparent, replicable, and impartial planning process.

As set out in Section 5(3) of the EAA, an EA document must include the following:

- A description of the purpose of the undertaking;
- The undertaking;
- The alternative methods of carrying out the undertaking; and,
- Alternatives to the undertaking.

The EA document must also include a description of:

- The environment that will be affected or that might reasonably be expected to be affected, directly or indirectly, by the undertaking or alternatives to the undertaking;
- The effects that will be caused or that might reasonably be expected to be caused to the environment by the undertaking or alternatives to the undertaking;
- The actions necessary or that may reasonable be expected to be necessary to prevent, change, mitigate or remedy the effects upon or the effects that might reasonably be expected upon the environment by the undertaking or alternatives to the undertaking; and,
- An evaluation of the advantages and disadvantages to the environment of the undertaking, the alternative methods of carrying out the undertaking and the alternatives to the undertaking (RSO1990, c.18, s.2).

2.1.2 Principles of Environmental Planning

The EAA sets a framework for a rational, objective, transparent, replicable and impartial planning process based on the following five key principles:

- **Consultation with affected parties.** Consultation with the public and government review agencies is an integral part of the planning process. Consultation allows the proponent to identify and address any concerns cooperatively before final decisions are made. Consultation should begin as early as possible in the planning process.
- **Consideration of a reasonable range of alternatives.** Alternatives include functionally different solutions, “alternatives to” the proposed undertaking and “alternative methods” of implementing the preferred solution. The “do nothing” alternative must also be considered.

- **Identification and consideration of the effects of each alternative on all aspects of the environment.** These aspects includes the natural, social, cultural, technical, and economic environments.
- **Systematic evaluation of alternatives in terms of their advantages and disadvantages to determine their net environmental effects.** The evaluation shall increase in the level of detail as the study moves from the evaluation of "alternatives to" to the evaluation of "alternative methods".

  Provision of clean and complete documentation of the planning process followed to allow "traceability" of decision-making with respect to the project. The planning process must be documented in such a way that it may be repeated with similar results.

2.1.3 Class Environmental Assessment

"Class" Environmental Assessments (Class EAs) were approved by the Minister of the Environment in 1987 for municipal projects having predictable and mitigable impacts. The Municipal Class EA process was revised and updated in 1993, 2000, 2007, 2011 and 2015. The Class EA approach streamlines the planning and approvals process for municipal projects that are:

- Recurring;
- Similar in nature;
- Usually limited in scale;
- Predictable in the range of environmental impacts; and,
- Responsive to mitigation.

THE CLASS EA – A FRAMEWORK FOR ENVIRONMENTAL PLANNING

The Class EA provides the framework for environmental assessment planning of municipal infrastructure projects to fulfill the requirement of the EA

The Municipal Class EA, prepared by the Municipal Engineers Association (October 2000, as amended in 2007, 2011 and 2015) outlines the procedures to be followed to satisfy Class EA requirements for water, wastewater, stormwater management and road projects.

The process includes five phases:

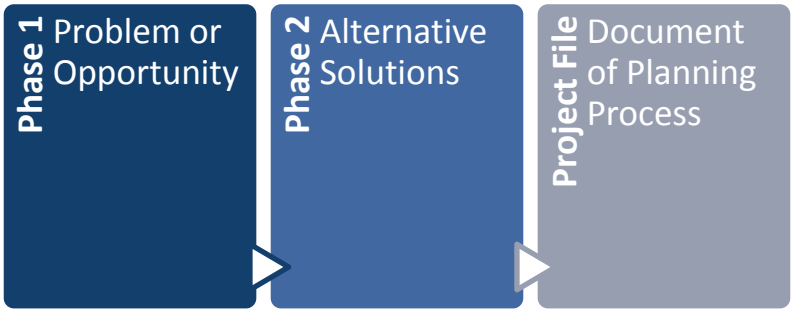
- **Phase 1: Problem or Opportunity Definition**;
- **Phase 2: Identification and Evaluation of Alternative Solutions** to Determine a Preferred Solution while taking input from the public and other stakeholders into consideration;
- **Phase 3: Examination of Alternative Methods** of Implementation of the Preferred Solution while taking input from the public and other stakeholders into consideration;
- **Phase 4: Documentation of the Class EA process** in the form of an Environmental Study Report (ESR) for public review; and
- **Phase 5: Implementation and Monitoring**.

Projects subject to the Class EA process are classified into following four "schedules" depending on the degree of the expected impacts.

Schedule A projects are minor or emergency operational and maintenance activities and are approved without the need for further assessment. These projects are typically smaller in scale and do not have a significant environmental effect.

Schedule A+ projects are also pre-approved; however, the public is to be advised prior to the project implementation. Although projects of this class do not usually have the potential for adverse environmental impacts, they tend to be broader in scale in comparison to Schedule A projects.

Schedule B projects require a screening of alternatives for their environmental impacts and Phases 1 and 2 of the planning process must be completed. The proponent is required to consult with the affected public and relevant review agencies. If outstanding issues remain after the public review period, any party may request that the Minister of the Environment consider a Part II Order, also known as bumping-up the project to a Schedule 'C' Class EA or an Individual EA. Provided that no significant impacts are identified and no requests for a Part II Order



to a Schedule ‘C’ or Individual EA are received, Schedule ‘B’ projects are approved and may proceed directly to implementation.

Schedule C projects must satisfy all five phases of the Class EA process. These projects have the potential for greater environmental impacts. Phase 3 involves the assessment of alternative methods of carrying out the project, as well as public consultation on the preferred conceptual design. Phase 4 normally includes the preparation of an Environmental Study Report (ESR) that is filed for public review. Provided no significant impacts are identified and no requests for Part II Order or “bump-up” to an Individual EA are received, Schedule ‘C’ projects are then approved and may proceed directly to implementation.

Given the nature of this project, the Municipal Class EA for the Creation of Cam 1W Pressure Zone is classified as a Schedule ‘B’ undertaking which includes the completion of Phases 1 and 2 of the Class EA process.

3 Existing Conditions

This section focuses on the existing servicing conditions and baseline features within the Class EA study area. The existing conditions listed below documented the opportunities and constraints within the proposed study area and helped define potential infrastructure improvements required to address system issues.

3.1 Water Supply Features and Characteristics

The Region of Waterloo is part of a two-tier water system in which it is responsible for the treatment and delivery of wholesale water to the local municipalities through the Integrated Urban Water System. The local municipalities are responsible for distributing the water to the local users.

The Integrated Urban Water methods system is a large and complex system that includes the Mannheim Water Treatment Plant, which receives 20% of its raw water from the Grand River via the Hidden Valley Pump Station located immediately downstream of the Highway 8 bridge. The remaining 80% of the Integrated Urban Water System is supplied through 83 groundwater production wells distributed throughout the system. The groundwater is treated either locally or at one of five nearby treatment and pump station facilities (which services a number of local wells), and is pumped directly into the Integrated Urban Water System.

Supporting the Integrated Urban Water System is a network of 220 kilometres of trunk watermains, 2,000 kilometres of local watermains, 21 storage facilities, and 20 pump stations, which supply 24 pressure zones. Due to the distributed nature of the Integrated Urban Water System supply sources, water from the various sources is pumped directly into the system and generally services the local area/pressure zone. However, there is some interconnectivity between adjacent pressure zones to allow for the transferring of water to meet demands.

The majority of Cambridge water demands are met by groundwater sources located within the City of Cambridge. However, supply to the northwest area of the Cam 1W Pressure Zone (Preston and Blair) is supplemented via connections to the City of Kitchener. The Cam 2W Pressure Zone (Preston, north of Highway 401) is almost entirely supplied by connections to Kitchener and the Freeport elevated tank.

The Cambridge system is distinct in that the majority of the system’s water uses free chlorine for secondary disinfection, while the remaining Integrated Urban Water System utilizes chloramine, including the Cam 2W Pressure Zone that is supplied via Kitchener.

Because of this difference in disinfection, the Region of Waterloo typically limits the transfer of water between the Cambridge free chlorine system and the Integrated Urban Water System remaining chloramine system. This separation under typical demand conditions limits some of the flexibility and redundancy provided by having an interconnected system. However, under emergency conditions, the Region will utilize these interconnections and allow the mixing of disinfection residuals in an effort to maintain system pressures and operations.

3.2 Natural Environment

This section summarized the findings of the desktop inventory completed by Golder and Associates. The completed reports are included in **Appendix C –** Natural Environment Report, **Appendix D –** Stage 1 and 2 Archaeological Assessment, and **Appendix E** – Cultural Heritage Assessment.

Appendix C – Natural Environment Report depicts the natural environment features within the study area. A summary of the key characteristics is provided below.

3.2.1 Terrestrial Environment

No natural features that have been designated provincially or federally, such as Provincially Significant Wetland (PSW) or Area of Natural and Scientific Interest (ANSI), were identified within the study area. One Conservation Area, Dumfries Conservation Area, occurs within the study area, north of Coronation Boulevard and the railway tracks. Based on criteria developed by both the City of Cambridge and Region of Waterloo Official Plans, the woodland located within the Dumfries Conservation Area may be considered a significant woodland.

3.2.2 Species at Risk

Based on the results of the desktop screening and field surveys, there is moderate potential for three bat species designated as endangered under the Endangered Species Act (ESA) to occur within the study area: tri-colored bat, northern myotis and little brown myotis. In addition, five species are designated as special concern under the ESA or considered a species of conservation concern (SOCC) with moderate to high potential to occur within the study area (see **Table 1**). These species do not have regulatory protection but must be considered under the Provincial Policy Statement (PPS) significant wildlife habitat criteria in the impact assessment of this Class EA study.

Table 1 Special Concern Species and Species of Conservation Concern

Common Name	ESA / SOCC Designations	Potential to Occur in Study Area
Monarch	Special concern designation for both	Moderate
Eastern Wood-pewee	Special concern designation under ESA	Low-to-Moderate
Red-headed Woodpecker	Special concern designation under ESA / threatened designation under SOCC	Moderate
Milksnake	Special concern designation under SOCC	Moderate
Woodland Flax	Imperiled provincial ranking	Moderate

3.2.3 Subwatershed

The study area includes a portion of the Grand River and its associated Regional Storm Floodplain, steep Valley/Erosion hazard Slopes. The study area is also traversed by Groff Mill Creek and its associated Regional Storm Floodplain, steep Valley/Erosion hazard Slopes. Both the Grand River and Groff Mill Creek and their associated regulation limit fall within the jurisdiction of the Grand River Conservation Authority (GRCA). Any work proposed within watercourses (including Groff Mill Creek), wetlands or waterbodies, or within the GRCA regulated limits, must be in compliance with the regulations of O. Reg. 150/06 Grand River Conservation Authority: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses.

3.2.4 Aquatic and Fish Habitat

Groff Mill Creek crosses Coronation Boulevard at the Galt Country Club, and is considered fish habitat. A portion of the woodland north of the railway tracks and north of Coronation Boulevard is mapped as an unevaluated wetland according to the Ministry of Natural Resources and Forestry (MNRF) Land Information Ontario. The Grand River exists southwest of Coronation Boulevard, located outside of the defined study area.

Although Groff Mill Creek historically supported coldwater species, it has since transitioned to a warmwater thermal regime. The creek now supports small-bodied

warmwater fish of minnow, dace and creek chub species, including common shiner (Luxilus cornutus), bluntnose minnow (Pimephales notatus), fathead minnow (Pimephales promelas), blacknose dace (Rhinichthys atratulus), creek chub (Semotilus atromaculatus), and pearl dace (Margariscus margarita) (Tupman 2004).

3.3 Archaeological and Built/Cultural Heritage Resources

3.3.1 Archaeological Assessment

A Stage 1 Archaeological Assessment (see **Appendix D)** indicated that potentially undisturbed portions of the study area were determined to exhibit archaeological potential due to:

- The identification of nine previously registered archeological sites within 300 meters of the study area.
- The location of an unnamed tributary of the Grand River that flows through the Study Area and the Grand River itself, which abuts the study area.
- The presence of well-drained soils at the western edge of the study area, and in the surrounding area.
- The fact that the study area overlies three historical transportation routes (Coronation Boulevard, Hespeler Road, CN Railway line) in Waterloo and North Dumfries Townships with a history of Euro-Canadian occupation beginning in the early 19th century.

Based on the combined results of the background research and property inspection, it was recommended that the potentially undisturbed portions of the study area relevant to the recommendations be subjected to a Stage 2 Archaeological Assessment. **Section 9.6** highlights the results of the Stage 2 Archaeological Assessment, which is also included in **Appendix D.**

3.3.2 Built / Cultural Heritage Assessment

The desktop cultural heritage screening report (see **Appendix E – Cultural Heritage Assessment**) determined that the study area contains known and potential cultural heritage resources, including:

- Six properties listed on the City of Cambridge Heritage Properties Register and protected under Section 27 of the Ontario Heritage Act:
  - ✓ 535 Dunbar Road

- ✓ 110 Blue Heron Ridge
- ✓ 140 Blue Heron Ridge
- ✓ 160 Blue Heron Ridge
- ✓ 435 Blue Heron Ridge
- ✓ 2156-2162 Coronation Boulevard

- Part of the St. Patrick Catholic Cemetery, established in 1864
- The Grand River, a Canadian Heritage River
- The Canadian Pacific Railway corridor, a historic corridor that carried the Galt and Guelph Railway (1857) and the Galt Preston and Hespeler Railway (1905)
- As many as 300 buildings and structures over 40 years old
- A tree planted in 1973 by the Preston Horticultural Society with a bronze plaque commemorating the visit of Queen Elizabeth II to Cambridge

To ensure that cultural heritage resources in the study area will not be adversely impacted by recommended solutions, proper planning will consider avoiding cultural heritage resources as much as possible.

3.4 Existing Transportation System

3.4.1 Road Network

The existing transportation network within the Cam 1W Pressure Zone study area includes a number of two lane residential streets in addition to three major roadways as described in **Table 2 Existing Road Network:**

Public Transportation

Public transit within the study area is operated by Grand River Transit (GRT). The transit route served by GRT operating within the study area includes:

- Route 51 - Hespeler
- Route 52 – Coronation
- Route 56 - Dunbar
- Route 61 - Fountain
- Route 64 – Langs

- Route 61 - Fountain
- Route 64 – Langs

Table 2 Existing Road Network

Street	Jurisdiction	Number of Lanes	Posted Speed
Coronation Boulevard	Region of Waterloo	Four lanes, a landscaped median boulevard and turning lanes at key intersections	60 km/h
Hespeler Road	Region of Waterloo	Four lanes and turning lanes at key intersections	60 km/h
King Street East	Region of Waterloo	Four lanes and turning lanes at key intersections	50 km/h

All efforts will be made by the design and construction team to work closely with GRT in order to minimize the impacts to traffic along the affected transit routes.

3.4.2 Railway Service

Canadian National and Canadian Pacific Railway currently operate freight traffic on a rail line that is located adjacent to Coronation Boulevard. The rail line is a crucial transportation corridor with up to 30 trains running per day, including serving Toyota Canada's Cambridge operations.

3.5 Existing Utilities

The study area within existing service boundary of the City of Cambridge and all local properties are serviced with local watermain, sanitary sewer collection, stormwater conveyance, natural gas, telecom and electrical services. The services are generally located within the existing road rights-of-way and utility service corridors needed to cross existing natural and physical features within the service area.

4 Technical Requirements and Decisions

4.1 Cambridge 1W Pressure Zone Operational Overview

As identified in **Technical Memorandum No. 1** (**Appendix B** – Technical Memorandum No. 1) the creation of a new Cam 1W Pressure Zone consists of the following new Regional infrastructure components:

- New Cam 1W BPCS to supply the new Cam 1W Pressure Zone HGL;
- New Kress Hill PRV, used as an additional supply to Cam 1W Pressure Zone;
- New trunk watermain along Coronation Boulevard to provide security of supply to the new pumping station and redundancy for the Cambridge Memorial Hospital; and,
- New Cam 2E to Cam 1 PRV on Hespeler Road to support security of supply to Cam 1.

Existing and proposed detailed system schematics are included in **Appendix A**.

The operational changes needed to implement the new Cam 1W Pressure Zone involves:

- Increasing the existing HGL within the new Cam 1W Pressure Zone from 332 metres to 337 metres;
- Changing the disinfection residual type in the Cam 1W Pressure Zone from free chlorine to chloramine; and,
- Reducing the existing HGL within the remaining Cam 1 Pressure Zone from 332 metres to between 324 and 326 metres, which will occur after the implementation of the Cam 1W HGL increase.

4.2 Cambridge 1 and Cambridge 1W Zone Boundary

The boundary separating the Cam 1 and Cam 1W Pressure Zones will be subject to the recommended Cambridge 1W Booster Pump Station location and new trunk watermain alignment. Both the WDSOMP and Implementation Plan identify the potential location as being generally within the Coronation Boulevard area between Hespeler Road and Concession Road.

A review of the Cambridge water system configuration and constraints generally confirms that separating the zone along Coronation Boulevard presents the only viable alternative as the simplified single trunk system is located between Cambridge Memorial Hospital

and Concession Road which includes the presence of a natural boundary to the north (Dumfries Conservation Area) and south (Grand River).

Attempting to place the zone boundary outside of this corridor is not viable due to the following challenges:

- It significantly complicates the zone re-alignment, including potential creation of new system dead-ends, and the need for new local watermains;
- The new watermain alignment needs to provide redundant supply to the Cambridge Memorial Hospital, which may not be feasible as the new watermain is outside of the Coronation Boulevard Alignment, and
- It increases the required infrastructure needed to support the zone separation.

These natural and system restrictions informed the selection of potential BPCS sites. The ultimate Cam 1W Pressure Zone boundary will be determined based on the preferred BPCS site location.

4.3 Cambridge 1W System Demands

4.3.1 Design Flow Considerations

The Cam 1W Pressure Zone will operate as a closed pressure zone. As such, the supply infrastructure, BPS and/or PRVs, will require sufficient operational flexibility to operate under all expected flow conditions including:

- Minimum Nighttime Flow (MNF)
- Average Day Demand (ADD)
- Peak Hour Demand (PHD)
- Maximum Day Demand + Fire Flow (MDD+FF)

4.3.2 Cambridge 1W Fire Flow

The Cam 1W fire requirements were estimated following a review of MOECC supply fire flow requirements and the Fire Underwriters Survey (FUS) guidelines. The FUS guidelines are variable and highly dependent on individual property and building configurations. Two approaches were used to identify the FUS Fire criteria for the Cambridge 1W Pressure Zone:

- Desktop FUS calculation of five critical system buildings
- Potential FUS fire flow range based on land use

Table 3 summarizes the design fire flow using the three different approaches.

Table 3 Cambridge 1W Fire Flow Analysis

Methodology	Design Condition		Fire Flow Target (L/S)
MOECC	MOECC Fire Flow (Future Cam 1W) ~ 37,500 total Equivalent Population		**368**
FUS - Desktop	1574 Eagle St. North	Hunt's Logistics – High Fire Flow Scenario	**554**
	Average calculated fire flow using both high and low fire flow scenarios		**340**
FUS – Land use	Industrial Land use	233 to 583 L/s Flow Range Expectation	**378**

In consultation with the Region and operations staff, the MOECC fire flow requirement of 368 L/s will be used as the design fire flow for the new Cambridge 1W Pressure Zone.

4.3.3 Confirmation of Cambridge 1W System Demands

A review of the Region's WSMP, the existing "All Pipes" water system model, historic water usage records, and the City of Cambridge 2014 water billing records confirmed existing system demand and projected future demand. The detailed system demand analysis is provided in **Table 4** summarizing the project system demands that will be used to confirm the design parameters. Note that in general, any projected growth within the zone is expected to be offset by the current trends in water conservation, with the net result being almost no change in design flows through 2031.

Table 4 Cambridge 1W Design Flows

Scenario	MNF (L/s)	ADD (L/s)	PHD (L/s)	MDD+FF (L/s)
Existing Demand	(ADD x Min Day Factor x Min Hour Factor) – 20%	Existing ADD	(ADD x Max Day Factor x Peak Hour Factor) + 20%	Existing MDD + FF
	30	**81**	**171**	**483**
Projected 2031 Demand	(Low 2031 ADD x Min Day Factor x Min Hour Factor) – 20%	2031 ADD	(2031 MDD x Peak Hour Factor) + 20%	2031 MDD + FF
	26	**83**	**173**	**484**

4.4 Cambridge 1W Target HGL Analysis

A system curve and HGL profile analysis were completed for the Cam 1W Pressure Zone to help identify the preferred Cam 1W target HGL. The analysis was conducted for each of the Cam 1W Pressure Zone feeds (new Cam 1W BPCS, new Kress Hill PRV, and existing New Dundee PRV) which reviewed the full range of expected flows.

The analysis targets the review of the critical points within the Cam 1W system. Cam 1W system performance was evaluated under varying typical and design fire flow conditions. This review was completed under the existing and proposed Cam 1W system configuration.

Further to the typical operating conditions, the system performance was reviewed under the extreme cases of the single Cam 1W source (new Dundee PRV, Kress Hill PRV, and new BPCS), to review the upper and lower operating limits and to identify the optimal PRV settings.

The Target HGL was then adjusted until it fit between the following pressure limits:

- Minimum pressure of 20 psi for MDD+FF;
- Target pressure of 50 to 80 psi;
- Minimum pressure of 40 psi under PHD, and;

- Maximum pressure of 100 psi under MNF.

Based on the system analysis, the Cam 1W Target HGL will be 337 m. The BPCS will be set to achieve the target 337 m HGL; the PRVs will have a slightly lower HGL target to avoid potential interference between the operations of the BPCS and PRVs. **Table 5** summarizes the set points for each of the supplies into Cam 1W. Further details on the BPCS and PRV set points are included in **Appendix B**.

Table 5 Target HGL and Corresponding Static Pressure Range

Facility	Target HGL (m)
New BPCS	337
New Kress Hill PRV	332
Existing New Dundee PRV	331

The operational set points should be further refined as part of the detailed design process. **Table 6** summarizes the expected Cam 1W operating pressures under the new Pressure Zone HGL of 337 m, contrasted against current system pressure.

Table 6 Existing and Future Performance under Zone Target HGL

		% of Customers within Pressure Range (psi)				
Scenario	**System Configuration**	**< 40**	**40 49**	**50 80**	**81 90**	**> 90**
MNF (Peak Pressure)	Existing (332 m HGL)	-	2	90	8	-
	Future (337 m HGL)	**-**	**3**	**91**	**6**	**-**
PHD (Minimum Pressure)	Existing (332 m HGL)	3	38	59	-	-
	Future (337 m HGL)	**-**	**3**	**93**	**4**	**-**

5 Phase 1 – Problem/Opportunities

The initial phase of the Municipal Class EA process is the development of a Problem / Opportunity Statement that documents the factors which lead to the conclusion that an improvement or change is needed. In other words, Phase 1 helps answer the question:

What is the justification for "X" to be undertaken?

For this Municipal Class EA study, the need for a new Cam 1W Pressure Zone arose from the need to support the *Implementation Plan for Cambridge Water System Upgrades* strategy which identified a number of key system and operational issues within Cambridge and proposed a series of upgrades to the Cambridge water system. The *strategy*, itself, was developed to support the recommendations made in the Region's 2013 *Water Supply and Distribution Operations Master Plan* and *Water Supply Master Plan* of its Integrated Urban Water System.

Based on the findings from the *Implementation Plan for Cambridge Water System Upgrades* strategy, as well as **Technical Memorandum No. 1** (*Background Review & Design Parameters Summary)* that identified baseline conditions for this study, the following water distribution opportunities and challenges exist within the study area:

- Certain areas in Preston experience low water pressure
- An emergency high water demand incident may result in the mixing of chlorine and chloramine – which is undesirable.
- Improved flow capacity will support improvements in water pressure levels and fire flow capacity throughout the study area
- Enabling the lowering of the Cam 1 HGL will enhance the operation and efficiencies of the Turnbull Reservoir
- Changing of the pressure zone secondary disinfection residual will enable operational flexibility and improve overall security of water supply to the Preston area

Recognizing these issues, the following statement was developed to capture the key water distribution challenges and opportunities in the study area:

"Optimize the existing water system to improve existing customer level of service while increasing overall security of supply and flexibility of system operations."

The Problem / Opportunity Statement was vetted through dialogue with residents and stakeholders to ensure the Region understood the opportunities and challenges associated with this study.

5.1 Cambridge 1W Pressure Zone Technical Objectives

This study has the following system objectives:

- Address existing low pressure issues within the Preston area;
- Allow for the disinfection residual change from free chlorine to chloramine in the new Cam 1W Pressure Zone by:
    - Flow-paced addition of ammonium sulfate at the proposed pumping station
    - Providing for the pressure zone supply supplementation from Cam 2W and Kit 2E without mixing residuals and potential breakpoint chlorination in the distribution system, as all sources to Pressure Zone 1W will be chloraminated
    - Addressing potential and reported treatment residual mixing occurrences in the current system
- Provide security of supply to the Cam 1W Pressure Zone with the new Kress Hill PRV;
- Provide security of supply to the Cam 1W Pressure Zone and to the Cambridge Memorial Hospital through the:
    - New Cam 1 trunk watermain
    - New Cam 2E to Cam 1 PRV
- Allow for the lowering of the Cam 1 HGL, which addresses existing Cam 1 storage issues by allowing better operation of the Turnbull Reservoir; and,
- Potential to reduce the magnitude of bi-directional flow within existing Cam 1W watermains, which may provide localized water quality improvements.

6 Phase 2 – Alternative Solutions

An overview of the evaluation alternative solutions for the various elements of the study are provided in **Technical Memorandum No. 3 – *Alternatives Evaluation*** (**Appendix G**). The operational strategy provided below is further described in **Technical Memorandum No. 1 and No. 3**

6.1 Cambridge 1W Pressure Zone Operational Strategy Evaluation

The operational strategy for the new zones generally consists of:

- New Cam 1W BPCS acting as the primary supply to the new Pressure Zone;
- Existing new Dundee PRV and Kress Hill PRV to act as secondary feeds to the new Pressure Zone; and,
- Sizing of a new Dundee PRV and new Kress Hill PRV combined to have sufficient capacity to supply the Cam 1W Pressure Zone independently of the new pumping station.

The Operational Strategy will govern the pumping station requirements and specifications, while maximizing operational efficiencies

Through the system review process, the option to leverage the new Kress Hill PRV and New Dundee PRV to simplify operations of the new Cam 1W BPCS are identified as a potential control strategy for the new Cam 1W Pressure Zone. This utilizes the Kress Hill PRV to support minimum nighttime flows, thereby reducing the normal operating range of the pumping station and eliminating the need for low flow pumps.

The more active utilization of the PRVs will enable a more streamlined pumping station design and reduced land use requirements, while resulting in more efficient system operations.

6.1.1 Cambridge 1W Pressure Zone Operational Strategy Options

In consultation with Regional staff, three potential Cam 1W Pressure Zone operational strategies were developed, as highlighted in **Table 7**.

Table 7 Cambridge 1W Pressure Zone Operational Strategy

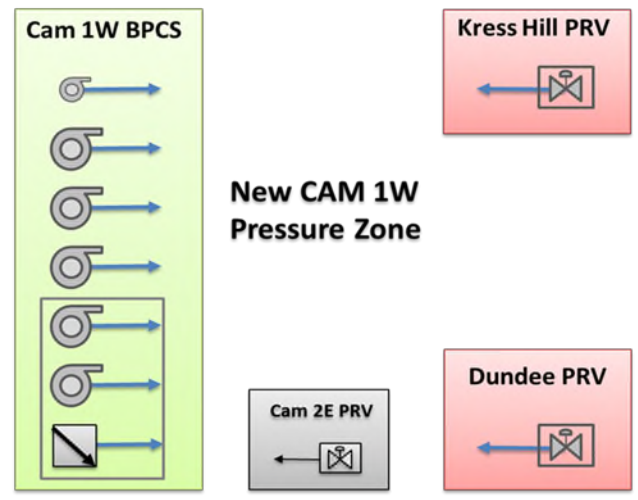
<table>
<tr><td colspan="2">Operational Strategy 1: Single Source - Booster Pump and Chloramination Station</td></tr>
<tr><td>

BPCS is sized and configured to provide the full range of potential flow rates, including:

Jockey pump for low flows
Duty pumps for normal flows
Fire pumps for fire flows

Kress Hill and new Dundee PRVs only operated under emergency conditions, designed as single valve stations.
Pressure Zone Firm Capacity calculation based on single source strategy:

BPCS firm capacity calculated with the two largest pumps out of service.
Kress Hill and Dundee PRVs are not included in the Pressure Zones Supply Firm Capacity Calculation.

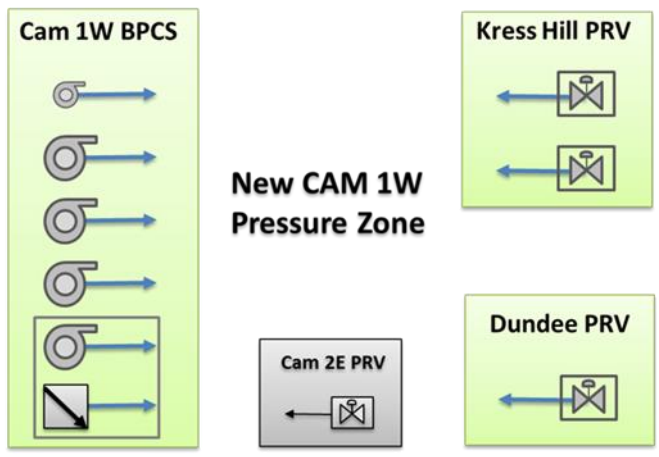
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<tr><td colspan="2">Operational Strategy 2: Multiple Source –Booster Pump Station and PRV</td></tr>
<tr><td>

BPCS is sized and configured to provide the full range of potential flow rates, including:

Jockey pump for low flows
Duty pumps for normal flows
Fire pumps for fire flows

Kress Hill and new Dundee PRVs can operate under normal conditions
Pressure Zone Firm Capacity calculation based on multi-source strategy:

Pressure Zone BPCS firm capacity calculated with one largest pump out of service
Kress Hill PRV firm capacity with largest PRV out of service

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<tr><td colspan="2">Operational Strategy 3: Low Flow PRV – High Flow Multi Source</td></tr>
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BPCS is sized and configured to provide average day to peak flow rate.

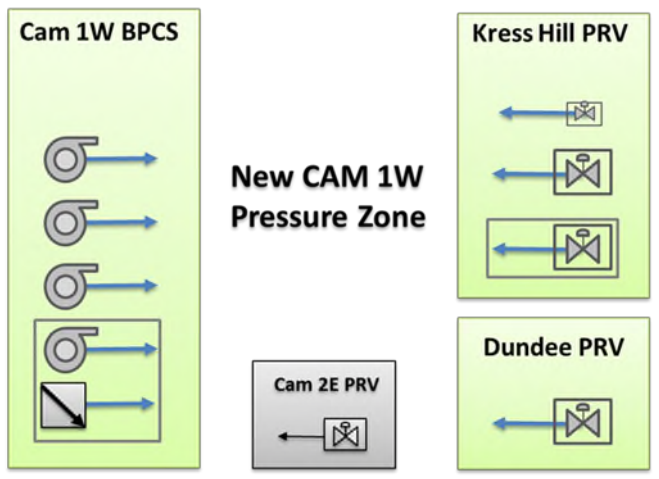
All pumps are the same size, in combination they meet average and peak flows

Kress Hill and new Dundee PRVs can operate under normal conditions.
Kress Hill PRVs are optimized for

Pilot PRV for low flows
Large PRV for normal and peak flows

Pressure Zone Firm Capacity calculation based on multi-source strategy:

Pressure Zone BPCS firm capacity calculated with one largest pump out of service
Kress Hill PRV firm capacity with largest PRV out of service

</td><td> 
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6.1.2 Cambridge 1W Pressure Zone Operational Strategy Evaluation Criteria

Each of the three potential operational strategies was evaluated against the criteria listed below using the Reasoned Argument approach highlighted in **Technical Memorandum No. 2** (**Appendix F**):

- System Level of Service
    - Capacity to meet pressure zone hydraulic performance objectives
    - Impacts on system water quality
    - System operational redundancy
- System Operations
    - Impacts on system energy efficiency
    - Impacts on Integrated Urban System supply strategy
    - Impacts on system operational flexibility
    - Impacts on facility capacity and component requirements
- Cost Impacts
    - Impacts on facility capital costs
    - Impacts on land acquisition requirements
    - Impacts on facility operational costs

6.1.3 Cambridge 1W Pressure Zone Operational Strategy Evaluation

A detailed Evaluation is included in **Technical Memorandum No. 3.** The key findings are summarized below:

- All three operational strategies are adequate to service the Cam 1W Pressure Zone, achieving all of the identified level of service objectives
- Increasing operational flexibility of the Kress Hill PRV will expand the cost and complexity of the Kress Hill PRV; however, these additional costs will be offset by the reduction in the Cam 1W BPCS cost and the potential re-utilization of the existing Kress Hill pump station as a PRV station
- Increasing the operational flexibility of the Kress Hill PRV will provide significant additional benefit to the Cam 1W Pressure Zone and Integrated Urban Water Systems operations, including:
    - Increased flexibility in system operations
    - Improved security of supply to the Cam 1W Pressure Zone

- Improved water quality within the Cam 2W and Kit 2E Pressure Zones due to regular flow through the Dundee and Kress Hill PRVs
- Simplification of the Cambridge 1W BPCS operations and configuration

6.1.4 Recommended Cambridge 1W Pressure Zone Operational Strategy

Based on a review of the different options, **Operational Strategy 3: Low Flow PRV – High Flow Multi Source** is recommended as the preferred operational strategy, as this option will provide additional system flexibility while strengthening the Cam 1W security of operations without increasing overall capital and operating costs of the Cam 1W Pressure Zone.

Based on the recommendation of Operational Strategy 3, the following Infrastructure components are required:

- Cam 1W BPCS;
- New Trunk Watermain; and,
- New Cambridge Hespeler Road 2E to Cam 1 PRV.

The following sections outline the alternative solutions evaluated and process undertaken to the preferred siting, alignment, and operational function of the Strategy 3 components

6.2 Trunk Watermain Alignment

6.2.1 Purpose and Need

A new trunk watermain is required to provide peak flow capacity to the Cam 1W BPCS and support security of supply to the Cambridge Memorial Hospital. It will need to be sized to provide peak flows to the pumping and chloramination station, and be sufficiently separate to the existing trunk watermain along Coronation Boulevard to minimize the potential for simultaneous watermain failure of the existing watermain and proposed trunk watermain.

6.2.2 Stage I: Evaluation for Long List of Potential Watermain Alignments

Recognizing these requirements, an initial list of eight watermain alignment options (and sub-options) was developed through site visits and a desktop review.

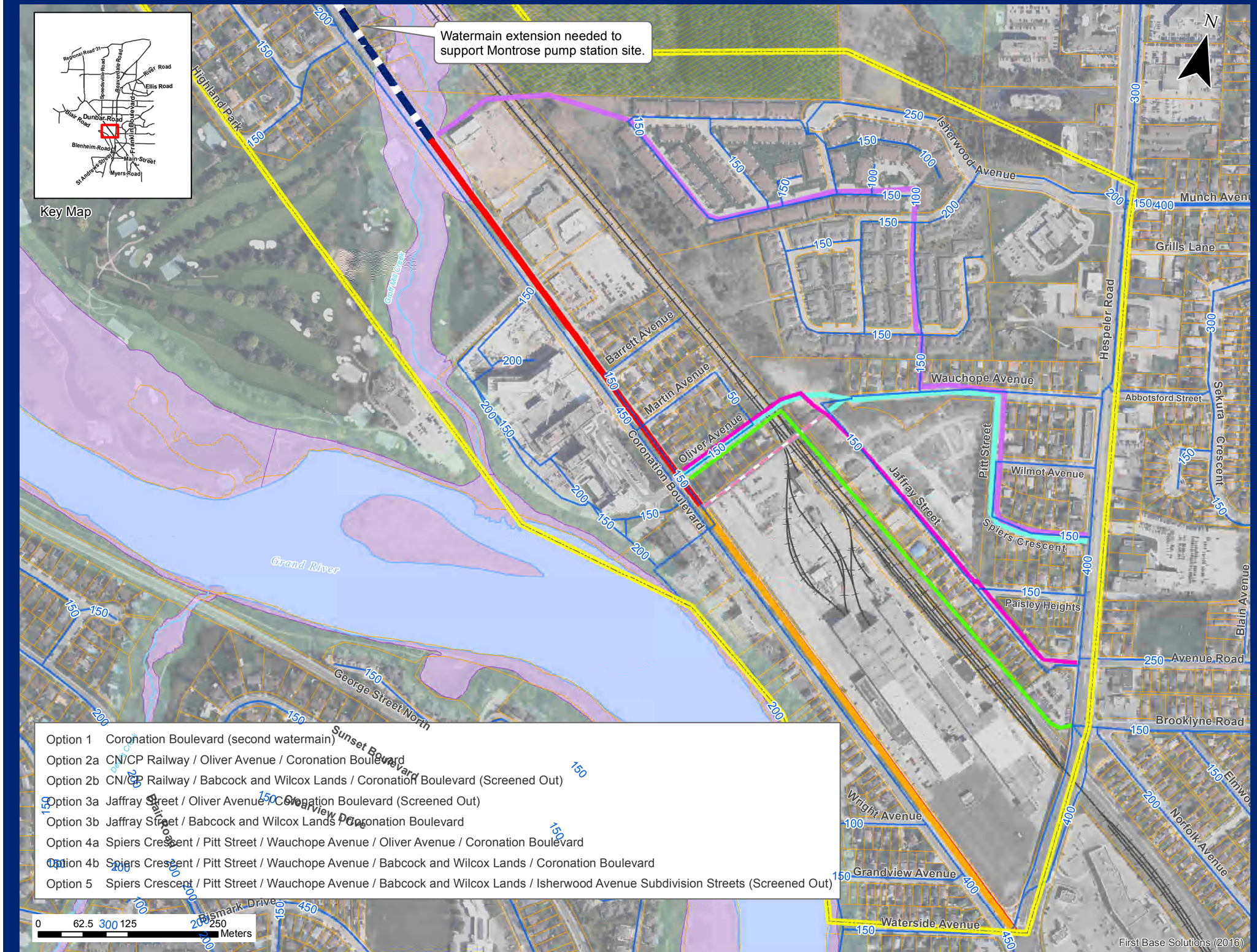
The options, illustrated in **Figure 3** included:

- **Option 1:** Coronation Boulevard (second watermain)
- **Option 2a:** CN/CP Railway / Oliver Avenue / Coronation Boulevard
- **Option 2b:** CN/CP Railway / Babcock and Wilcox Lands / Coronation Boulevard
- **Option 3a:** Jaffray Street / Oliver Avenue / Coronation Boulevard
- **Option 3b:** Jaffray Street / Babcock and Wilcox Lands / Coronation Boulevard
- **Option 4a:** Spiers Crescent / Pitt Street / Wauchope Avenue / Oliver Avenue / Coronation Boulevard
- **Option 4b:** Spiers Crescent / Pitt Street / Wauchope Avenue / Babcock and Wilcox Lands / Coronation Boulevard
- **Option 5:** Spiers Crescent / Pitt Street / Wauchope Avenue / Babcock and Wilcox Lands / Isherwood Avenue Subdivision Streets

The evaluation of the watermain alignments was undertaken in two stages: Stage I "screened" a long list of watermain alignment alternatives down to a smaller group, which would be evaluated more rigorously in Stage II.

The long list of alignment alternatives was evaluated on the following three screening criteria:

- **Does the Alignment Support the Problem/ Opportunity Statement?**
    - Is the alignment alternative able to address the issues identified in the problem/opportunity
- **Is the Alignment Technically Viable?**
    - Is the alignment alternative able to meet service requirements?
    - Is the site available?
- **Is the Alignment Reasonable?**
    - Will the alignment alternative avoid unnecessary impacts to existing and future land uses?
    - Will the alignment alternative maximize the use of existing infrastructure capacity, while minimizing capital upgrades where possible?



Option 1 Coronation Boulevard (second watermain)
Option 2a CN/CP Railway / Oliver Avenue / Coronation Boulevard
Option 2b CN/CP Railway / Babcock and Wilcox Lands / Coronation Boulevard (Screened Out)
Option 3a Jaffray Street / Oliver Avenue / Coronation Boulevard (Screened Out)
Option 3b Jaffray Street / Babcock and Wilcox Lands / Coronation Boulevard
Option 4a Spiers Crescent / Pitt Street / Wauchope Avenue / Oliver Avenue / Coronation Boulevard
Option 4b Spiers Crescent / Pitt Street / Wauchope Avenue / Babcock and Wilcox Lands / Coronation Boulevard
Option 5 Spiers Crescent / Pitt Street / Wauchope Avenue / Babcock and Wilcox Lands / Isherwood Avenue Subdivision Streets (Screened Out)

Region of Waterloo

Creation of Cambridge Pressure Zone 1W Class EA

Figure 3

Watermain Alignment Alternatives - Long List

- Watermain
- Railway
- Focus Area
- Parcels

Alignment Options

- Option 1 +
- Option 2a +
- Option 2b + +
- Option 3a +
- Option 3b + +
- Option 4a +
- Option 4b + +
- Option 5

Environmental Features

- Creeks
- Rivers
- Grand River Conservation Authority Limits
- Regulatory Floodplain
- Dumfries Conservation Area

BluePlan ENGINEERING

716015-15-W-Watermain Alignment Long List Alternatives v2
May 2017
Data Source: Region of Waterloo
Scale: 1:5,091 | NAD 1983 UTM Zone 17N

Those alternatives that received one "no" (*x*) response would be screened out from further consideration. Conversely, those alignment alternatives that met all three screening criteria (√) would be carried forward into the more rigorous Stage II evaluation.

Table 8 summarizes the Screen I Evaluation of alignment alternatives.

Table 8 Screen I Evaluation of Watermain Alignment Alternatives

Watermain Alignment Options	Addresses the Problem Statement?	Is Technically Viable?	Is Reasonable?	Recommended for Further Study?
Option 1: Coronation Boulevard	√	√	√	Yes
Option 2a: CN/CP Railway / Oliver Avenue / Coronation Boulevard	√	x	x	No
Option 2b: CN/CP Railway / Babcock and Wilcox Lands / Coronation Boulevard	√	x	x	No
Option 3a: Jaffray Street / Oliver Avenue / Coronation Boulevard	√	√	√	Yes
Option 3b: Jaffray Street / Babcock and Wilcox Lands / Coronation Boulevard	√	√	√	Yes
Option 4a: Spiers Crescent / Pitt Street / Wauchope Avenue / Oliver Avenue / Coronation Boulevard	√	√	√	Yes
Option 4b: Spiers Crescent / Pitt Street / Wauchope Avenue / Babcock and Wilcox Lands / Coronation **Boulevard**	√	√	√	Yes
Option 5: Spiers Crescent / Pitt Street / Wauchope Avenue / Babcock and Wilcox Lands / Isherwood Avenue Subdivision Streets	√	√	x	No

6.2.3 Stage II: Evaluation for Short-List of Potential Watermain Alignments

The short list of watermain alignment alternatives was assessed in greater detail during the Stage II evaluation. The remaining five alternatives were evaluated on five key factors:

- Environmental impacts;
- Technical feasibility;
- Financial viability (costs);
- Legal / jurisdictional (coordination and compliance); and
- Socio/cultural impacts.

Each factor comprised a number of specific criteria, and a rating system was used to evaluate each alternative based on those criteria. The rating system applied a “Low”, “Medium” or “High” ranking enabling a comparative review of each alternative. The ratings represent the following:

- “High” refers to mostly positive elements with few (if any) negative impacts
- “Medium” refers to a mix of positive and negative elements with some impacts
- “Low” refers to mostly negative elements with several impacts

The criteria developed to evaluate both the alternative alignments and pumping station locations are provided in **Technical Memorandum No. 2** (*The Planning Framework to Evaluate Alternatives*) and were applied to the Stage II evaluation in **Appendix H – Stage II Evaluation**. A breakdown of the watermain alignment cost estimates is included in **Appendix I – Estimated Project Costs**.

6.2.4 The Recommended Watermain Alignment

Having ranked each alternative accordingly, the evaluation and selection of a technically preferred solution was guided by the Reasoned Argument Approach which provided a clear and thorough rationale of the tradeoffs between the various evaluation factors and criteria and identified the reasons why one option best meets the servicing needs of the new Cam 1W Pressure Zone. **Table 9** below presents an overview of the recommended watermain alignment.

Table 9 Stage II Evaluation: Results and Recommendations

Watermain Alignment Option	Recommendation
Option 1: Coronation Boulevard	**Recommended** **Justification:** Option 1 is recommended as the most technically feasible alignment alternative because: • It is the most compatible with existing and future infrastructure. • It will cost the least to construct of the five alignment alternatives ($2.5 million*). • Unlike the other options, Option 1 is the only option that is not anticipated to require any additional property/easement acquisition. • It will result in the least amount of scheduling and financial risk and would be able to accommodate traffic during construction. • Potential to coordinate new watermain construction with planned Coronation Blvd. major rehabilitation works, which may further reduce construction costs and impacts. • Limits construction to existing right-of-way. • Minimizes impact to local residential roads and avoids requirement to cross rail lines. While there are some impacts associated with Option 1, they are minor in nature and can be mitigated. As is the case with all of the options, it is imperative to coordinate with Cambridge Memorial Hospital to ensure access and mobility issues are addressed as needed.
Option 3a: Jaffray Street / Oliver Avenue / Coronation Boulevard	**Not Recommended** **Justification:** Option 3a involves several challenges: • It will be constrained by smaller rights-of-way to accommodate the new watermain. • It will experience higher capital costs ($4.0 million*) plus additional costs related to property acquisition. • It will require significant coordination with CN and CP rail over rail crossings. • It could hinder access to St. John's ambulance station. • Increased impact to residents during construction. • Significant legal/jurisdictional complexity due to land ownership and rail crossing.
Option 3b: Jaffray Street / Babcock and Wilcox Lands / Coronation Boulevard	**Not Recommended** **Justification:** Option 3b involves several challenges: • It will experience higher capital costs ($3.2 million*) plus additional costs related to property acquisition. • It will require significant coordination with CN and CP rail over rail crossings. • It could hinder access to St. John's ambulance station. • Significant legal/jurisdictional complexity due to land ownership and rail crossing.
Option 4a: Spiers Crescent / Pitt Street / Wauchope Avenue / Oliver Avenue / Coronation Boulevard	**Not Recommended** **Justification:** Option 4a involves several challenges: • Construction impacts could be significant for the many residents who live along the corridor. • It will experience higher capital costs ($4.3 million*) plus additional costs related to property acquisition. • It will require significant coordination with CN and CP rail over rail crossings. • A steep embankment on Wauchope Avenue would increase the potential for a trenchless length. • Significant legal/jurisdictional complexity due to land ownership and rail crossing
Option 4b: Spiers Crescent / Pitt Street / Wauchope Avenue / Babcock and Wilcox Lands / Coronation Boulevard	**Not Recommended** **Justification:** Option 4b involves several challenges: • Construction impacts could be significant for the many residents who live along the corridor. • It will experience higher capital costs ($3.6 million*) plus additional costs related to property acquisition. • It will require significant coordination with CN and CP rail over rail crossings. • A steep embankment on Wauchope Avenue would increase the potential for a trenchless length.

* Total project cost including project design, construction admin, and contingency. All cost based BPCS located at BWXT site

DRAFT

6.3 Booster Pumping Station and Chloramination Facility

6.3.1 Purpose and Need

The new Cam 1W BPCS will be the primary source of water to the Cam 1W system, a closed pressure zone. As such, identifying a suitable location for a pumping station focused on having adequate overlap between pumps that would configure with Variable Frequency Drive (VFD) and pump controls in order to maintain a constant pressure zone HGL under all demand conditions. In addition, the pumping station would be required to be fully integrated into the Region's existing SCADA system to allow for:

- Pumping station controls to be managed by local discharge pressures and may be informed by system pressures at either the Kress Hill PRV and/or new Dundee PRV or other pressure monitoring points as required;
- Coordination of operations of the Middleton Pumping Station, Turnbull and other Pressure Zone 1 sources during peak flow periods; and,
- Automated monitoring of upstream and downstream secondary disinfection residual levels.

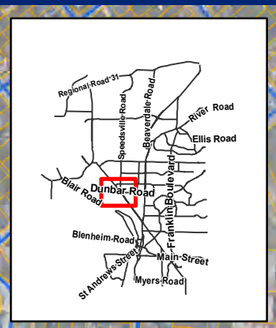
6.3.2 Evaluation of Long List of Potential Pump Station Sites

Recognizing the important functions of a new pumping station within the Cam 1W Pressure Zone, and the need to be integrated with the recommended Coronation Boulevard watermain alignment (Option 1) described above, an initial list of 12 pumping station sites within the study area was identified through site visits and a desktop review. To facilitate this evaluation, the pumping station sites were grouped into a "north" study area and a "south" study area as illustrated in **Figure 4** and **Figure 5** as described below:

Potential Pumping Station Sites – North Study Area

- Option 1: Montrose Street South[1]
- Option 2: Duke Street / Bishop Street North
- Option 3: Concession Road / Railway
- Option 4: Gore Park
- Option 5: King Street East
- Option 6: Coronation Boulevard / Railway

[1] *The Montrose Street parcel is located outside of the study area but was considered as a potential pumping station location because the land is currently owned and maintained by the Region of Waterloo.*



Key Map

Option 1	Montrose Street South
Option 2	Duke Street / Bishop Street North
Option 3	Concession Road / Railway
Option 4	Gore Park
Option 5	King Street East
Option 6	Coronation Boulevard / Railway

0 62.5 125 250 Meters

First Base Solutions (2016)

Region of Waterloo

Creation of Cambridge Pressure Zone 1W Class EA

Figure 4

Pumping Station Site Alternatives - Long List (Northern Sections)

- Watermain
- Railway
- Long List of Property Sites
- Focus Area
- Parcels

Pump Station Foot Print Limits

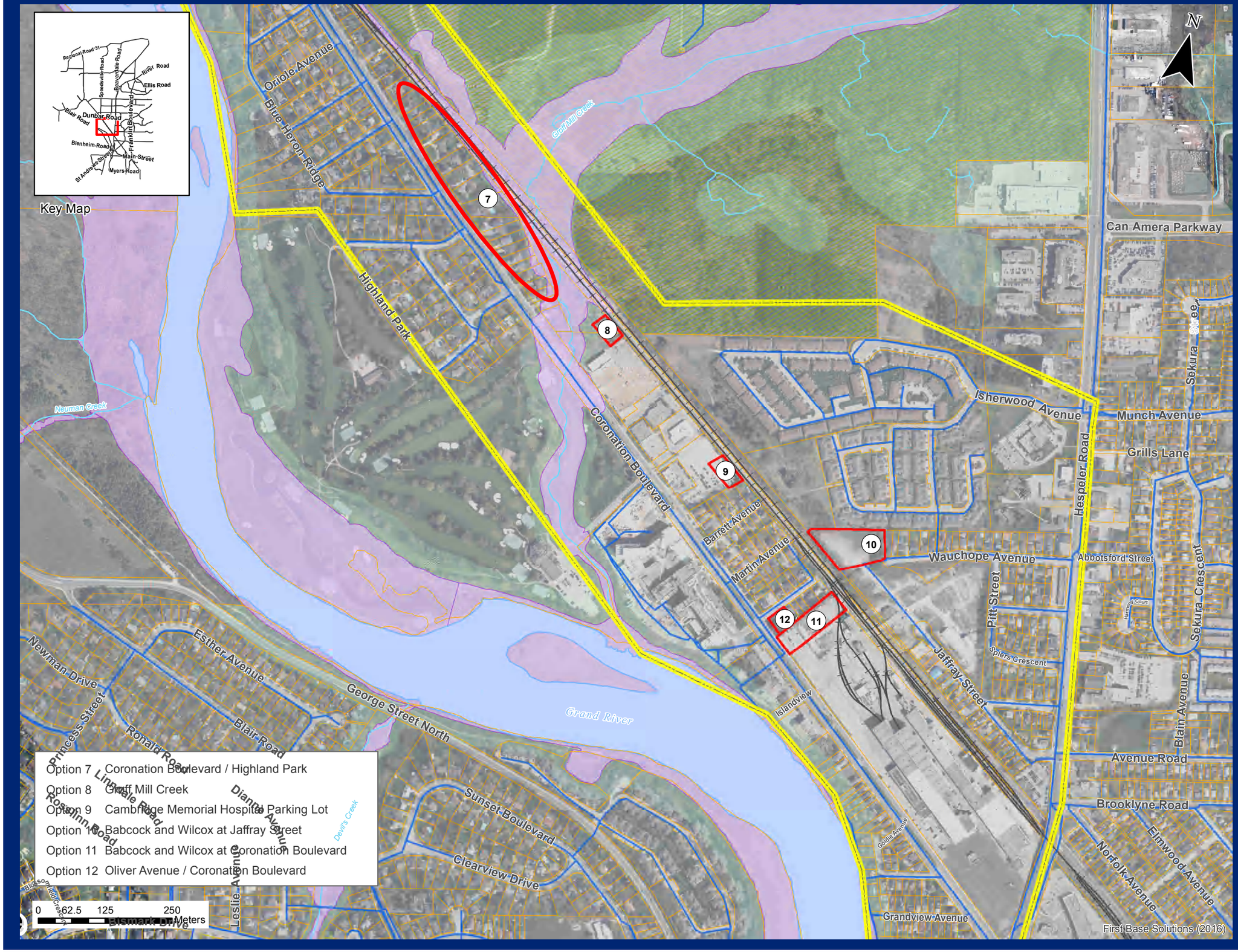
- 30 m X 20 m
- 30 m X 60 m

Environmental Features

- Creeks
- Rivers
- Grand River Conservation Authority Limits
- Regulatory Floodplain
- Dumfries Conservation Area

BluePlan ENGINEERING

716015-17A-W-PS Long List (North)
May 2017
Data Source: Region of Waterloo
Scale: 1:6,750 | NAD 1983 UTM Zone 17N



Region of Waterloo

Creation of Cambridge Pressure Zone 1W Class EA

Figure 5

Pumping Station Site Alternatives - Long List (Southern Sections)

- Watermain
- Railway
- Long List of Property Sites
- Focus Area
- Parcels

Pump Station Foot Print Limits

- 30 m X 20 m
- 30 m X 60 m

Environmental Features

- Creeks
- Rivers
- Grand River Conservation Authority Limits
- Regulatory Floodplain
- Dumfries Conservation Area

BluePlan ENGINEERING

716015-17B-W-PS Long List (South)
May 2017
Data Source: Region of Waterloo
Scale: 1:6,750 | NAD 1983 UTM Zone 17N

Potential Pumping Station Sites – South Study Area

- Option 7: Coronation Boulevard / Highland Park
- Option 8: Groff Mill Creek
- Option 9: Cambridge Memorial Hospital Parking Lot
- Option 10: Babcock and Wilcox at Jaffray Street
- Option 11: Babcock and Wilcox at Coronation Boulevard
- Option 12: Oliver Avenue / Coronation Boulevard

The evaluation of the pumping station sites was also undertaken in two stages: Stage I "screened" a long list of pumping station sites down to a smaller group, which would be evaluated more rigorously in Stage II. Similar to the screening of alignment alternatives, the long list of pumping station sites was evaluated on the following three screening criteria:

- **Does the Pumping Station Site Support the Problem/Opportunity Statement?**
    - Is the pumping station site able to address the issues identified in the problem/opportunity?
- **Is the Pumping Station Site Technically Viable?**
    - Is the site available and large enough to accommodate a pumping station?
    - Will the site support the community's infrastructure needs?
- **Is the Pumping Station Site Reasonable?**
    - Will the site avoid unnecessary impacts to existing and future land uses?
    - Will the site maximize the use of existing infrastructure capacity, while minimizing capital upgrades where possible?

Those alternatives that received one "no" (x) response were screened out from further consideration. Conversely, those pumping station sites that met all three screening criteria (√) were carried forward into the more rigorous Stage II evaluation. **Table 10** and **Table 11** summarize the Stage I Evaluation of the pumping station sites for the northern and southern sections of the study area.

Table 10 Screen I Evaluation of Pumping Stations- Northern Sites

Pumping Station Site Options (North)	Addresses the Problem Statement?	Is Technically Viable?	Is Reasonable?	Recommended for Further Study?
Option 1: Montrose Street South	√	√	√	**Yes**
Option 2: Duke Street / Bishop Street North	√	**x**	√	**No**
Option 3: Concession Road / Railway	√	√	**x**	**No**
Option 4: Gore Park	√	**x**	√	**No**
Option 5: King Street East	√	**x**	√	**No**
Option 6: Coronation Boulevard / Railway	√	**x**	√	**No**

Table 11 Screen I Evaluation of Pumping Stations- Southern Sites

Pumping Station Site Options (South)	Addresses the Problem Statement?	Is Technically Viable?	Is Reasonable?	Recommended for Further Study?
Option 7: Coronation Boulevard / Highland Park	√	√	x	No
Option 8: Groff Mill Creek	√	√	√	Yes
Option 9: Cambridge Memorial Hospital Lot	√	√	√	Yes
Option 10: Babcock and Wilcox at Jaffray Street	√	x	√	No
Option 11: Babcock and Wilcox at Coronation Boulevard	√	√	√	Yes
Option 12: Oliver Avenue / Coronation Boulevard	√	√	√	Yes

6.3.3 Evaluation of Short List of Potential Pump Station Sites

Five pumping station sites advanced into the Stage II evaluation – one located in the northern section of the study area and four sites positioned in the south. The remaining five alternatives were evaluated on the same key factors as applied to the evaluation of alignment alternatives:

- Technical feasibility;
- Financial viability (costs);
- Legal / jurisdictional (coordination and compliance);
- Environmental impacts; and,
- Socio/cultural impacts.

The evaluation process used to assess the pumping and chloramination station locations mirrored the one previously used for the watermain alignment options (**Section 6.2**). The complete results of the Stage II Evaluation of the pumping station sites is provided in **Appendix J Stage II Evaluation of Pumping and Chloramination Statio**.

6.3.4 Recommended Pump Station Site

Having ranked each alternative accordingly, the evaluation and selection of a technically preferred solution was again guided by the Reasoned Argument Approach which provided a clear and thorough rationale of the tradeoffs between the various evaluation factors and criteria and identified the reasons why one pumping station site best meets the servicing needs of the new Cam 1W Pressure Zone. **Table 10** presents an overview of the recommended pump station site.

6.4 Kress Hill Pressure Reducing Valve Station

6.4.1 Purpose and Need

Based on the recommended Cambridge 1W operational strategy, a total of three PRVs were recommended at the Kress Hill PRV Station. The new PRV station will be located within the existing Kress Hill Pump Station site. The Kress Hill Pump Station has been offline for several years and is planned to be decommissioned as part of the Kress Hill PRV works. A subsequent site visit to the Kress Hill Pump Station site and building confirmed that the existing pump station building appears to be in relatively good condition.

Table 10: Stage II Evaluation: Results and Recommendations

Watermain Alignment Option	Recommendation
Option 1: Montrose Street South	**Not Recommended** **Justification:** Option 1 involves several challenges: • The site requires excessive costs for watermain extension (Additional $5.3 million). • The site necessitates watermain crossing Groff Mill Creek as part of the watermain extension along Coronation Boulevard, which would require permits and additional mitigation measures. • Construction impacts could be significant for many residents along Montrose Street South and those that back onto the site.
Option 8: Groff Mill Creek	**Recommended** **Justification:** Option 8 is recommended as the most technically feasible alternative because: • The site is located on a large parcel partially owned by the City of Cambridge and adjacent to proposed Coronation Boulevard watermain. • The site requires modest additional costs to extend watermains to the site (Additional $0.2 million). • Few properties surround the proposed site so community impacts will be minimal. While part of the property is owned by the City of Cambridge, construction of the pumping station will require acquisition of property or easement for access to the site. In addition, the site is partially located within a floodplain requiring special permitting, but initial discussions with GRCA suggested no major issues with locating pumping station on this parcel.
Option 9: Cambridge Memorial Hospital Parking Lot	**Not Recommended** **Justification:** Option 9 involves several challenges: • The parcel is located on land currently owned by Cambridge Memorial Hospital. • Potential community resistance would revolve around the location's potential impact on the hospital, emergency access, and parking availability. • Significant traffic impacts may occur during construction in heavily used hospital parking lot. • The site requires modest additional costs to extend watermains to the site (Additional $0.2 million).
Option 11: Babcock and Wilcox at Coronation Boulevard	**Not Recommended** **Justification:** Option 11 involves several challenges: • The property will need to be acquired through a private land owner, further increasing the costs of the pumping station. • Construction impacts could be significant for many residents who around the site. • The parcel historic industrial use is subject to an increased risk of soils contamination suggests delays in coordination, transferring the property and constructing the facility.
Option 12: Oliver Avenue and Coronation Boulevard	**Not Recommended** **Justification:** Option 12 involves several challenges: • The property will need to be acquired through a private land owner, further increasing the costs of the pumping station. • The parcel adjacent to historic industrial use is subject to an increased risk of soils contamination suggests delays in coordination, transferring the property and constructing the facility. • The site comprises significant access issues as a result of its limited size and surrounding land uses.

6.4.2 Identification and Evaluation of Potential Alternatives

In consultation with the Region's operations staff, a total of three potential site options were considered:

- Construct a new PRV chamber and decommission (demolish) the existing Kress Hill Pump Station building and/or convert the building into a local storage facility.
- Partially demolish the existing Kress Hill Pump Station building, and install the PRVs within the existing pump station basement.
- Re-purpose the existing pump station as a PRV station, by replacing the three existing pumps with PRVs, along with general process pipe replacement.

Table 12 Kress Hill PRV Cost Estimates summarizes the projected capital cost of the three options. For each option, the following assumptions were made:

- No significant yard piping works will be needed to accommodate the new PRVs
- The PRVs will consist of:
  - 1 – 100 mm low flow PRV
  - 2 – 350 mm high flow PRV, each sized to convey ~400 L/s
- New electrical and SCADA controls are required

Table 12 Kress Hill PRV Cost Estimates

	Option 1 Construct a new PRV chamber	Option 2 Partially demolish the existing Kress Pump Station Building	Option 3 Re purpose the existing Pump Station as a PRV station
Pump Station Building Demolition and/or Modifications	$350K	$300K	$100K
PRV & Equipment	$500K	$400K	$400K
Total Cost	**$850K**	**$700K**	**$500K**

6.4.3 The Recommended Kress Hill Station PRV Option

Based on a review of the options, it is recommended that Option 3, Re-purposing the existing pump station as a PRV station, be implemented as it:

- Has the lowest capital cost, by a significant margin;
- Utilizes an existing facility that would otherwise be demolished; and,
- Provides operations with additional space, allowing for ease of future inspection and maintenance.

6.5 Hespeler Road Cambridge 2E to Cambridge 1 Pressure Reducing Valve

6.5.1 Purpose and Need

As part of the Cam 1 Pressure Zone boundary re-alignment and HGL change, the boundary between Cam 2E and Cam 1 along Munch Avenue and Elgin Street will be adjusted south. **Figure 6** highlights this proposed boundary change.

As part of the pressure zone boundary change and overall strategy to strengthen security of supply within the Cambridge water system, a Cam 2E to Cam 1 PRV was proposed at the new pressure zone boundary along the existing Hespeler trunk watermain. As identified in the Cambridge Implementation Plan, this new PRV will be normally closed, and would open only under emergency conditions.

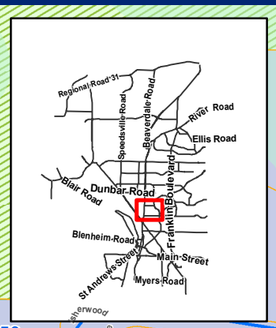
6.5.2 Identification and Evaluation of Potential Alternatives

Based on the proposed pressure zone boundary change, the PRV is required to be located between Spiers Crescent and Paisley Heights. In consultation with Region operations staff, the new PRV chamber must be located within the existing roadway cul-de-sacs of either Spiers Crescent or Paisley Heights. **Figure 7** and **Figure 8** present the two potential PRV chamber locations and inter-connecting watermain.

6.5.3 The Recommended Hespeler Road Cambridge 2E to Cambridge 1 PRV Option

Based on a review of the two sites and the required watermain works, it is recommended that the PRV be located at Spiers Crescent due to the increased installation complexity at the Paisley Heights site resulting from:

- Significant elevation grading within the Hespeler Road boulevard at Paisley Heights; and,
- The need for an additional watermain to integrate the existing Paisley Heights watermain into the Cam 1 Pressure Zone.



Key Map

Cambridge Zone 2 (E)

Cambridge Zone 1

Can Amera Parkway
Acorn Way
Woodborough Place
Sekura Street
Perkins Street
Hillidale Drive
Kovac Road
Isherwood Avenue
Munch Avenue
Grills Lane
Sekura Place
Hespeler Road
Braemar Road
Tuscany Court
Macleith Court
Carter Crescent
Elgin Street North
Ferguson Avenue
Rouse Avenue
Sekura Crescent
Gail Street
Wauchope Avenue
Abbotsford Street
Pitt Street
Wilmot Avenue
Spiers Crescent
Jaffray Street
Paisley Heights
Blain Avenue
Avenue Road
Glamis Road
Brooklyne Road
Norfolk Avenue
Elmwood Avenue
Broadview Avenue
Glen Road
Winter Avenue
Thunderbird Drive
Coronation Boulevard
Wright Avenue

0 50 100 200 Meters

N

Region of Waterloo

Creation of Cambridge Pressure Zone 1W Class EA

Figure 6

Hespeler Road
Overview of Pressure Zone Boundary Change

- Watermain
- Parcels

Pressure Zone Changes

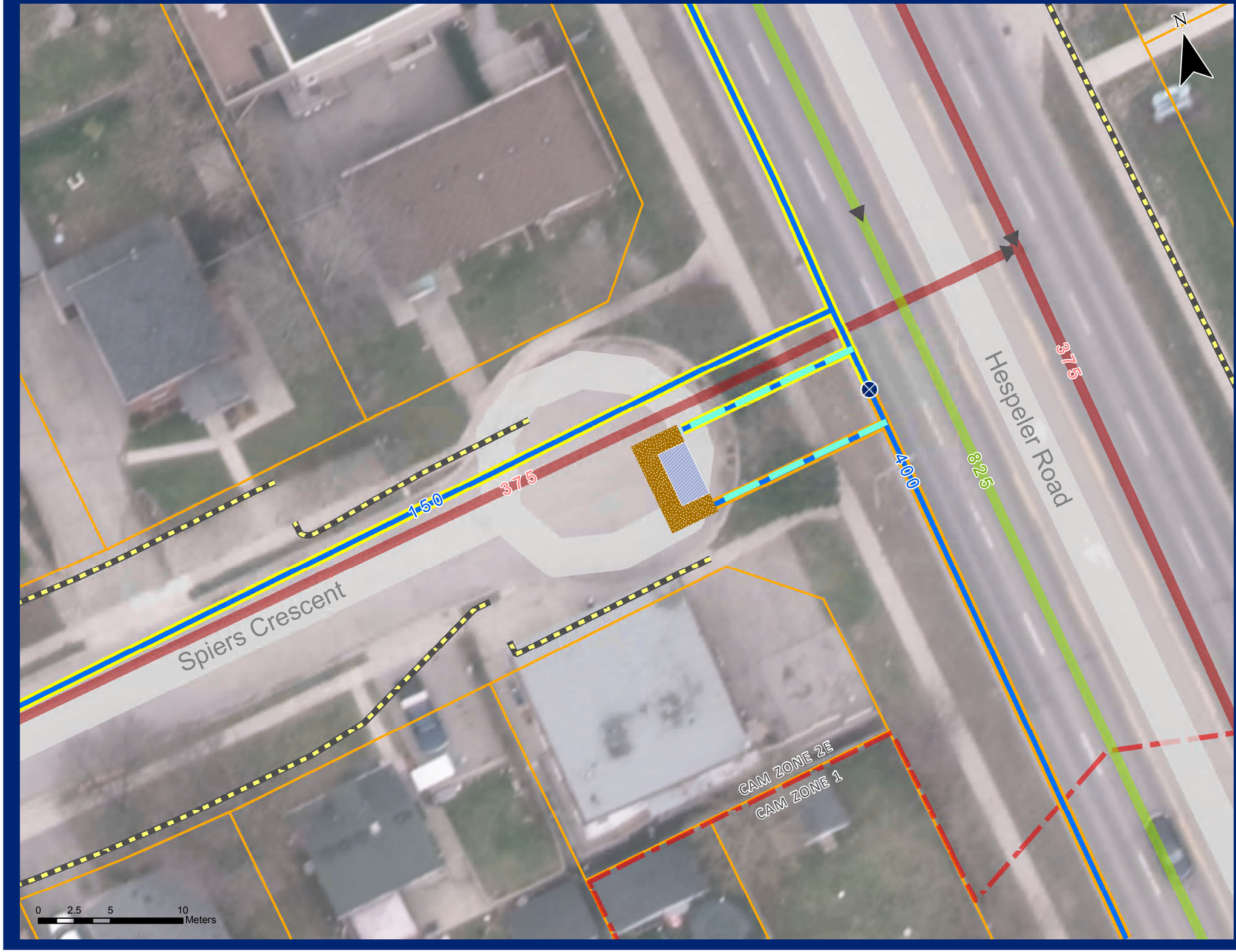
- Cam 2E Expansion
- Existing Cam 1 Pressure Zone
- Existing Cam 2E Pressure Zone

Environmental Features

- Creeks
- Rivers
- Grand River Conservation Authority Limits
- Regulatory Floodplain
- Dumfries Conservation Area

BluePlan ENGINEERING

716015-20-W-Overview Water Pressure Zone Change
May 2017
Data Source: Region of Waterloo
Scale: 1:5,012 | NAD 1983 UTM Zone 17N



Region of Waterloo

Creation of Cambridge Pressure Zone 1W Class EA

Figure 7

Option 1

Spiers Crescent Hespeler Road Pressure Reducing Valve

- New Isolated Valve
- Cam 1 Watermain
- Cam 2E Watermain
- New Cam 1 Watermain
- New Cam 2E Watermain
- Storm Pipes
- Sanitary Pipes
- Gas Without Service
- Cam 2E Expansion
- Parcels

Environmental Features

- Creeks
- Rivers
- Grand River Conservation Authority Limits
- Regulatory Floodplain
- Dumfries Conservation Area

BluePlan ENGINEERING

716015-21A-W-Hespeler PRV Spiers
May 2017
Data Source: Region of Waterloo
Scale: 1:250 | NAD 1983 UTM Zone 17N



Region of Waterloo

Creation of Cambridge Pressure Zone 1W Class EA

Figure 8

Option 2

Paisley Heights
Hespeler Road
Pressure Reducing Valve

- New Isolated Valve
- Cam 1 Watermain
- Cam 2E Watermain
- New Cam 1 Watermain
- New Cam 2E Watermain
- Storm Pipes
- Sanitary Pipes
- Gas Without Service
- Cam 2E Expansion
- Parcels

Environmental Features

- Creeks
- Rivers
- Grand River Conservation Authority Limits
- Regulatory Floodplain
- Dumfries Conservation Area

BluePlan ENGINEERING

716015-21B-W-Hespeler PRV Paisley
May 2017
Data Source: Region of Waterloo
Scale: 1:250 | NAD 1983 UTM Zone 17N

7 Converting Disinfection Residual from Free Chlorine to Chloramination

7.1 Water Treatment Process

The majority of the Cambridge water system, excluding Cam 2W which is supplied directly from the City of Kitchener, utilizes free chlorine for secondary disinfection. The remaining IUS uses chloramine for secondary disinfection. Because of this difference in disinfection methods, the Region of Waterloo typically limits the transfer of water between the Cambridge free chlorine system and the IUS remaining chloramine system. This separation under typical demand conditions limits some of the flexibility and redundancy provided by having an interconnected system. However, under emergency conditions, the Region will utilize these interconnections and allow for the mixing of disinfection residuals in an effort to maintain system pressures and operations.

The proposed Cam 1W Pressure Zone operational strategy will utilize the new Cam 1W BPCS as the primary pressure zone supply, drawing water directly from the existing Cam 1 Pressure Zone. However, as part of the new Cambridge 1W control and operation strategy, the Cam 1W will utilize chloramine for secondary disinfection. This change in secondary disinfection from free chlorine to chloramine will allow the Cam 1W Pressure Zone to be supplied from the existing Cam 2W and Kit 2W Pressure Zones - both chloraminated zones - without the current disinfection residual mixing and water quality issues. This will provide enhanced supply security and operational flexibility to the Cam 1W Pressure Zone.

7.2 Chlorination vs. Chloramination

Both chlorination and chloramination are commonly used methods of secondary disinfection within municipal water systems. The use of chloramination typically consists of the addition of ammonium sulfate to chlorinated water to form a combined chlorine residual referred to as chloramines. Chloramines comprise the following oxidizing chemicals: monochloramine (NH_2Cl), dichloramine ($NHCl_2$), and trichloramines (NCl_3). For municipal drinking water, the preferred form of chloramine is monochloramine.

Both chlorinated and chloraminated water provide the same disinfection function: to maintain high quality potable water and prevent bacterial regrowth in distribution systems after treated water has left a treatment plant.

Chloramination provides the following benefits over chlorination:

- Chloramine is more stable disinfectant and does not dissipate quickly in water;
- Chloramine is typically less odorous than free chlorine; and,
- Monochloramine is more effective in killing Legionnaire bacteria that causes respiratory issues.

7.3 Potential Impacts of Changing from Chlorination to Chloramination

Chloramination is a proven method for secondary disinfection that has been in place for several years in Kitchener and Waterloo, as well as in the City of Toronto and York Region. Chloraminated water at controlled levels of approximately two parts per million is safe for general use in cooking and drinking, and for pregnant women, infants and children, and individuals on low-sodium diets.

Generally, all users who are sensitive to chlorinated water will be sensitive to chloraminated water. As such, the change to chloramination is not anticipated to affect any new users when compared to chlorinated water. However, existing sensitive users will need to make changes to their current de-chlorination method to account for the more difficult de-chloramination process.

For endpoint users, free chlorine can be easily removed through either:

- Boiling;
- Aeration (letting the water sit for a period of time); or
- Standard whole house or point-of-use filters.

To remove chloramines, more active processes are required such as:

- Activated carbon filters; and,
- Additional neutralizing chemicals, such as potassium or sodium metabisulfite.

Due to the nature of the change and the potential effects on these sensitive users, a public awareness program should be undertaken to ensure that all users (i.e., residents, employees, etc.) within the new Cam 1W Pressure Zone are made aware of the new secondary disinfection residual and new removal process. The Public Consultation Centre for this Class EA study – held on March 2, 2017 – included several materials and a slide presentation highlighting the conversion process.

A summary of typical sensitive users is listed below:

- Kidney Dialysis: The dialysis process involves removing waste products from a patient's blood through using large amounts of purified water. All chemical disinfectants, including chlorine and chloramine must be removed during this process. Therefore, dialysis patients must ensure their equipment removes these chemicals by following up with their physicians and equipment suppliers.
- Pets: Chloraminated water is safe for animals to consume, with the exception of fish and amphibians. Similar to chlorine, chloramine must be removed before using tap water in a fresh or salt-water aquarium or pond. Chloramine treatment systems and chloramine test kits are available for purchase from aquarium supply stores.
- Industry*:* Existing industries with water dependent processes, including the food and beverage industry, may need to adjust their current filtration process to allow for the removal of chloramine. Major water users within the Cam 1W Pressure Zone will need to be contacted well in advance to allow for implementation of their new filtration systems.

Other challenges associated with converting to chloramine are listed below. However, it is anticipated that they can be mitigated effectively through proper system operation and monitoring:

- Overdosing of chloramine: compared to chlorine, chloramine can more strongly oxidize some types of rubber hoses and gaskets, which typically include parts of washing machines and hot water heaters. The degraded material might show up as black or greasy particles. Proper ammonia dosing and control will ensure chloraminated water is not more corrosive to plumbing than chlorinated water.
- Water used at varying pH levels: at pH levels below 7.2 or above 7.8, dichloramine and trichloramine may arise. These chemicals can be irritable to sensitive skin and have a greater tendency to break down into disinfection by-products (DBPs). These issues are not anticipated in the distributed drinking water in Preston, as the water source emanates from groundwater in deep bedrock aquifers where the pH level is consistently between 7.2 and 7.8 throughout the year.
- The current chlorine secondary disinfection is known to cause lead leaching from existing lead services. Currently this lead is deposited in a form of a solid scale along the edges of the service wall. In some communities where the secondary residual was changed to chloramine from chlorine, increases in lead levels at properties with lead services were recorded; due to the reduction in lead leaching

potential causing the lead scale to redeposit into the water. However, this phenomena is not common to all system having under gone the changeover and his highly depended on the existing water chemistry. Based on the existing source chemistry with its stable pH, high alkalinity, and the existing calcium scale within the water system a precipitous increase in lead levels is not expected. Further the Region previously converted its Kitchener and Waterloo system, which has similar source water chemistry and system composition without any major reported incidents.

7.4 Implementation Process

7.4.1 Pre-Implementation Plan

Prior to the conversion, the Region and City will need to undertake an extensive public information program to facilitate the changeover. It is recommended that the public information program address the following key questions

1. Why does the Region provide secondary disinfection?
2. What is the Region currently doing?
3. What is changing?
4. Why the change?
5. Is chloramine safe?
6. Who else uses chloramine?
7. Has the Region done this before?
8. How will things change? Taste, filtration, etc.
9. How is chloramine filtration different from chlorine filtration?

The public information program should also highlight:

- The Region's successful historic chlorine to chloramine conversion in the Kitchener/Waterloo system.
- The Region's wider use of chloramination in Kitchener and Waterloo, as well as other communities such as Ottawa, Toronto, and York Region.

Further, the program should be of wide distribution across the Cam 1W Pressure Zone, with additional targeting of known and potential sensitive water users. This information program should also include notices to City and Regional agencies that may need to make adjustments to their practices and procedures such as local health authority, school

boards, community groups, the Ministry of Environment and Climate Change, and Grand River Conservation Authority.

7.4.2 Monitoring Plan

As part of the Cam 1W Pressure Zone implementation, an appropriate monitoring program should be developed in coordination with the Region's Water Operations and Public Health Authority, as well as the City of Cambridge's Water Operations. The monitoring program should include:

- Additional baseline monitoring before the conversion occurs, to measure existing water quality metrics;
- Ongoing daily and/or hourly monitoring during the chlorine to chloramine change over process; and,
- Additional post implementation monitoring to measure any changes in overall system water quality, including lead level monitoring.

7.4.3 Implementation Plan

A six step implementation plan should be developed to support the commissioning of the Cam 1W Pressure Zone and its conversion to chloramine. The primary objectives of this implementation plan will be to:

- Ensure the functionality of the BPCS and establishment of new Pressure Zone HGL; and,
- Minimize the extent and duration of secondary disinfection residual mixing.

The six step preliminary implementation plan is included in **Table 13**. It will be important to develop the detailed Implementation Plan in cooperation with the City of Cambridge and Public Health staff.

Table 13 Steps of Implementation Plan

Steps to Implementation	Key Activities	Monitoring Required	Proceed To Next Step
Step 1: Commission BPCS and Watermain	Construction of new watermain; Construction of new BPCS Commissioning of new BPCS	Pressure at Dundee and Kress Hill PRVs; In system pressure monitoring at hydrants; Pressure at Cam 1W BPCS	Once BPCS has been fully commissioned
Step 2: Initiated Chloramination of Cam 1W	Activation of chloramination facilities; Coordinated unidirectional flushing program	Chloramination levels at BPCS sample point Infield sampling; Pressure at Cam 1W BPCS	One month of successful operation
Step 3: Adjust Dundee PRV	Adjust Dundee PRV setting Nighttime testing of Dundee PRV operations with controlled BPCS rampdown/shutdown	Pressure and flow at Dundee PRV; Pressure at Kresshill PRV; In system pressure monitoring at hydrants. Pressure at Cam 1W BPCS	One week of successful operation
Step 4: Commission Kress Hill PRV	Construction of new Kress Hill PRVs Nighttime testing of Kress Hill PRV operations with controlled BPCS rampdown/shutdown	Pressure and flow at Kress Hill and Dundee PRVs; In system pressure monitoring at hydrants; Pressure at Cam 1W BPCS	One week of successful operation
Step 5: Implement normal Cam 1W operational controls	Implement recommended normal operational controls; Increase Cam 1W BPCS discharge pressure from 331m to 337m	Pressure and flow at Kress Hill and Dundee PRVs; In system pressure monitoring at hydrants	Stop monitoring after one month
Step 6: Cam 1 HGL change	Creation of Cam 1W Pressure Zone; Cam 1 Pressure Zone boundary adjustment including required valving and watermain work; Change in Middleton PS modifications	Normal system monitoring. Pressure at Cam 1W BPCS	Cam 1W Implementation Plan undertaken

8 Final Recommendations

Figure 1 illustrates the recommended infrastructure improvements that will establish the new Cam 1W Pressure Zone. The recommended improvements include the following:

- **Constructing a new watermain along Coronation Boulevard** to support peak flows for the future Cam 1W Pumping and Chloramination Station while providing security of supply to the Cambridge Memorial Hospital. The new watermain will be sized to provide peak flows to the pumping station, and will be constructed within the Coronation Boulevard right-of-way.
- **Constructing a new booster pumping station and chloramination facility** adjacent to Coronation Boulevard and east of Groff Mill Creek to serve as the primary source of water to the Cam 1W Pressure Zone system.
- **Re-purposing the existing Kress Hill Pumping Station as a PRV station** which will minimize implementation costs while providing operations with additional space, allowing for ease of future inspection and maintenance.
- **Construction of New Cambridge 2E to Cambridge 1 PRV** at Spiers Crescent, this will allow for the implementation of the proposed Cambridge 1 Pressure Zone boundary adjustment and to strengthen security of supply within the Cambridge water system.

8.1 Costs of Recommendations

Table 14 below includes the estimated costs of the recommended improvements associated with the new Cam 1W Pressure Zone.

The total costs include construction, engineering and design activities, and project contingencies. These costs however, exclude property acquisition. A detailed cost breakdown is summarized in **Appendix I – Estimated Project Costs**.

Table 14 Estimated Project Costs

	Base Construction Cost	Design/Admin & Contingency	Total Project Cost
Kress Hill PRV	$420,000	$150,000	$570,000
Hespeler Road PRV	$350,000	$140,000	$490,000
Coronation Blvd. Watermain	$2,525,000	$770,000	$3,295,000
Cambridge 1W BPCS	$3,925,000	$1,395,000	$5,320,000
Total	$7,220,000	$2,455,000	$9,675,000

9 Potential Effects and Mitigation

An overview of the mitigation measures required to avoid or minimize impacts to the study area is provided below.

9.1 Land Use and Property Requirements

9.1.1 Recommended Watermain Alignment

As the recommended alignment is located within the Regional right-of-way of Coronation Boulevard, no property is required for this improvement.

9.1.2 Recommended Pumping Station Site

The proposed site of the pumping station is located on a parcel owned by the City of Cambridge as well as on land privately owned. The Region has contacted both parties to discuss efforts to acquire the lands, and will continue to engage them in the acquisition process during detailed design. **Figure 9** illustrates the parcels required for the recommended pumping station site.

9.2 Natural Environment

9.2.1 Recommended Alignment

Planted boulevard and residential trees, including some large, mature trees, occur along the majority of the alignment. Tree removal will be conducted in accordance with the City of Cambridge's Tree By-law (By-law #71-06).

Some trees may provide suitable nesting habitat for migratory birds. Migratory birds, including active nests, eggs, and young, are protected during the breeding season under the federal Migratory Birds Convention Act. As a result, the removal of vegetation may directly impact nesting birds. In order to minimize impacts to nesting birds, the Region will avoid removal of vegetation during the active season for breeding birds (April 15 – August 15), unless construction disturbance is preceded by a nesting survey conducted by a qualified biologist. In so doing, no residual effects are anticipated by implementing this mitigation measure

9.2.2 Recommended Pumping Station Site

Dumfries Conservation Area and a candidate significant woodland are located within 120 metres of the recommended pumping station location. No vegetation removal is proposed in these areas. With the implementation of a 10-metre buffer between the recommended pumping station site and the Dumfries Conservation Area and woodland (as required by City policy), no impacts are anticipated. Because there is the potential for milksnake – a



Region of Waterloo

Creation of Cambridge Pressure Zone 1W Class EA

Figure 9

Preferred Pump Station Site Property Acquisition

Groff Mill Creek

- Railway
- Existing Easement
- Tentative Pumping Station Site
- Tentative Pumping Station Building
- Station Access Way
- Land to Acquire

Environmental Features

- Creeks
- Rivers
- Grand River Conservation Authority Limits
- Dumfries Conservation Area
- Regulatory Floodplain

BluePlan ENGINEERING

716015-24-W-Preferred PS Site (Property Acquisition)
May 2017
Data Source: Region of Waterloo
Scale: 1:1,500 | NAD 1983 UTM Zone 17N

Because there is the potential for milksnake – a species designated special concern – to occur in the study area, exclusion fencing will be installed around the active construction site of the recommended pumping station location to prevent individuals from entering the site.

Woodland habitat adjacent to Groff Mill Creek north of Coronation Boulevard and adjacent to the recommended pumping station site may provide suitable habitat for the three species at risk bats as well as special concern species including the Eastern Wood-peewee, the Red-headed Woodpecker, the Milksnake and the Woodland Flax. However, as there are no plans to remove any trees or vegetation in the woodland, the habitat for these species are not anticipated to be impacted.

9.3 Groundwater

While there is the potential for dewatering to occur during the installation of the watermain, no groundwater impacts are anticipated. Groundwater mitigation measures for both recommended alignment and pumping station site will be further identified during detailed design, as needed.

9.4 Surface Water

The Region will manage the surface water on site during construction. A surface water management plan will identify additional measures to accommodate capacity considerations for the emergency BPCS overflow.

9.5 Pump Station Overflow

Any emergency BPCS overflows will consist of treated chloraminated water. These overflows will occur from emergency relief valves within the station and will be directed to an underground storage tank equipped with standby de-chloramination agent before being directed to the stormwater service. Overflows leaving the site will be de-chloraminated with water quality levels at or greater than the site stormwater runoff.

9.6 Archaeology and Built Heritage

The only potentially undisturbed portions of the study area that will be impacted by the project is the recommended pumping station site. As a result, a Stage 2 Archaeological Assessment was undertaken on these lands to specify the potential archaeological impacts, if any (See **Appendix D** – Archaeological Assessment 2). The results of the Archaeological Assessment 2 did not identify any archaeological sites on the pumping station lands, so no additional assessments are required.

While there is a high number of properties with potential cultural heritage value or interest throughout the entire study area, no identified cultural heritage resources will be directly impacted by this project.

9.7 Utilities

The recommended alignment within the Coronation Boulevard right-of-way comprises utilities typical of an urban area including municipal water, sanitary and storm sewers, electrical and other utilities. The pumping station site will require new municipal services including sanitary and storm sewers. The Region identified the location of existing utilities and services along Coronation Boulevard and within the pumping station site and determined that there would be no conflicts associated with either recommendation. During detailed design, the Region will reconnect with the relevant firms to ensure impacts to utilities are minimized or avoided during construction and operations.

9.8 Transportation System

Coronation Boulevard is a Regional arterial road primarily comprising four lanes, a landscaped median boulevard and turning lanes at key intersections. As construction of the watermain will occur within the Coronation Boulevard right-of-way, the need for short-term lane closures during construction will be determined during detailed design. The Region of Waterloo will prepare a traffic management plan to provide safe and uninterrupted service to commuters, and identify the need for and extent of any short-term lane closures along the alignment and around the proposed site of the pumping station, including required signage and traffic control measures to aid the safe ingress and egress of trucks to and from the site. Special focus of the traffic management plan will be to ensure access and mobility is maintained for Cambridge Memorial Hospital and emergency service providers. Work may be able to be coordinated with other work identified by Region Transportation engineering, minimizing the impact to the public.

9.9 Noise and Vibration

The existing pumping station is located adjacent to a commercial facility but away from residences. Construction activities may result in additional noise and dust around the site and along the recommended alignment. As a result, the Region of Waterloo will:

- Employ a noise and dust control strategy to reduce emissions;
- Obtain an Environmental Compliance Approval for Air and Noise during detailed design;
- Equip a diesel generator exhaust system with appropriate noise abatement equipment to minimize impacts to the nearest sensitive receptors;

- Develop a construction staging plan to minimize community disruption;
- Use low noise equipment during construction, where possible; and,
- Restrict working hours for construction, in accordance with the Region's Noise Control By-law.

9.10 Permits and Approvals

Table 15 provides an overview of the key permits and approvals that may be required in advance of the construction activities, and which will be further explored during detailed design.

Table 15 Approvals and Study Components

Agency	Description of Permits / Approvals Required
Region of Waterloo	• Regional road permit for works associated with right-of-way construction.
Ministry of the Environment and Climate Change	• Environmental Compliance Approval required for Booster Pumping and Chloramination Station. • Any activities that discharge air contaminants at the facility will be registered in the Environmental Activity and Sector Registry as prescribed by O. Reg. 1/17. • Amendment to the Region's Municipal Drinking Water License associated as needed. • Completion of Form 1 Record of Watermains Authorizes as a Future Alternation as required (watermain). • Completion of Form 2 Record of Minor Modification or Replacement to the Drinking Water System as required (Kress Hill PRVs)
Ministry of Natural Resources and Forestry	• Permit or other authorization may be required to conduct an activity that could impact an endangered or threatened plant or animal or its habitat.
Ministry of Tourism, Culture and Sport	• The Ministry of Tourism, Culture and Sports must approve of the fieldwork and reporting completed as part of the archaeological assessments, and must deem it compliant with the Ministry's 2011 Standards and Guidelines for Consultant Archaeologists.
Grand River Conservation Authority	• Permit (O. Reg. 150/06) required to comply with the Regulation of Development, Interference with Wetlands and Alterations to Shoreline and Watercourses. • Permit (O. Reg. 166/06) required to traverse all areas regulated by the Grand River Conservation Authority.
City of Cambridge	• Tree removal will be conducted in order to comply with the City's By-law (#71-06).

10 Public Consultation and Communication

Public consultation is an integral component of the Class EA process enabling the Region to inform the public about the study while eliciting input from potentially interested and affected parties during the study process.

The primary goals of the public consultation process were to:

- Present clear and concise information to stakeholders at key stages of the study process;
- Solicit community, regulatory and Regional staff input;
- Undertake comprehensive consultation to complete the duty to consult with Aboriginal people in Ontario;
- Consider stakeholder comments when evaluating alternative solutions and in recommending the technical feasible solution; and,
- Comply with Municipal Class EA consultation requirements.

At the outset of the public consultation process, the Region of Waterloo developed a Communication and Consultation Plan tailored to this study. The primary objective of the plan was to encourage two-way communication with the community, regulatory agencies, and Regional staff. More specifically, the plan was designed to:

- Build on previous Class EAs communication protocols, consultation plans, and municipal planning - to ensure consistency and continuity;
- Ensure the general public, regional councilors, stakeholders, external agencies (including federal, provincial and regional) and special interest groups had an opportunity to participate in the study process;
- Ensure that relevant information was provided to interested and affected stakeholders early and often throughout the planning process
- Make contact with external agencies to obtain legislative or regulatory approvals, and to collect pertinent technical information

In order to comply with the Municipal Class EA process, the Region of Waterloo hosted a Public Consultation Centre to elicit input on the study process and recommended strategy. Complete documentation of the consultation and communication program is provided in **Appendix K – Public Engagement and Consultation**.

10.1 Phase 1 Communication and Consultation Summary

10.1.1 Contact List

A list of stakeholders, review agencies and other interested parties was developed at the outset of the study to invite participation in the planning process. The contact list was updated throughout the study as more individuals became aware of the study or provided feedback.

This developing contact list has representatives from the following:

- Aboriginal Communities
- Community Associations
- Conservation Authorities
- Federal Agencies
- Institutions
- Major Water Users
- Provincial Agencies
- Railway/Transit Operations
- Regional/City Councillors
- Region of Waterloo
- School Boards
- Special Interests
- Utilities

10.1.2 First Nations Consultation

The Region provided direct consultation with local First Nation communities. This involved email correspondence to address the Notice of Study Commencement – Creation of Cam 1W Pressure Zone – Schedule B Class EA.

The Region of Waterloo utilized the Aboriginal and Treaty Rights Information System (ATRIS) in order to identify which Aboriginal communities may have an interest in this study. The City identified additional contacts who were engaged in previous infrastructure studies. **Table 16** presents the First Nations and Métis communities who were invited to participate in the planning process and PCC.

Three separate follow-up emails were received by the Region. These emails enclosed comments, further contact information, and identified third parties the Notice of Study Commencement had been forwarded to.

Table 16 Summary of Comments

	Summary of Comments	Action
Curve Lake First Nation	• Received Notice of Study Commencement on November 21, 2016. • Proposed Study Area is within the Traditional Territory of Curve Lake First Nation which is incorporated within the Williams Treaties Territory – subject of a claim under Canada's Specific Claims Policy. • Contact of Claims Coordinator provided in letter correspondence – with recommendation to send project proposal to this contact respectively. • Not currently aware of any issues that could cause concern with respect to Tradition, Aboriginal, and Treaty rights. • Particular concern for the remains of ancestors – if evidence encountered, notification to representative and First Nation must be given immediately. • Obligations under Cemetery Act – Reminder to notify nearest First Nation Government or other community of Aboriginal people which is willing to act as a representative and whose members have a close cultural affinity to the interred person.	• Emailed Williams Treaties First Nation Claims Coordinator to provide further project details. • Notified the nearest First Nation Government in compliance with the Cemetery Act. • Documented protocol in the event ancestry remains are discovered.
Chippewas of Thames First Nation	• Reviewed Notice of Study Commencement on November 17, 2016. • No concerns with information presented in Notice of Commencement. • To inform respective contacts if substantial project changes occur – if only minor changes, no need to receive regular project updates.	• Removed Chippewas of Thames First Nation from circulation list. • Will send notification if substantial changes occur during the study.
Chippewas of Rama First Nation	• Reviewed Notice of Study Commencement on November 8, 2016. • Letter was screened and shared with Council members and Williams Treaties First Nation Process Coordinator/Negotiator. • In the event necessary action is required, Coordinator will provide further comments.	• Comments acknowledged, no further action taken.
Conservation Authorities (GRCA)	• Email correspondence as follow-up to meeting previously held on November 9, 2016. • Portions of the study area are regulated by the GRCA under Ontario Regulation 150/06 (Development, Interference with Wetlands and Alterations to Shorelines and Watercourse Regulation). • Any further development within the regulated area will require the prior insurance of a Permit pursuant to Ontario Regulation 150/60. This includes submission of a Permit Application to the GRCA for respective approval/refusal. • Recommended to contact the Guelph District Office of the Ontario Ministry of Natural Resources and Forestry (MNRF) obtain information on endangered/rare species and fisheries data. • GRCA is interested in receiving information as the study progresses to provide further review and comment.	• Will submit a Permit Application to the GRCA in the event further development within the regulated area takes place. • Followed-up with the Guelph District Office of the Ontario Ministry of Natural Resources and Forestry to obtain addition information on endangered/rare species and fisheries data. • Added GRCA to circulation list to provide further details as the study progresses.

	Summary of Comments	Action
Ministry of Infrastructure	• Ministry of Infrastructure (MOI) – requested more information to determine whether the proposed location requires support under the control of the MOI.	• Proposed site location does not impact MOI land.
Ministry of Tourism, Culture and Sport (MTCS)	• Ministry of Tourism, Culture and Sport (MTCS) – expressed interest in three items that relate to the mandate of conserving Ontario's cultural heritage including: Archaeological resources (including land-based and marine); Built heritage resources (including bridges and monuments); and Cultural heritage landscapes.	• A desktop inventory was completed by Golder and Associates to capture the Natural Environmental Features of this study (See Appendix B, C, and D).
Ministry of Environment and Climate Change (MOECC)	• Staff are available for consultation as the EA continues in regards to the Safe Drinking Water Act to ensure that legislative requirements are going to be met. • Proposed project may have the potential to affect Aboriginal or treaty rights protected under Section 35 of *Canada's Constitution Act 1982*. • MOECC – GIS map provided to identify existing features that may be relevant.	• No further action required.
Consultation and Accommodations Unit (CAU)	• Received confirmation of electronic delivery to Consultation and Accommodations Unit (CAU) of Aboriginal Affairs and Northern Development Canada.	• No further action required.
Transport Canada	• Received confirmation of electronic delivery to Transport Canada.	• No further action required.
Residents	• A sample of water residue from a household appliance was received during the PCC. • 12 local residents attended the PCC.	• During consultation, water residue is likely a result of calcification. • Discussion took place during PCC.
Canadian National Railway	• Received updated contact information for future correspondence.	• No further action required.
Enbridge	• Reviewed subject application. No facilities exist within the proposed study area.	• No further action required.
Union Gas	• Received updated contact information for future correspondence.	• No further action required.

10.1.3 Notice of Commencement

GM BluePlan issued a Notice of Study Commencement on November 8, 2016. After issuing the notice, the Region published the Notice of Study Commencement in the Waterloo Region Record and the Cambridge Times.

The Notice was also published on the Region's website. The Region and GM BluePlan Project Manager's contact information was made available in the notice, from whom interested parties can obtain additional information or request that they be added to the Study Contact List. In addition to the newspaper Notices, GM BluePlan Team prepared a Notice in letter format which was mailed respectively to the established list of stakeholders, local businesses and residents. The GM BluePlan Team followed up with select agencies in person or by mail, e-mail or phone to facilitate the coordination of input into the study. The GM BluePlan Team will maintain a file of all correspondence sent and received. This documentation will be included in the final Citizens Document.

Internal contacts and notification were coordinated via the Region's Project Manager. The study took an integrated project approach with Notices and Public Consultation Centre to ensure that the strategy, its project components, and their relationship are clearly understood by stakeholders.

10.1.4 Public Consultation Centre

A Public Consultation Centre took place on March 2, 2017. This Public Consultation Centre followed the identification of preliminary preferred solutions for the creation of the Cam 1W Pressure Zone.

This Public Consultation Centre is a mandatory point of contact in the EA process and satisfies Phases 1 and 2 of the Class EA process. The Public Consultation Centre was held at the Galt Country Club Limited, a venue located within close proximity to the study area which followed an "open house" format with display boards presenting project information.

The study's Public Consultation Centre elicited input on the Class EA process, servicing constraints and opportunities, alternative concepts and strategies to address the servicing challenges and opportunities, and the technically feasible solution.

The Public Consultation Centre also provided an overview of the chlorine to chloramination conversion, and included water samples of each. This information was presented in a slideshow presentation, through fact sheets, and was discussed with attendees.

10.1.5 Stakeholder Workshop

Stakeholder meetings had previously been held to engage, inform and enable technical, policy and regulatory input at key decision-making points. These were intended to include a wider audience than the Project Team, including: The Grand River Conservation Authority, The City of Cambridge, and Regional staff.

10.1.6 Comments and Inquiries

The project team received comments from a variety of stakeholders once the notices had been sent out. Additional comments were received during the Public Consultation Centre held on March 2, 2017.

10.1.7 Notice of Completion

To ensure all comments are captured within the scope of this study, the Notice of Completion will be finalized following final review of this Project File respectively.

11 Conclusions and Follow-up Commitments

During this Municipal Class EA, the Region of Waterloo worked closely with key stakeholders to address and resolve key issues or challenges associated with this study. However, not all issues can be addressed within the context of the Municipal Class EA process since the design of the recommended strategy has been prepared at a conceptual level only. As a result, the Region has identified a list of future commitments (see **Table 17**) as the study moves forward into detailed design and construction.

Table 17 Project Commitments

Project Commitments
Chlorine to Chloramine Conversion
• Prior to the conversion, the Region and City should undertake an extensive public information program to facilitate the conversion, and ensure additional targeting of known and potential sensitive water users. • Include notices to City and Regional agencies that may need to make adjustments to their practices and procedures such as local health authority, school boards, community groups, the Ministry of Environment and Climate Change, and Grand River Conservation Authority. • Initiate a monitoring program in coordination with the Region's Water Operations and Public Health Authority, as well as the City of Cambridge's Water Operations. • Further develop a detailed implementation plan with City and Public Health to ensure the functionally of the booster pumping station and chloramination facility while minimizing the extent and duration of secondary disinfection residual mixing.
Noise, Odour and Dust
• Develop a noise and dust control strategy. • Develop a construction staging plan. • Use low noise equipment during construction where possible. • Restrict working hours for construction, in accordance with the Region's Noise Control By-law. • Equip a diesel generator exhaust system with appropriate noise abatement equipment to minimize impacts to the nearest sensitive receptors.

- Obtain an Environmental Compliance Approval for Air and Noise during detailed design.

Groundwater

- Identify mitigation measures for both the recommended alignment and pumping station site during detailed design, as needed.

Surface Water

- Develop a surface water management plan that will identify additional measures to accommodate capacity considerations for the pumping station's emergency overflow.
- Implement sediment / erosion controls during construction adjacent to natural features, including Groff Mill Creek. Measures may include installation of sediment barriers on all catch basin and maintenance holes, and a silt fence barrier along all areas that sheet drain off site.
- Confirm appropriate set-backs and /or mitigation measures for work within GRCA regulated areas adjacent to Groff Mill Creek, as needed.

Species at Risk

- Identify additional mitigation measures or permits to address impacts to species at risk if vegetation removal is proposed around the pumping station site.
- Undertake proper planning, design and construction mitigation measures to avoid impacts to locally rare or special concern species.

Wildlife and Wildlife Habitat

- Avoid removal of vegetation during the active season for breeding birds (April 15 – August 15), unless construction disturbance is preceded by a nesting survey conducted by a qualified biologist.

Significant Woodlands

- Provide tree protection or exclusion fencing to avoid impacts to significant woodlands.
- Limit clearing areas to the minimum size needed for construction.
- Create a restoration plan during detailed design which includes a strategy to restore disturbed areas.

Fish Habitat
• Implement standard and accepted mitigation measures outlined in the Land Development Guidelines for the Protection of Aquatic Habitat (DFO 1993), Fisheries Protection Policy Statement (DFO 2013a) and Measures to Avoid Causing Harm to Fish and Fish Habitat (DFO 2013c) during construction. • Complete all refueling, washing and servicing of machinery beyond 30 metres of the water course where fish are present.
Archaeology
• Given that there are undisturbed areas within the study area that still retain archaeological potential, they should be subject to a Stage 2 field assessment prior to any proposed ground disturbance. Areas of archaeological potential within the study area will not require a Stage 2 assessment if they will not be impacted by any proposed ground disturbance (i.e. construction).
Contamination and Waste
• If contaminated soils are present, determine how and where they are to be disposed of, consistent with Part XV.1 of the Environmental Protection Act and Ontario Regulation 153/04, Records of Site Condition, which details the new requirements related to site assessment and clean up. • Dispose of all waste generated during construction in accordance with MOECC requirements. • In the event of a spill, contact the MOECC's Spills Action Centre immediately. • Develop and a spill response plan that will be implemented immediately in the event of a sediment release or spill of a deleterious substance.
Traffic Management
• Prepare a traffic management plan to identify the need for lane closures, signage and traffic control measures during construction, with special focus on ensuring mobility and accessibility is maintained for Cambridge Memorial Hospital
Property
• Engage the City of Cambridge and private land owner to discuss potential property acquisition which would accommodate the proposed pumping station site.

Utilities
• During detailed design, reconnect with the relevant utility firms to ensure impacts to utilities are minimized or avoided during construction and operations.
Permits
• Obtain permits (as needed) as identified in this Project File.
Additional Consultation
• Hold further consultation with key stakeholders and adjacent property owners (as needed) during detailed design and construction.
Municipal Class EA Addendum Process
• Undertake an addendum to this Municipal Class EA study if any significant modification to the project or change in the environmental setting occurs after the filing of the Project File.

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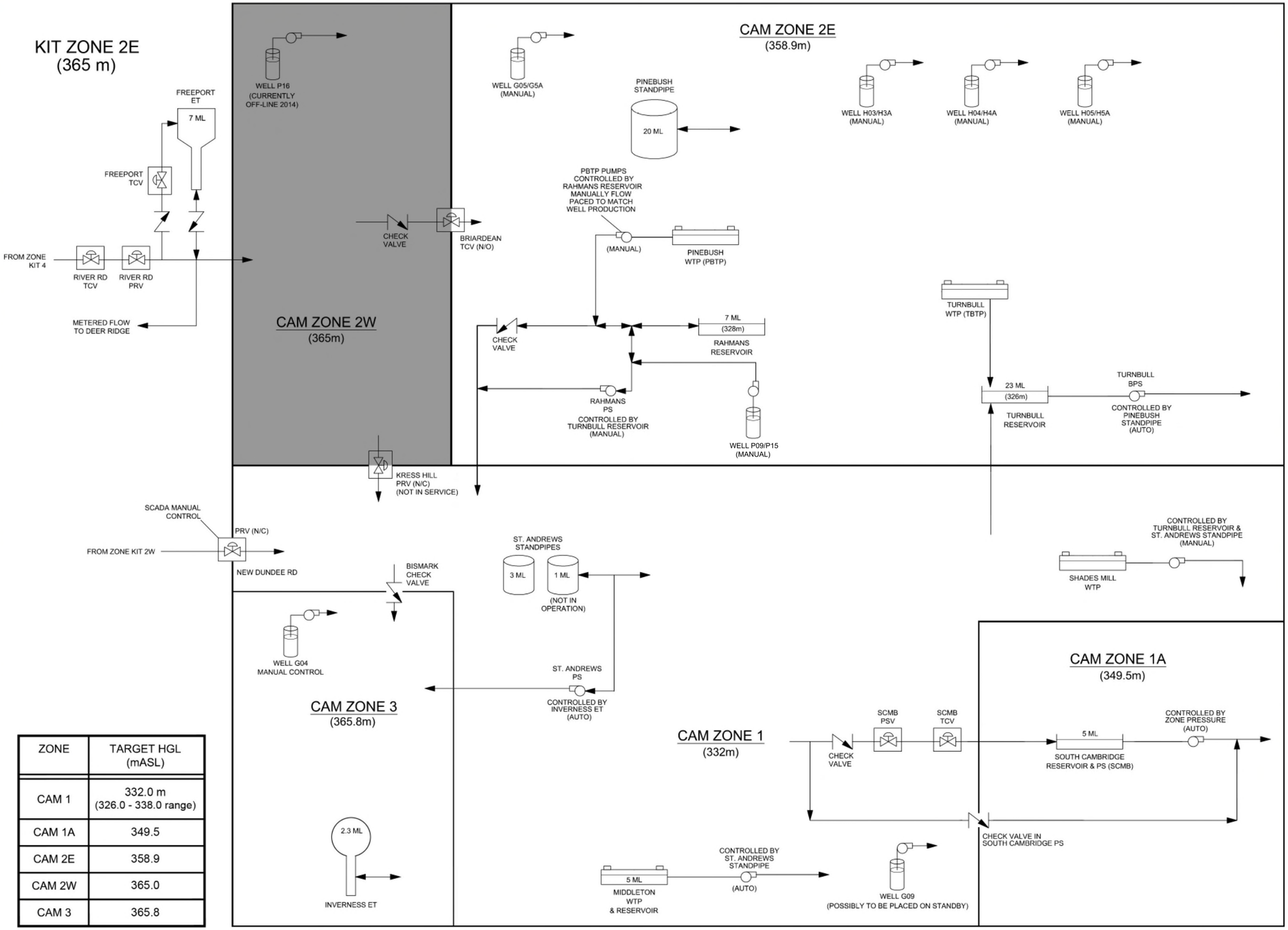
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Appendices

Appendix A - System Schematic of Cam 1W Pressure Zone



ZONE	TARGET HGL (mASL)
CAM 1	332.0 m (326.0 - 338.0 range)
CAM 1A	349.5
CAM 2E	358.9
CAM 2W	365.0
CAM 3	365.8

Region of Waterloo

N

EXISTING CAMBRIDGE DISTRIBUTION SYSTEM

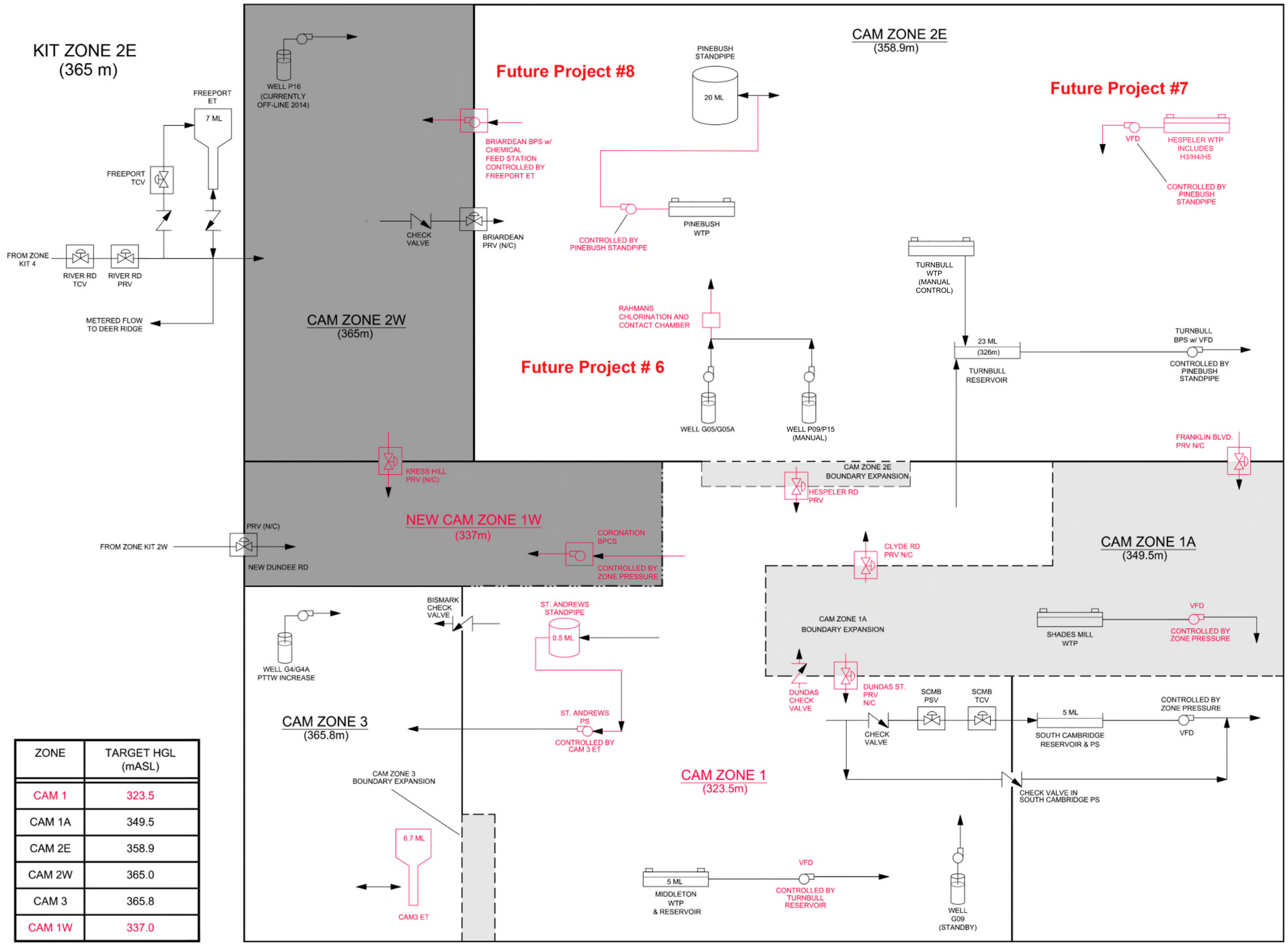
Figure A1

Process Flow Diagram

- WELL
- PUMPING STATION (PS)
- RESERVOIR (GROUND LEVEL)
- STANDPIPE
- ELEVATED TANK (ET)
- WATER TREATMENT PLANT (WTP)
- FLOW CONTROL VALVE
  - PRV — PRESSURE REDUCING VALVE
  - TCV — THROTTLING CONTROL VALVE
  - PSV — PRESSURE SUSTAINING VALVE
  - N/C — NORMALLY CLOSED
- FREE CHLORINE
- COMBINED CHLORINE (CHLORAMINE)
- ML — MILLION LITRES

BluePlan ENGINEERING

May 2017
NAD 1983 UTM Zone



ZONE	TARGET HGL (mASL)
CAM 1	323.5
CAM 1A	349.5
CAM 2E	358.9
CAM 2W	365.0
CAM 3	365.8
CAM 1W	337.0

Region of Waterloo

N

PROPOSED CAMBRIDGE DISTRIBUTION SYSTEM

Figure A2

Process Flow Diagram

- WELL
- PUMPING STATION (PS)
- RESERVOIR (GROUND LEVEL)
- STANDPIPE
- ELEVATED TANK (ET)
- WATER TREATMENT PLANT (WTP)
- FLOW CONTROL VALVE
  - PRV — PRESSURE REDUCING VALVE
  - TCV — THROTTLING CONTROL VALVE
  - PSV — PRESSURE SUSTAINING VALVE
  - N/C — NORMALLY CLOSED
- FREE CHLORINE
- COMBINED CHLORINE (CHLORAMINE)
- ZONE BOUNDARY CHANGE
- ML — MILLION LITRES

BluePlan ENGINEERING

May 2017
NAD 1983 UTM Zone

Appendix B - Technical Memorandum 1

Creation of Cambridge Pressure Zone 1W
Environmental Assessment
Technical Memorandum #1
Background Review & Design Parameters Summary

Prepared by GM BluePlan for:

Region of Waterloo

Project No. 716015

Sept 2016

Region of Waterloo

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Appendix D – Demand Analysis
Appendix E – HGL System Profiles

Alternate formats of this document are available upon request.
Please contact Kevin Dolishny at kdolishny@regionofwaterloo.ca,
519-575-4757 ext. 3862, or TTY: 519-575-4608 to request an alternate format.

1 Introduction

The Region of Waterloo retained GM BluePlan Engineering Limited to complete a Schedule 'B' Municipal Class Environmental Assessment (EA) for the Creation of the Cam 1W Pressure Zone.

The aim of the Class EA is to confirm the necessary infrastructure requirements and system modifications needed to create a new pressure zone Cambridge Zone 1 West (Cam 1W) in the City of Cambridge. This includes:

- Confirmation of the new pressure zone operational configuration,
- Identification and sizing of new infrastructure, system modification, and operational changes,
- Identifying the infrastructure and locations required at each zone boundary, including the new booster pumping station and chlorination facility, trunk watermain alignment, and Pressure Reducing Valves (PRVs), and
- Preparing the environmental screening report and project file.

Upon completion of the Schedule 'B' Class EA, GM BluePlan will complete a conceptual design of the proposed system upgrades, which will provide the Region with a clear vision of the infrastructure requirements and facilitate the next steps of detailed design and construction. Key conceptual design elements will include:

- Pump station site layout and conceptual layout, including related structural, mechanical and electrical work;
- Preliminary plan and profile drawings for the watermain alignments;
- PRV chamber layouts and site layouts; and,
- Design brief that comprises all key technical details and project considerations, including capital and operating cost estimates.

1.1.1 Project Context

In 2013, the Region of Waterloo (RoW) retained Stantec to complete the Water Supply and Distribution Operations Master Plan (WSDOMP) and Water Supply Master Plan (WSMP) of its Integrated Urban Water System (IUS). These studies had the objective of developing a comprehensive water supply and water distribution strategy to support the long-term growth within IUS. A key finding of the WSMP was that current, and planned, local water sources were sufficient to meet demands beyond 2031, and that development of the previously planned Lake Erie based supply was not needed until beyond 2051. As such, the WSDOMP upgrade recommendations focus on capital projects, system modifications, and operational changes to improve, optimize, and strengthen the IUS.

A second key finding of the WSMP was that there was limited surplus capacity from the Mannheim Water Treatment Plant (WTP) supply aquifers and therefore growth beyond 2031 would depend on maximizing the remaining available supply capacity within the IUS. To achieve this objective, the WSMP supply management strategy focused on maximizing the City of Cambridge supply self-sufficient and to limit flow transfers from remaining IUS into Cambridge.

In support of the ultimate WSMP and WSDOMP, several system upgrades and capital projects were recommended for the Cambridge water system. Following WSMP and WSDOMP, the RoW retained GM BluePlan to develop the Implementation Plan for the Cambridge Water System Upgrades. The Implementation Plan was a follow-up study to review, evaluate, and refine the proposed Cambridge Water System Upgrades before the Region proceeds with implementation. This study supplemented the original study's findings by carrying out further system investigations including site visits, system modelling, system performance testing, and stakeholder consultation.

A total of (8) eight major water system upgrade projects are summarized in the Final Implementation Plan for the Cambridge Water System, consisting of:

Project #1	Cam 3 Capacity Upgrades
Project #2	**New Kress Hill PRV**
Project #3	**Creation of New Cam 1 West Pressure Zone**
Project #4	Cam 1 Pressure Zone Change
Project #5	Pinebush Re-Configuration
Project #6	Rahmans Wells Re-Configuration
Project #7	New Hespeler WTP
Project #8	New Cam 2W Booster Pumping Station

The **Creation of New Cam 1 West Pressure Zone** is integral to the overall Cambridge Water System Upgrade Strategy with its completion allowing for the implementation of many of the remaining water system upgrade projects. For the purposes of this Class EA, both Project #2 and Project #3 have been consolidated into a single overall project.

1.2 Technical Memo #1

In support of the Final Class EA submission, the technical work related to the **Creation of New Cam 1 West Pressure Zone EA** will be structured into interim Technical Memorandums (TMs). Each TM will summarize: the work completed to date, key assumptions and results, and key recommendations and outcomes moving forward.

The scope of Technical Memo 1 consists of:

- A summary of the results of the collection and review of background information to be used for subsequent tasks;
- An overview of the Class EA preparatory work and key considerations;
- An overview of the project study areas and current opportunities and constraints;
- An overview of the proposed Cam 1W configuration and potential operational strategy;
- A confirmation of the project design parameters, and key system performance and operational constraints; and,
- A review of the potential user impacts resulting from the change in secondary disinfection method.

2 Data Sources

This section summarizes the various data sources and activities that that were used to form our basis of understanding. The key outcomes of this data collection and review are summarized in the subsequent sections of Technical Memo 1.

2.1 Digital Infrastructure and GIS Data

The Region provided a wide range of detailed water system and other infrastructure data. A summary of the key digital data sources related to this include:

- Water system infrastructure GIS database;
- Municipal utility infrastructure GIS database;
- Environmental features GIS database;
- Municipal parcel and land use information; and,
- City of Cambridge water billing records.

2.2 Relevant Historic Reports

A review of relevant reports was completed for additional project context and information pertinent to the confirmation of design parameters, including:

- Water Supply and Distribution Operations Master Plan (WSDOMP) – Stantec 2015;
- Water Supply Master Plan (WSMP) – Stantec 2015; and,
- Implementation Plan for Cambridge Water System Upgrades – GM BluePlan 2015.

2.3 Water System InfoWater Hydraulic Model

A copy of the Region's newly developed all-pipe model was provided and used as the base model for all hydraulic modelling activities.

2.4 Historic Water System SCADA Records

A review of the Region's SCADA data was used to validate our understanding of current system performance and facility operations. Relevant facilities included Freeport Elevated Tank and River Road PRV, Turnbull Reservoir, New Dundee PRV, St. Andrews Tank, Rahmans Reservoir and Pumping Station (PS), and Middleton Reservoir and PS.

2.5 Facility Drawings

Drawings of key facilities were reviewed, including:

- Existing Kress Hill PS;
- New Dundee PRV;
- Rahman's Reservoir and PS;
- Turnbull Reservoir and PS; and,
- Middleton Reservoir and PS.

2.6 Regional Consultation

An operations workshop was held with Regional staff to review the proposed operations of the Cam 1W Zone, confirm the preferred operational strategies and capacity requirements, and validate the facility's specific needs and requirements.

2.7 Site Visit: Kress Hill

GM BluePlan and Regional staff carried out a site visit of the existing Kress Hill PS. The purpose of the site visit was to assess the general condition of the existing facility and suitability for the proposed Kress Hill PRVs, in addition to any opportunities and constraints that may inform latter stages of the project.

3 Class EA Related Preparatory Work

In parallel, several Class EA related preparatory work activities were completed. This Class EA related preparatory work supplements the data collection and review, and confirmation of design parameter activities, and will support future technical tasks and completion of the final Environmental Screening Report. A summary of the key relevant works are outlined in this section.

3.1 Communication Plan and Stakeholder List

A project communication plan and stakeholder list was prepared. A copy of the communication plan is included in **Appendix A** – Communication Plan. The communication plan outlines proposed methods and strategies to engage key stakeholders.

Consultation with these stakeholders is expected to occur during Phase 2 of the Class EA process (*Evaluating Alternative Solutions*). A list of key stakeholders is listed below; a complete list of all identified stakeholders is also included in **Appendix A** – Communication Plan.

- Aboriginal Groups;
- Local municipal governments, with special focus on Region of Waterloo and City of Cambridge Councilors;
- City of Cambridge and Region of Waterloo Water Operations and Engineering Staff;
- Grand River Conservation Authority (GRCA);
- Provincial ministries including:
    - Ministry of the Environment and Climate Change,
    - Ministry of Transportation, and
    - Ministry of Natural Resources and Forestry;
- Major water users within the Cam 1W zone; and,
- Cambridge Memorial Hospital.

3.1.1 Grand River Conservation Authority

A GRCA permit may be required for construction or development work completed within its regulated area. Communications with the GRCA will occur during Task 4 to confirm the permitting requirements.

3.1.2 Utility Coordination

Utility companies will be contacted as part of the public consultation process and Class EA document filling, and will be asked to provide feedback on the proposed alternatives. Further, the utility contacts will be sent copies of the conceptual design of the preferred route and sites. The utilities will identify the permits needed by the Region upon design review.

3.2 Government/Agency Policies, Legislation, and Regulations

Relevant government/agency policies, legislation, and regulations were reviewed to identify how they will apply to current and subsequent stages of this Class EA. The following were used to support and confirm the design parameters:

- Region of Waterloo and Area Municipalities Design Guidelines and Supplemental Specification for Municipal Services (DGSSMS);
- MOECC Design Guidelines for Drinking Water Systems;
- The City of Cambridge Official Plan; and,
- The Region of Waterloo Official Plan.

3.3 Environmental Screening Review

The GM BluePlan team completed a Stage 1 Archaeological Assessment, Cultural and Built Heritage Assessment, and Natural Environmental Existing Conditions Report for the general study area. **Appendix B** – Golder Reports, includes copies of these reports.

3.3.1 Archaeological Assessment

Potentially undisturbed portions of the Study Area were determined to exhibit archaeological potential due to:

- The identification of nine previously registered archeological sites within 300 meters of the Study Area;
- The location of an unnamed tributary of the Grand River that flows through the Study Area and the Grand River itself, which abuts the Study Area;
- The presence of well-drained soils at the western edge of the Study Area, and in the surrounding area; and,
- The fact that the Study Area overlies three historical transportation routes (Coronation Boulevard, Hespeler Road, CN Railway line) in Waterloo and North Dumfries Townships with a history of Euro-Canadian occupation beginning in the early 19th century.

Based on the combined results of the background research and property inspection, it is recommended that the potentially undisturbed portions of the Study Area be subjected to a Stage 2 archaeological assessment. All areas identified as having low to no archaeological potential due to previous disturbance and steep slope observed through the Stage 1 property inspection do not require further archaeological assessment.

3.3.2 Cultural and Built Heritage Assessment

The desktop cultural heritage screening report determined that the Study Area contains known and potential cultural heritage resources. It is therefore recommended that:

- A more detailed Cultural Heritage Evaluation Report (CHER) be completed once the boundaries of the Study Area or Areas have been refined and once potential construction activity sites are known.
- Project mapping for the Cambridge Pressure Zone 1W project include the location of known cultural heritage resources, and planning should consider avoiding cultural heritage resources as much as possible.

3.3.3 Natural Environment Existing Conditions Report

Based on the results of the natural environment screening assessment, there are many natural features and species at risk within the study area. These are summarized in detail in **Appendix B** – Golder Reports. There is potential for the proposed Project to interact with these natural environment features, which may result in negative impacts to either the feature itself or its function and connection to adjacent features. Field studies are recommended to confirm the desktop findings, and more importantly to provide site specific information for those areas that will occur within the proposed Project footprint. Field level data is required to assess potential Project impacts and to identify mitigating opportunities or measures.

4 Project Study Area

Figure 1 illustrates the general new Cam 1W Pressure Zone and Class EA Project Study Area. The New Cam 1W Pressure Zone will consist of the existing Cam 1 zone within the Preston area of Cambridge. The new Cam 1W pressure zone will be roughly bound by Hespeler Road to the east, Highway 401 to the north, and the Grand River to the west. The southern limit of the pressure zone will be established as part of the Class EA and will be separated from the CAM 1 pressure zone by the new Cam 1W pumping station.

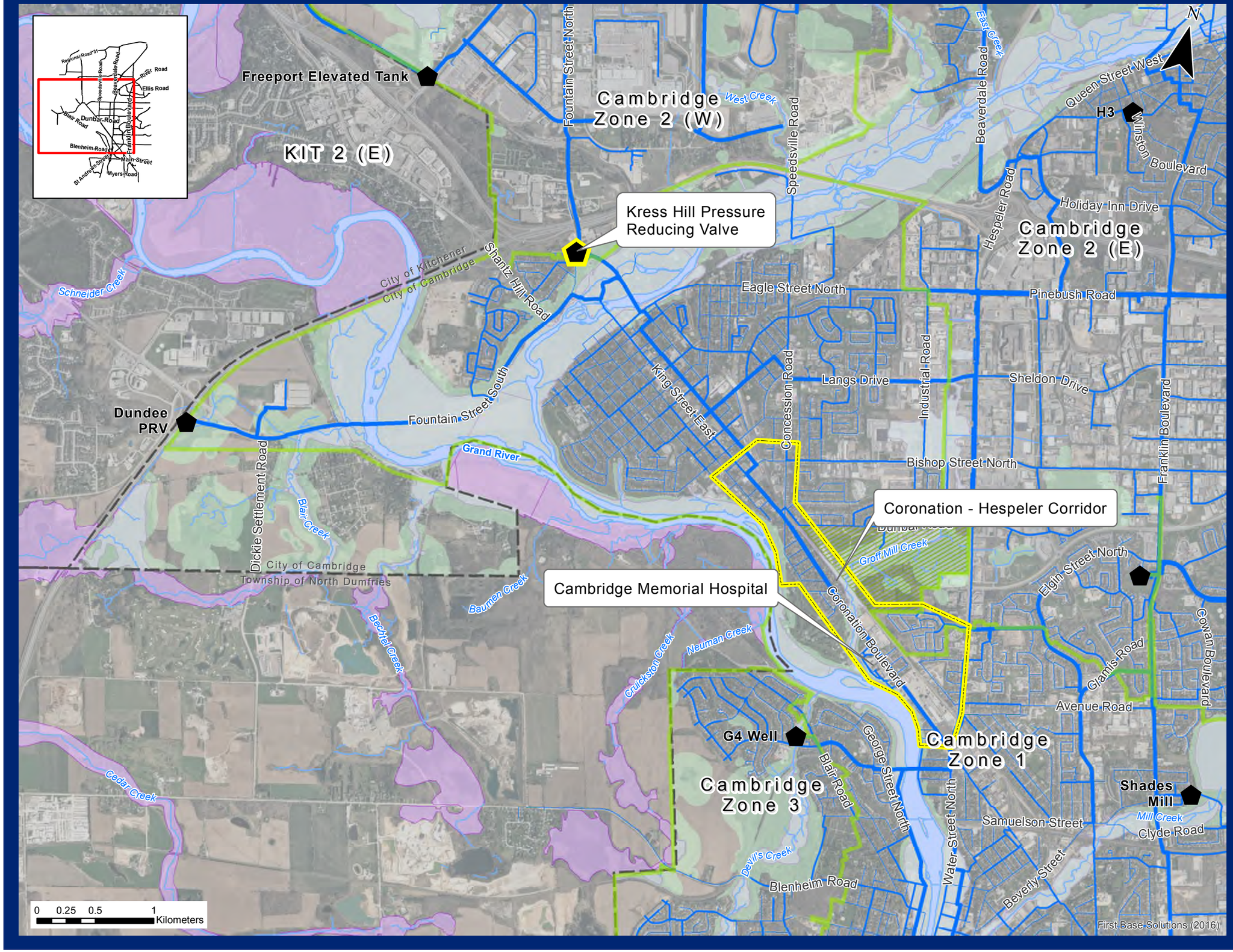
The Cam 1W zone consists of a mature neighbourhood that comprises many land uses. At the western limit is Conestoga College, to the east is an industrial area, and the remaining land use is generally residential. The low points of the study area are along Speed River and Grand River (including Speedville Road area and Dover Street South, at 273 m), whereas the high points are along Kitchener Drive, east of Shantz Hill (at 303 m). Each of these key areas is identified in **Figure 2**.

4.1 Project Study Area

Within the context of the Class EA, there are two project study areas within the new Cam 1W Pressure Zone consisting of the existing Kress Hill PS site in the north of the Cam 1W zone, and the Coronation-Hespeler corridor area in the south Cam 1W Zone.

4.1.1 Existing Kress Hill PS Site

The existing Kress Hill booster pumping station site is located along Fountain Street North in Cambridge. It was built to supply Cam 2W from Cam 1; however, it became redundant once the Freeport ET went into service and is no longer needed. The Kress Hill PS is currently scheduled to be decommissioned and torn down in order to reduce the amount of property owned and managed by the Region. Given the amount of yard piping that will continue to remain in service, it does not seem practical to sell off all or part of the existing site for private use, even though the existing facility occupies more land than is necessary to accommodate the new Kress Hill PRV. However, the new PRV would benefit from a heated building to house the monitoring and communications equipment, and a dry chamber space to house and maintain the zone boundary valves. There is a potential cost savings opportunity to adapt and re-use the existing site infrastructure, including the existing surplus pump station building which already has these dry, heated spaces, to support the New Kress Hill PRV, as it may be less expensive to keep the larger building in service instead of tearing it down and replacing it with a smaller building in the same place.



Region of Waterloo

Creation of Cambridge Pressure Zone 1W Class EA

Figure 1

Focus Area

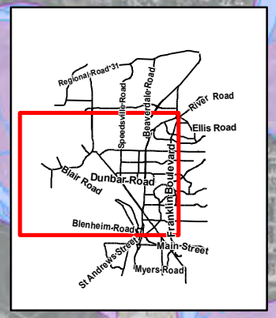
- Existing Facilities
- Railway
- Focus Areas
- Existing Pressure Zone
- Municipal Boundary

Environmental Features

- Creeks
- Rivers
- Grand River Conservation Authority Limits
- Dumfries Conservation Area
- Regulatory Floodplain

BluePlan ENGINEERING

716015-8-W-Focus Area
March 2017
Data Source: Region of Water ob
Scale: 1:30,769 | NAD 1983 UTM Zone 17N



Freeport Elevated Tank

Freeport Elevated Tank - potential to support Cam 1 W via Kress Hill Pressure Reducing Valve.

KIT 2 (E)

Fountain Street North

Cambridge Zone 2 (W)

Speedsville Road

High Pressures in Speedville Road Area

Queen Street West

H3

Winston Boulevard

Holiday Inn Drive

Hespeler Road

Cambridge Zone 2 (E)

Kress Hill PRV

New Kress Hill Pressure Reducing Valve at existing Kress Hill Pumping Station Site.

Low pressures in Shantz Hill Area will govern Cam 1 W Zone Hydraulic Grade Line.

City of Kitchener

City of Cambridge

Shantz Hill Road

Eagle Street North

Pinebush Road

Conestoga College - high fire flow demands. Potential to support via Dundee Pressure Reducing Valve.

High Pressures in Dover Street Area (Lowest Elevation).

Downtown Preston.

King Street East

Concession Road

Industrial Road

Langs Drive

Sheldon Drive

Dundee PRV

Fountain Street South

Industrial area will govern zone fire flows.

Bishop Street North

Franklin Boulevard

Implementation Plan to facilitate chlorine to chloramine change within the new Cam 1 W Pressure Zone.

Dickie Road

City of Cambridge

Township of North Dumfries

Dunbar Road

Coronation Boulevard

Elgin Street North

Gramis Road

Cowan Boulevard

Avenue Road

Cambridge Memorial Hospital.

G4 Well

Cambridge Zone 3

Blair Road

George Street North

Cambridge Zone 1

Shades Mill

Samuelson Street

Clyde Road

Water Street North

Beverly Street

Blenheim Road

0 0.25 0.5 1 Kilometers

First Base Solutions (2016)

N

Region of Waterloo

Creation of Cambridge Pressure Zone 1W Class EA

Figure 2

Existing Opportunities and Constraints

- Existing Facilities
- Railway
- Focus Area
- Existing Pressure Zone
- Municipal Boundary

Watermain

- ≤150 mm
- 200 - 350 mm
- 400 - 750 mm

Environmental Features

- Creeks
- Rivers
- Grand River Conservation Authority Limits
- Dumfries Conservation Area
- Regulatory Floodplain

BluePlan Engineering

716015-9-W-Existing Opportunities and Constraints
March 2017
Data Source: Region of Waterloo
Scale: 1:30,769 | NAD 1983 UTM Zone 17N

4.1.2 Coronation-Hespeler Corridor

Figure 1 also illustrates the Coronation-Hespeler corridor, which is the project focus area roughly bound by Hespeler Road to the east, the Grand River to the south, Bishop Street to the west, and the existing rail corridor and Isherwood Avenue to the North.

Both the WSDOMP and the Implementation Plan identified the southern limit of the new Cam 1W pressure zone along the Coronation-Hespeler corridor. Further, it is within this general corridor that majority of the new Cam 1W infrastructure will be constructed, including:

- Cam 1W Booster Pumping Station and Chloramination Station
- New Trunk Watermain, and
- New Cam 2E to Cam 1 PRV.

There are many key features of this area that will need to be considered when identifying the technically preferred pumping station location, PRV location, and trunk watermain alignment. These features, highlighted in **Figure 3**, include:

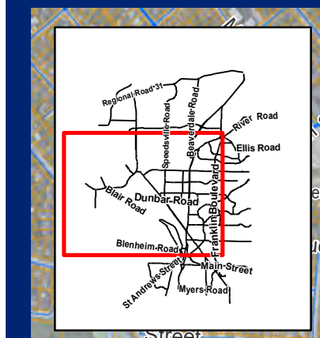
- Dumfries Conservation Area,
- Railway tracks,
- Grand River, creeks, and floodplain,
- Cambridge Memorial Hospital, and
- Potential TCE contaminated area.

4.2 Regional Water System Overview

The Region of Waterloo is part of a two-tier water system in which it is responsible for the treatment and delivery of wholesale water to the local municipalities through the IUS. The local municipalities are responsible for distributing the water to the local users.

The IUS is a large and complex system that includes the Mannheim WTP, which receives raw water from the Grand River via the Hidden Valley Pump Station located immediately downstream of the Highway 8 bridge. The majority of the IUS is supplied through 83 groundwater production wells distributed throughout the system. The groundwater is treated either locally or at one of five nearby integrated treatment and pump station facilities (which services a number of local wells), and is pumped directly into the IUS.

Supporting the IUS is a network of 220 kilometres of trunk watermains, 2,000 kilometres of local watermains, 21 storage facilities, and 20 pump stations, which supply 24 pressure zones.



Existing trichloroethalyne (TCE) Groundwater contamination area.

Booster Pump and Chloramination Station located north of Concession / King intersection could complicate Zone separation.

Existing single family residential properties.

Existing single feed watermain.

Cam 1 W Zone separation after Cambridge Memorial Hospital to avoid water quality changes to the hospital.

Cambridge Memorial Hospital

Dumfries Conservation Area

New watermain will need to cross existing railway

Potential Hespler Road Pressure Reducing Valve with Cam 2E boundary expansion - independent of Cam 1 W Zone creation

Potential tie-in for new watermain

Cambridge Zone 2 (E)

Cambridge Zone 3

Cambridge 2E Expansion

Cambridge Zone 1

Township of North Dumfries

City of Cambridge

Michael Crescent

Bishop Street North

Dunbar Road

Isherwood Avenue

Waterside Avenue

Augusta Street

Avenue Road

Can Amera Parkway

Newman Drive

George Street North

Sunset Boulevard

Clearview Drive

Bismark Drive

Duke Street

King Street East

Railway Street

Hamilton Street South

Montrose Street South

Beck Street

Industrial Road

Briarwood Drive

Hespeler Road

Collier MacMillan Drive

Conestoga Boulevard

Coronation Boulevard

Jaffray Street

Pitt Street

Esther Avenue

Leslie Avenue

Blair Road

Ronald Road

Linndale Road

Rosslinn Road

Hawthorne Road

Rosecliff Court

Westcliff Way

Bosomworth Crescent

Devils Creek Drive

Hilldale Drive

Kovac Road

Elgin Street North

Elmwood Avenue

Norfolk Avenue

Glen Road

Magor Drive

0 125 250 500 Meters

First Base Solutions (2016)

N

Region of Waterloo

Creation of Cambridge Pressure Zone 1W Class EA

Figure 3

Focus Area Opportunities and Constraints

- Existing Facilities
- Railway
- Focus Area
- Existing Pressure Zone
- Municipal Boundary

Watermain

- ≤150 mm
- 200 - 350 mm
- 400 - 750 mm

Environmental Features

- Creeks
- Rivers
- Grand River Conservation Authority Limits
- Regulatory Floodplain
- Dumfries Conservation Area

BluePlan Engineering

716015-10-W-Focus Area Opportunities and Constraints
March 2017
Data Source: Region of Waterloo
Scale: 1:11,443 | NAD 1983 UTM Zone 17N

Due to the distributed nature of the IUS supply sources, water from the various sources is pumped directly into the system and generally services the local area/pressure zone. However, there is some interconnectivity between adjacent pressure zones to allow for the transferring of water to meet demands.

Appendix C presents a schematic overview of the current Cambridge water system. The majority of Cambridge water demands are met by groundwater sources located within the City of Cambridge. However, supply to the northwest area of the Cam 1 Zone (Preston and Blair) is supplemented via connections to the City of Kitchener. Further, the Cam 2W Zone (Preston, north of Highway 401) is almost entirely supplied by connections to Kitchener and the Freeport elevated tank.

Table 1 summarizes the elevations and existing design settings for the existing and proposed Cam 1W infrastructure.

Table 1: Cam 1W Facility Summary

Facility	Elevation (m)	Existing Setting (m)	Existing Design HGL (m)
Kress Hill PRV	301	Not Operational	N/A
Dundee PRV	295	30	325
Proposed New BPCS	284	---	N/A

The Cambridge system is also unique in that the majority of the system's water uses free chlorine for secondary disinfection, while the remaining IUS utilizes chloramine, including the Cam 2W Zone that is supplied via Kitchener. Because of this difference in disinfection methods, the RoW typically limits the transfer of water between the Cambridge free chlorine system and the IUS remaining chloramine system. This separation under typical demand conditions limits some of the flexibility and redundancy provided by having an interconnected system. However, under emergency conditions, the Region will utilize these interconnections and allow the mixing of disinfection residuals in an effort to maintain system pressures and operations.

5 Project Definition

The **Creation of New Cam 1 West Pressure Zone** consists of a proposed low lift Booster Pump and Chloramination Station (BPCS), supporting trunk watermain and PRV, and modifications to the Kress Hill PS and PRV in order to create a new Cam 1W Zone separate from the existing Cam 1 Zone. This project will involve:

- Increasing the existing HGL within the new Cam 1W Zone from 332 m to 337 m
- Reducing the existing HGL within the remaining Cam 1 Zone from 332 m to 323.5m, which will occur after the implementation of the Cam 1W HGL increase
- Changing the disinfection residual type in the Cam 1W Zone from free chlorine to chloramine
- Constructing the supporting Regional infrastructure, including:
    - New Cam 1W BPCS to supply the new zone HGL
    - New Kress Hill PRV, used as an additional supply to Cam 1W Zone
    - New trunk watermain along Coronation Boulevard to provide security of supply to the new BPCS
    - New Cam 2E to Cam 1 PRV on Hespeler Road to support security of supply to Cam 1

This **Creation of New Cam 1 West Pressure Zone** has the following system objectives:

- Addresses existing low pressure issues within the Preston area
- Allows for the disinfection residual change from free chlorine to chloramine in the new Cam 1W Zone by:
    - Flow-paced addition of ammonium sulfate at the proposed BPCS
    - Providing for the zone supply supplementation from Cam 2W and Kit 2E without mixing residuals and potential breakpoint chlorination in the distribution system, as all sources to Zone 1W will be chloraminated
    - Addressing potential and reported treatment residual mixing occurrences in current system
- Provides security of supply to the Cam 1W Zone with the new Kress Hill PRV
- Provides security of supply to Cam 1W and to the CMH through the:
    - New Cam 1 trunk watermain
    - New Cam 2E to Cam 1 PRV.
- Allows for the lowering of the Cam 1 HGL (Project #4), which addresses existing Cam 1 storage issues by allowing better operation of the Turnbull Reservoir

- Reduces watermains within the Cam 1W area experiencing bi-directional flow, which results in water quality improvements

Figure 2 and **Figure 3** highlight the existing system opportunities and constraints for the general study area and the detailed focus area respectively.

5.1 Proposed System Configuration

Appendix C summarizes the proposed ultimate Cambridge water system configuration. The new Cam 1W zone will operate as a closed pressure zone with the New Cam 1W BPCS acting as the zone's primary supply source. The Cam 1W supply will be supplemented by the Kress Hill PRV and New Dundee PRV, which in combination can provide full Cam 1W peak flows, as security of supply to the zone. An overview of the new trunk infrastructure needed to support the creation of the new Cam 1W pressure zone is discussed below.

Storage for the new Cam 1W Zone will be provided by the Turnbull Reservoir (Cam 1) via Cam 1W BPCS, with supplement storage available from the Freeport ET (Cam 2W) via the Kress Hill PRV.

5.1.1 New Cam 1W Booster Pump and Chloramination Station

The new Cam 1W BPCS will be the primary source of water to the Cam 1W Zone system, a closed pressure zone. As such, pump selection should focus on having adequate overlap between pumps and will be configured with Variable Frequency Drive (VFD) and pump controls in order to maintain a constant Zone HGL under all demand conditions.

The BPCS will be fully integrated into the Region's existing SCADA system to allow for:

- BPCS controls to be managed by local discharge pressures and informed by system pressures at either the Kress Hill PRV and/or New Dundee PRV or other pressure monitoring points as required,
- Coordination of operations of the Middleton PS, Turnbull and other Zone 1 sources during peak flow periods, and
- Automated monitoring of upstream and downstream secondary disinfection residual levels.

5.1.2 New Cam 1W Trunk Watermain

The new trunk watermain is required to provide security of supply to Cam 1W BPCS and Cambridge Memorial Hospital. The new trunk watermain will need to be sized to provide peak flows to the Cam 1W BPCS; and, follow a sufficiently different alignment that minimizes the potential for simultaneous watermain failure of the existing Coronation Boulevard watermain and proposed trunk watermain.

5.1.3 New Kress Hill PRV

The new Kress Hill PRV will replace the existing Kress Hill PS and PRV. The Region is expected to maintain the existing Kress Hill PS property due to its configuration and need to maintain portions of the existing yard piping. As such, the new PRV is expected to be constructed within the existing property.

The new Kress Hill PRV will be sized to support peak flows to Cam 1W while maintaining adequate zone pressures.

5.1.4 Existing New Dundee PRV

The Region has recently refurbished the New Dundee PRV. No further upgrades to the New Dundee PRV, beyond operational control modifications, are anticipated. The New Dundee PRV, is expected to supplement the Kress Hill PRV during an outage of the Cam 1W BPCS.

5.1.5 New Cam 2E to Cam 1 Hespeler Road PRV

The new Cam 1 Zone boundary PRV is only anticipated to be operational under emergency conditions, and only as a supplement to the existing system – not full backup to the zone. As such, the sizing of the PRVs should be based on the capacity of existing and proposed watermains in the vicinity of each chamber.

6 Cam 1W Pressure Zone Overview

6.1 Cam 1W Zone Operational Strategies

Figure 4 and **Figure 5** depicts a simplified system schematic of the New Cam 1W Zone, with new infrastructure highlighted in red. The operational strategy for the new zones generally consists of:

- New Cam 1W BPCS acting as the primary supply to the new Zone; BPCS to have sufficient firm capacity to supply peak Cam 1W demands.
- Existing New Dundee PRV and Kress Hill PRV to act as secondary feeds to the new Zone; the combined capacity of the PRVs is sufficient to supply peak Cam 1W demands.

Through the system review process, the option to leverage the Kress Hill PRV and New Dundee PRV to simplify operations of the new Cam 1W BPCS as identified as a potential control strategy for the new Cam 1W Zone. The more active utilization of the PRVs could allow for a more streamlined BPCS design and reduced land use requirements, while resulting in a more efficient system operation.

In consultation with Regional staff, three potential Cam 1W operational strategies were developed (described below in **Table 2**). Consideration for each of these different zone control strategies and their impacts of infrastructure and site requirements will be reviewed when completing the infrastructure alternatives development and evaluation.

Further, in consultation with the Region, considerations will be made for the implementation of a Cam 2E to Cam 1W PRV that would provide additional security should there be a major Cam 1W failure, recognizing the Cam 2E source would be free chlorine. However, this potential PRV will not be considered when establishing the final Cam 1W zone operations configuration.

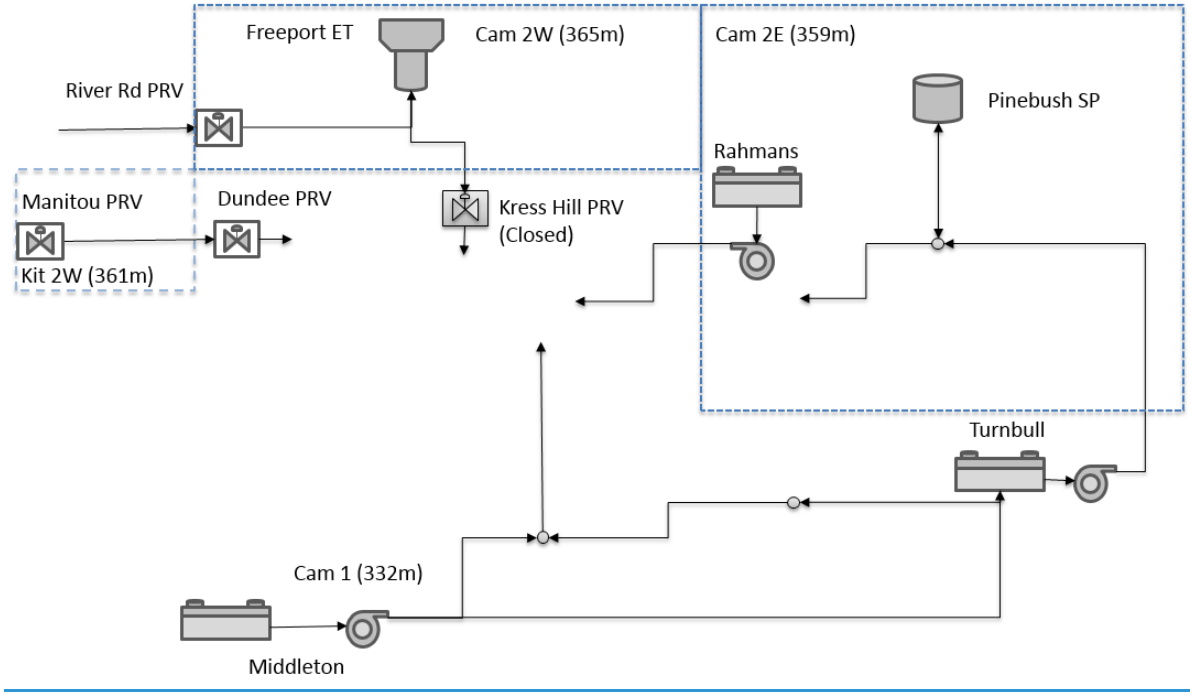


Figure 4 Schematic for Existing Cam 1 Pressure Zone

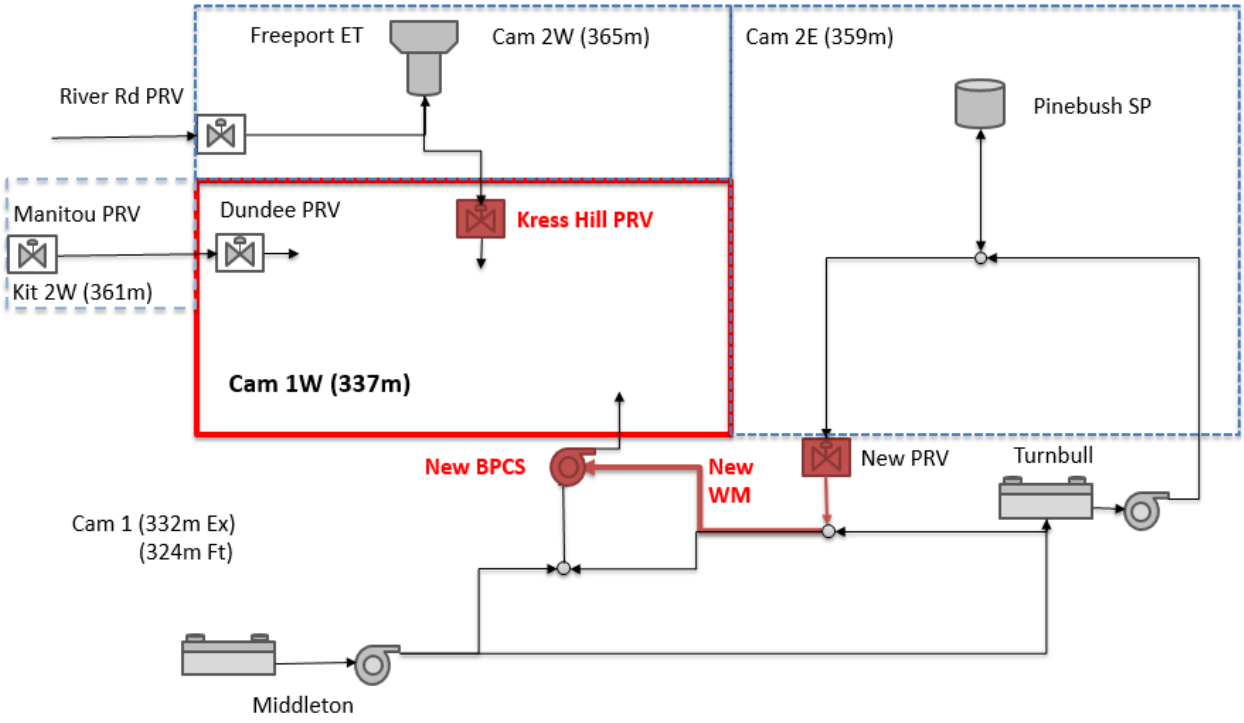


Figure 5: Schematic for New Cam 1W Pressure Zone

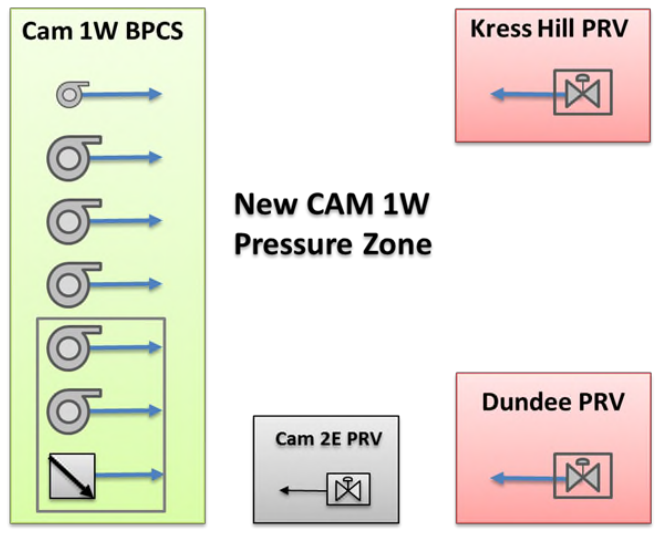
Table 2 Cambridge 1W Pressure Zone Operational Strategy

<table>
<tr><td colspan="2">Operational Strategy 1: Single Source - Booster Pump Station</td></tr>
<tr><td>

BPCS is sized and configured to provide the full range of potential flow rates, including:

Jockey pump for low flows
Fire pumps for fire flows
Duty pumps for normal flows

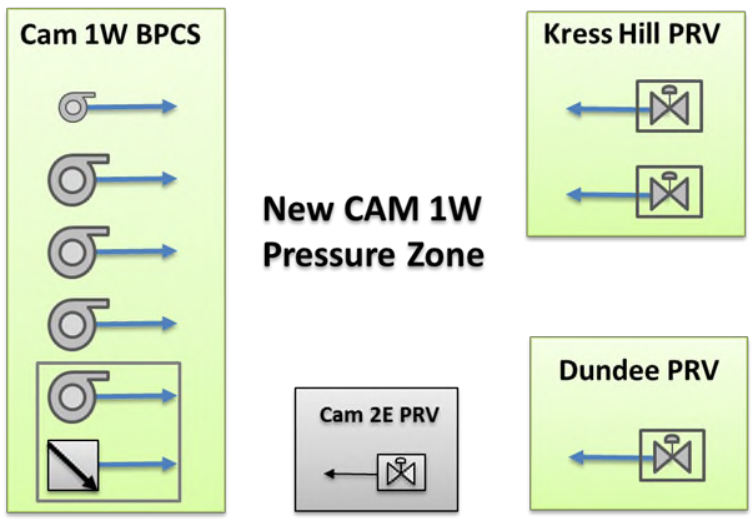
BPCS firm capacity calculated with the two largest pumps out of service
Kress Hill and New Dundee PRVs only operated under emergency conditions, designed as single valve stations

</td><td> 
</td></tr>
<tr><td colspan="2">Operational Strategy 2: Multiple Source –Booster Pump Station and PRV</td></tr>
<tr><td>

BPCS is sized and configured to provide the full range of potential flow rates, including:

Jockey pump for low flows
Fire pumps for fire flows
Duty pumps for normal flows

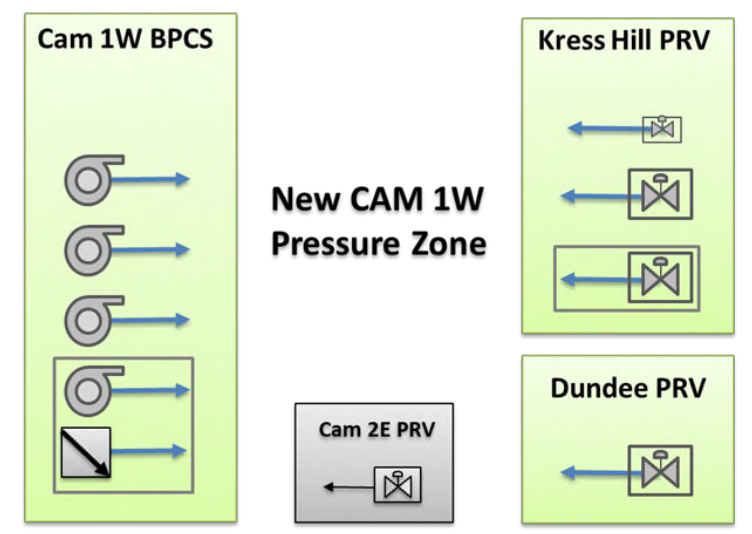
BPCS firm capacity calculated with one largest pump out of service
Kress Hill and New Dundee PRVs can operate under normal conditions; Kress Hill PRV firm capacity with one largest PRV out of service

</td><td> 
</td></tr>
<tr><td colspan="2">Operational Strategy 3: Low Flow PRV – High Flow Multi Source</td></tr>
<tr><td>

BPCS is sized and configured to provide average day to peak flow rate.
All pumps are the same size, in combination they meet average and peak flows
BPCS firm capacity calculated with one largest pump out of service
Kress Hill PRVs are optimized for

Pilot PRV for low flows
Large PRV for normal and peak flows

Kress Hill and New Dundee PRVs can operate under normal conditions, Kress Hill PRV firm capacity with one largest PRV out of service

</td><td> 
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</table>

6.2 Cam 1 and Cam 1W Zone Boundary

The boundary separating the Cam 1 and Cam 1W pressure zones has not been finalized, as it will be subject to the recommended Cam 1W Booster Pump and Chloramination Station location and new trunk watermain alignment. Both the WDSOMP and Implementation Plan identify the potential location as being generally within the Coronation Boulevard area between Hespeler Road and Concession Road. **Figure 6** illustrates the general Cam 1 and Cam 1W Zone boundary scenarios.

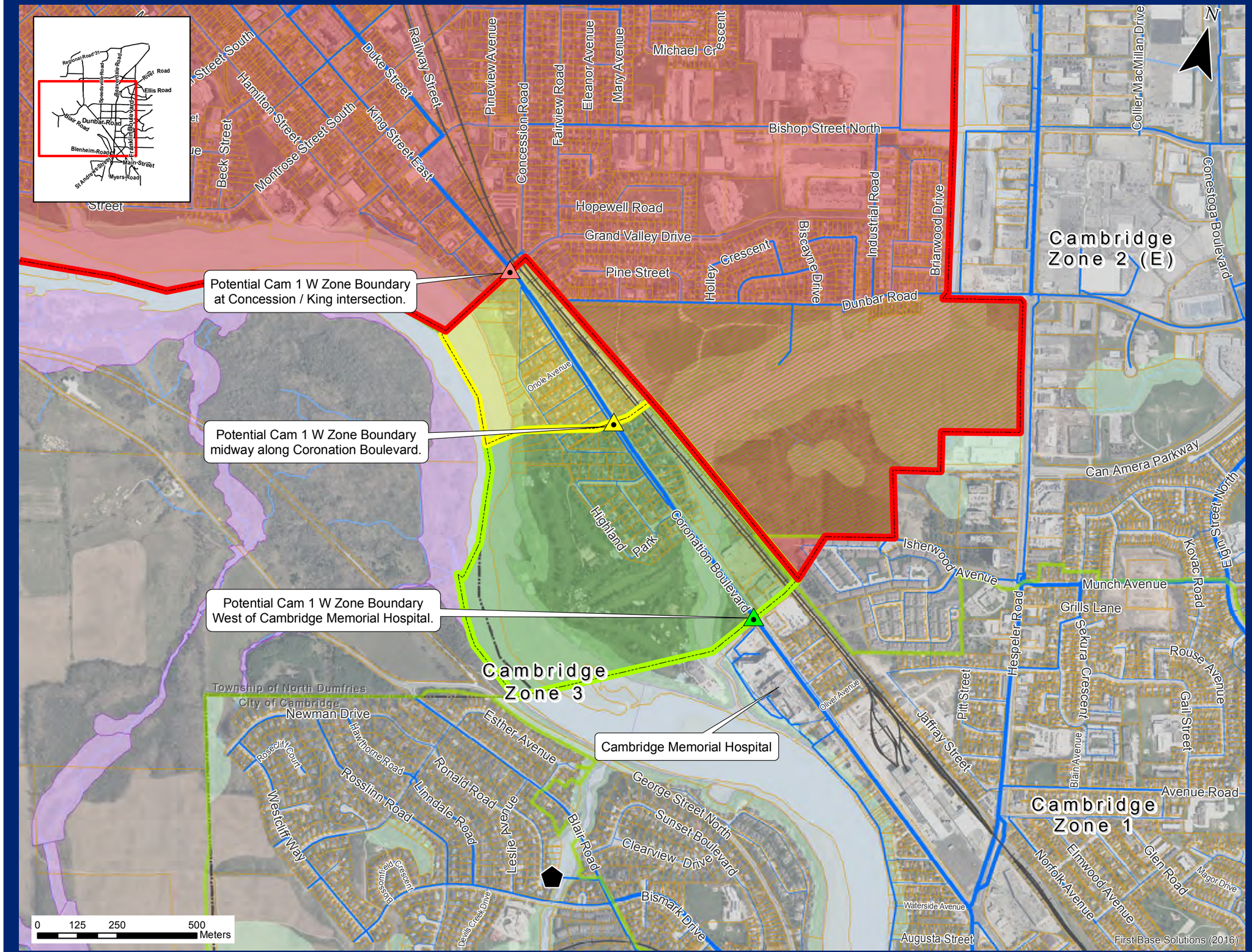
A review of the Cambridge water system configuration and constraints generally confirms that separating the zone along Coronation Boulevard presents the only viable alternative as the simplified single trunk system is located between Cambridge Memorial Hospital and Concession Road which includes the presence of a natural boundary to the north (Dumfries Conservation Area) and south (Grand River). Attempting to place the zone boundary outside of this corridor is not viable due to the following challenges:

- It significantly complicates the zone re-alignment, including potential creation of new system dead-ends, and the need for new local watermains;
- The new watermain alignment needs to provide redundant supply to the Cambridge Memorial Hospital, which may not be feasible as the new watermain is outside of the Coronation Boulevard Alignment, and
- It increases the required infrastructure needed to support the zone separation.

Due to the uncertainty in the ultimate Cam 1W zone boundary and its servicing needs, three general Cam 1W boundary area scenarios were developed to support the development of the Cam 1W design criteria. The three boundary areas scenarios are listed below:

- Cam 1W (A): Boundary at Concession-King intersection,
- Cam 1W (B): Boundary midway between the Cambridge Memorial Hospital and Concession-King intersection, and
- Cam 1W (C): Boundary immediately west of Cambridge Memorial Hospital.

The servicing needs for each future BPCS and watermain alternative will be based on their relative proximity to the three boundary scenarios above.



Region of Waterloo

Creation of Cambridge Pressure Zone 1W Class EA

Figure 6

Cam 1 W Boundary Scenarios

- Existing Facilities
- Railway
- Focus Area
- Existing Pressure Zone
- Municipal Boundary

Cam 1W Boundary Scenario Areas

- Pumping Stations
- Scenario Area - A
- Scenario Area - B
- Scenario Area - C

Watermain

- ≤150 mm
- 200 - 350 mm
- 400 - 750 mm

Environmental Features

- Creeks
- Rivers
- Grand River Conservation Authority Limits
- Regulatory Floodplain
- Dumfries Conservation Area

BluePlan ENGINEERING

716015-12-W-Cam 1 W Boundary
March 2017
Data Source: Region of Waterloo
Scale: 1:11,443 | NAD 1983 UTM Zone 17N

7 Confirmation of Design Parameters

7.1 Facility Design Criteria, Requirements, and Considerations

7.1.1 Design Criteria

The following design criteria will be used to size the required infrastructure and to evaluate the technical viability of alternatives:

- System Pressures
    - Target operating pressure range of 345 kPa (50 psi) to 550 kPa (80 psi).
    - Maintain a minimum pressure of 275 kPa (40 psi) under normal operating conditions (peak hour demand)
    - Maintain a maximum pressure of 700 kPa (100 psi) under normal operating conditions (minimum night time flow)
    - Maintain a minimum pressure of 140 kPa (20 psi) under max day + fire flow conditions
- System Demands – as outlined in WSMP – see Section 7.2
- System Fire Flows – see Section 7.2
- Watermain Velocities < 1.5 m/s

7.1.2 Cam 1W Trunk Watermain Design Requirements and Considerations

In addition to the design criteria listed above, the new trunk watermain design and alignment should:

- Be sized to provide peak flows to the Cam 1W BPCS and CMH;
- Follow an alignment that minimizes the potential for simultaneous watermain failure of the existing Coronation Boulevard watermain and proposed watermain;
- Provide a second hospital service connection;
- Consider cost/difficulty, connection to Middleton/Turnbull, Cambridge Memorial Hospital connection, railway, future maintenance; and,
- Consider installing two casings when undertaking the rail crossing.

7.1.3 Cam 2E to Cam 1 Hespeler Road PRV

In addition to the design criteria listed above, the New Cam 2E to Cam 1 Hespeler Road PRV design should include:

- A chamber bypass;
- Butterfly valves allowing isolation of the control valve;
- SCADA interface for flow and pressure monitoring;
- Supporting features including ventilation, sump pump, interior lighting, and safety devices for chamber entry; and,
- Consider use of a factory built welded steel chamber instead of precast to reduce potential water infiltration.

Property considerations for New Cam 2E to Cam 1 Hespeler Road PRV should include:

- Vehicle parking for two persons and maintenance equipment on an adjacent low traffic side street, outside of the Hespeler Road right-of-way;
- Site access for maintenance purposes in all weather conditions, including sleeves for lifting devices; and,
- Keeping chambers and critical infrastructure out of the travelled roadway and have consideration for future road widening.

7.1.4 Kress Hill PRV Design Requirements and Considerations

In addition to the design criteria listed above, the new Kress Hill PRV design should:

- As the primary backup to the BPCS, consider a more robust Kress Hill PRV design with up to three different PRVs;
- Provide sufficient access to the PRVs for maintenance;
- Include three facility options:
    - New larger PRV chamber
    - Knock down building, using an existing basement and build structure for PLC and electrical equipment with stairs down to basement
    - Repurposing of the existing building;
- Maintain existing yard piping and chambers used for access to swabbing;
- Include motorized butterfly valves allowing isolation of the control valve;
- Include SCADA interface for pressure and flow monitoring, and remote operation of the bleeder control valve to maintain water quality across the normally closed main valve; and,

- Support features including ventilation, sump pump, interior lighting, and safety devices for chamber entry if required.

Property Considerations for the New Kress Hill PRV should include:

- Minimum parking for two vehicles outside of the road right-of-way for chambers;
- Site access for maintenance purposes including sleeves for personnel and lifting devices, equipment handling features if existing building is re-purposed, materials selected for longevity; and,
- Promote building re-use as alternative to throwing away good infrastructure, consider ways to redirect funds intended to be used to tear down facility in order to lower maintenance and operating costs, with energy efficiency in mind.

7.1.5 Cam 1W Booster Pump Station Facility Design Requirements and Considerations

In addition to the design criteria listed above, the New Cam 1 W BPCS must:

- Accommodate BPCS capacity requirements
    - Under all operational concepts, the BPCS must be able to supply:
        - Existing and 2031 ADD, MNF; and,
        - The greater of 2031 PHD or 2031 MDD + fire flow;
- Consider operation of the BPCS under existing Cam 1 configuration (HGL ~332m, interim) and future configuration (HGL ~324 m, long-term) due to the planned change in future Cam 1 target HGL;
- Consider Cam 1W demand impacts on the Cam 1 HGL, under normal and emergency conditions;
- Provide a check valve at the BPCS site as an emergency backup supply at lower (Cam 1) pressure;
- Provide a controlled outlet to prevent the zone from over-pressurizing, in the form of a transient pressure surge relief valve;
- Provide sufficient treatment capacity to:
    - Fully convert all potential flows from free chlorine to chloramine
    - Boost free chlorine levels to target concentration
    - Require two weeks of chemical storage at MDD
    - Incorporate a suitable chamber in order to meet contact time requirements, if insufficient contact time is provided;

- Require full standby power at BPCS if full flow redundancy is not provided by the PRVs;
- Consider suction side transient mitigation measures;
- Consider electrical design elements: VFDs, PLCs, MCCs, including sufficient monitoring and control for fully automatic operation with remote manual options; and,
- Provide SCADA interface for pressure and flow monitoring, and remote operation, including consideration for pressure control supported by remote pressure monitoring sources, sliding pressure setpoints to compensate for flow based friction in supply and discharge piping at high demand, and responsive control loop that allows for all pumps, valves and hydrants to be exercised regularly.

Property building considerations for the Cam 1W BPCS should include:

- A parking lot and access ramp large enough to accommodate up to four Regional trucks and a boom truck;
- A 'green' site emphasis with energy efficiency, porous pavers, low maintenance landscaping, and natural gas heating;
- A building design that facilitates maintenance, includes an internal overhead crane and double doors with suitable access for a boom truck to get close enough to reach in;
- A location to park a portable backup generator at site (included with a concrete pad);
- Fenced-in property;
- Decorative exterior finishes and vegetative screenings, sound attenuation measures can be employed to minimize the visual and noise impacts during normal operation; preferred location is away from residences and businesses that may be impacted by operations teams requiring occasional 24 hour access;
- Accessible for chemical deliveries and equipment maintenance vehicles;
- Storm outlet for surge relief;
- Provide equipment to support the following flow options:
    - Pumped flow with chlorine trim dosing followed by ammonia dosing
    - Check valve emergency flow with chlorine trim dosing followed by ammonia dosing
    - Surge relief of high pressure side transients

  - Surge relief of low pressure side transients not anticipated
  - Reverse flow with breakpoint chlorination not anticipated;
- AODA washroom;
- Separate electrical control room with window, door, and HVAC to reduce chemical and humidity attack on sensitive electrical components;
- Chemicals that can be stored with all wet equipment; and,
- Design for potential for sodium hypochlorite top up before adding ammonium sulfate
  - Separate chemical storage areas
  - Flow paced dosing algorithm with monitoring downstream of mixing zone
  - Consider implication of short term power failures on dosing
  - Two injection points – suction and discharge header
  - Consider need for Contact pipe on discharge side.
  - Monitoring of secondary disinfection residuals entering and leaving station

7.2 Cam 1W System Demands

7.2.1 Design Flow Considerations

The Cam 1W zone will operate as a closed pressure zone, as such the supply infrastructure, BPCS and/or PRVs, will require sufficient operational flexibility to operate under all expected flow conditions including:

- Minimum Nighttime Flow (MNF)
- Average Day Demand (ADD)
- Peak Hour Demand (PHD)
- Maximum Day Demand + Fire Flow (MDD+FF)

7.2.2 Cam 1W Fire Flow

The Cam 1W fire requirements were estimated following a review of MOECC supply fire flow requirements and the Fire Underwriters Survey (FUS) guidelines. The FUS guidelines are variable and highly dependent on individual property and building configurations. Two approaches were used to identify the FUS Fire criteria for the Cam 1W Zone:

- Desktop FUS calculation of five critical system buildings
- Potential FUS fire flow range based on land use

Table 3 summarizes the design fire flow using the three different approaches.

Table 3: Cam 1W Fire Flow Analysis

Methodology	Design Condition		Fire Flow Target (L/S)
MOECC	MOECC Fire Flow (Future Cam 1W) ~ 37,500 total Equivalent Population		**368**
FUS - Desktop	1574 Eagle St. North	Hunt's Logistics – High Fire Flow Scenario	**554**
	Average calculated fire flow using both high and low fire flow scenarios		**340**
FUS – Land use	Industrial Land use	233 to 583 L/s Flow Range Expectation	**378**

In consultation with the Region and operations staff, the MOECC fire flow requirement of 368 L/s will be used as the design fire flow for the new Cam 1W zone.

7.2.3 Confirmation of Cam 1W System Demands

A review of the Region's WSMP, the existing "All Pipes" water system model, historic water usage records, and the City of Cambridge 2014 water billing records confirmed existing system demand and projected future demand. The detailed system demand analysis is provided in **Appendix D** – Demand Analysis, including:

- Existing Cambridge water system demands,
    - Average daily demand
    - System peaking factors
    - Daily diurnal demand
- Review of Cam 1W demands,
- Projected 2031 demands, and
- Cam 1W fire flow requirements.

Table 4 summarizes the project system demands that will be used to confirm the design parameters, which include:

Table 4: Cam 1W Design Flows

Scenario	MNF (L/s)	ADD (L/s)	PHD (L/s)	MDD+FF (L/s)
Existing Demand	(ADD x Min Day Factor x Min Hour Factor) – 20%	Existing ADD	(ADD x Max Day Factor x Peak Hour Factor) + 20%	Existing MDD + FF
	30	**81**	**171**	**483**
Projected 2031 Demand	(Low 2031 ADD x Min Day Factor x Min Hour Factor) – 20%	2031 ADD	(2031 MDD x Peak Hour Factor) + 20%	2031 MDD + FF
	26	**83**	**173**	**484**

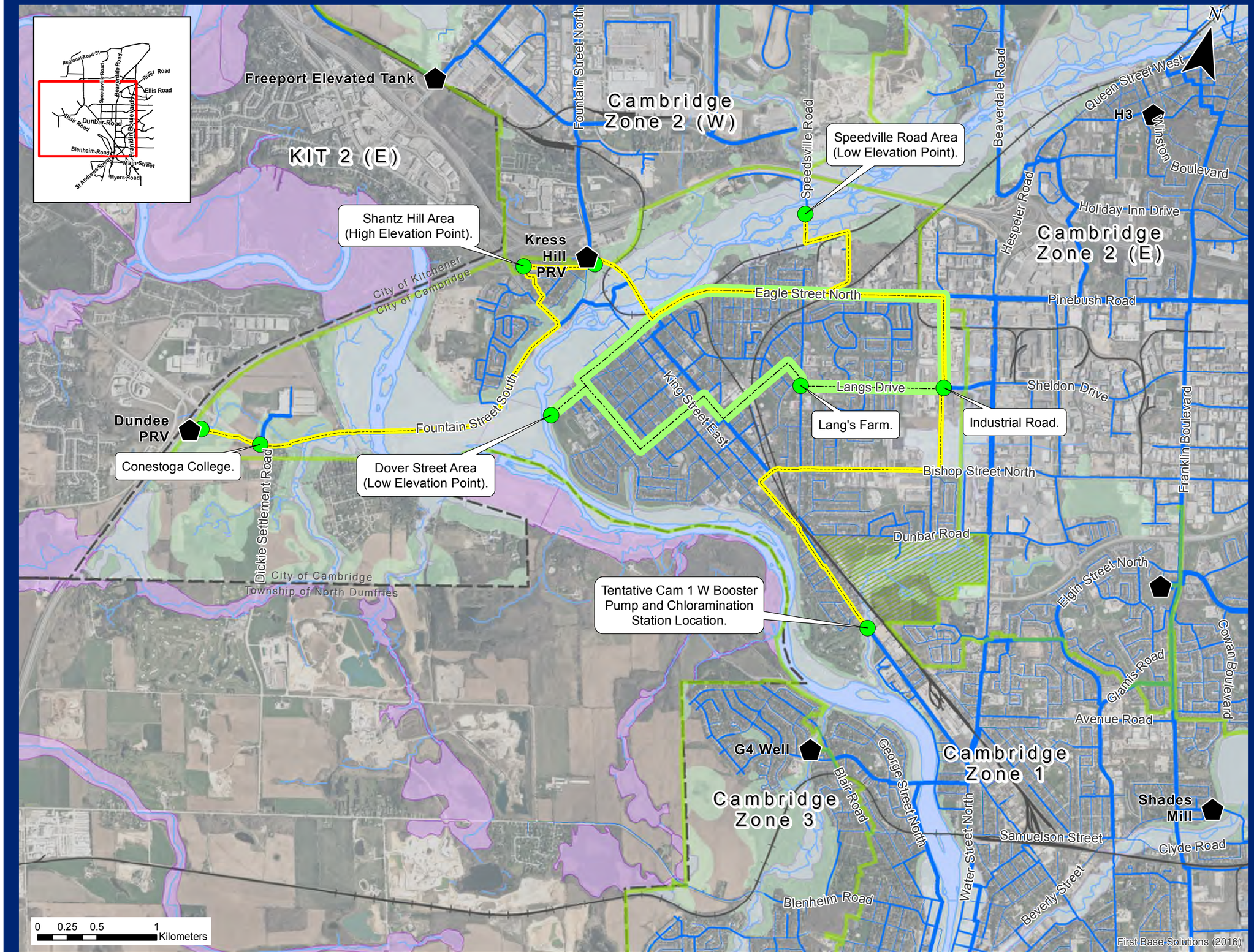
Note that in general, any expected growth within the zone is expected to be offset by the current trends in water conservation, with the net result being almost no change in design flows from existing to 2031.

7.3 Cam 1W Target HGL Analysis

A system curve and HGL profile analysis were completed for the Cam 1W Zone to help identify the preferred Cam 1W target HGL. The analysis was conducted for each of the Cam 1W zone feeds (new Cam 1W BPCS, new Kress Hill PRV, and existing New Dundee PRV) which reviewed the full range of expected flows.

The analysis targets the review of the critical points within the Cam 1W system identified below. **Figure 7** highlights the alignment and key points used to map out the system HGLs, including.

- Kitchener Street – Zone High Point (303 m);
- Conestoga College – System Extremity;
- Bishop Street and Industrial Road – High Fire Flow Area;
- Speedville Road – System Low Point (273 m); and,
- Dover Street South – System Low Point (273 m).



Region of Waterloo

Creation of Cambridge Pressure Zone 1W Class EA

Figure 7

Hydraulic Grade Line (HGL) Analysis Alignment

- Existing Facilities
- Critical Locations
- Alignment #1
- Alignment #2
- Railway
- Existing Pressure Zone
- Municipal Boundary

Watermain

- ≤150 mm
- 200 - 350 mm
- 400 - 750 mm

Environmental Features

- Creeks
- Rivers
- Grand River Conservation Authority Limits
- Regulatory Floodplain
- Dumfries Conservation Area

BluePlan Engineering

716015-11-W-HGL Analysis Alignment
March 2017
Data Source: Region of Waterloo
Scale: 1:30,769 | NAD 1983 UTM Zone 17N

Cam 1W system performance was evaluated under varying typical and design fire flow conditions listed below. This review was completed under the existing and proposed Cam 1W system configuration.

- Existing MNF,
- 2031 PHD,
- 2031 MDD+FF @ Kitchener Street (75 L/s for residential),
- 2031 MDD+FF@ Conestoga College (150 L/s for institutional), and
- 2031 MDD+FF @ Bishop Street and Industrial Road (368 L/s for industrial).

Further to the typical operating conditions, the system performance was reviewed under the extreme cases of the single Cam 1W source (New Dundee PRV, Kress Hill PRV, and new BPCS), to review the upper and lower operating limits and to identify the optimal PRV settings.

The Target HGL was then adjusted until it fit between the following pressure limits:

- Minimum pressure of 20 psi for MDD+FF,
- Target pressure of 50 to 80 psi,
- Minimum pressure of 40 psi under PHD, and;
- Maximum pressure of 100 psi under MNF.

Appendix E – HGL System Profiles, includes all five HGL Profile graphs.

Based on the system analysis, the Cam 1W Target HGL will be 337 m. The BPCS will be set to achieve the target 337 m HGL; the PRVs will have a slightly lower HGL target to avoid potential interference between the operations of the BPCS and PRVs.

Table 5 summarizes the suggested target discharge HGL at the new BPCS, and Kress Hill and New Dundee PRVs. Note that in practice, the actual HGL will vary depending on the precision and responsiveness of the pump station and PRV controls. Tuning of the responsiveness of the source will be critical to avoiding big pressure swings when demands change.

Table 5: Target HGL and Corresponding Static Pressure Range

Facility	Target HGL (m)
New BPCS	337
New Kress Hill PRV	332
Existing New Dundee PRV	331

Table 6 summarizes the expected Cam 1W operating pressures under the new Zone HGL of 337 m, contrasted against current system pressure.

Table 6: Existing and Future Performance under Zone Target HGL

		% of Customers within Pressure Range (psi)				
Scenario	**System Configuration**	**< 40**	**40 – 49**	**50 - 80**	**81 - 90**	**> 90**
MNF (Peak Pressure)	Existing (332 m HGL)	-	2	90	8	-
	Future (337 m HGL)	**-**	**3**	**91**	**6**	**-**
PHD (Minimum Pressure)	Existing (332 m HGL)	3	38	59	-	-
	Future (337 m HGL)	**-**	**3**	**93**	**4**	**-**

Key Findings – Typical Flow Conditions

- A target HGL of 337m at the BPCS:
  - Ensures that system pressures remain between 40 psi and 90 psi during the full range of normal operating conditions (MNF to PHD); and,
  - Over 90% of the system within the target pressure zone range of 50 psi and 80 psi during the full range of normal operating conditions (MNF to PHD).
- The target HGLs at the New Dundee and Kress Hill PRVs were established using the following criteria:
  - Maintain 40 psi during PHD conditions – when the Cam 1W zone is supplied entirely by the PRVs; and,
  - Is two meters lower than the expected downstream PHD pressure when the BPCS is operating. This is to prevent operational interference between the PRVs and the BPCS.

Key Findings – Fire Flow Conditions

- **Under normal operating conditions:**
  - The majority of the Cam 1W peak fire flow would be provided by the new Cam 1W BPCS with support primarily through the Kress Hill PRV
  - There is sufficient capacity to provide the peak zone fire flow of 368 L/s to all industrial areas while maintaining Cam 1W zone pressures above 20 psi.

- **Under Single Feed Scenarios**
  - The existing single 450 mm watermain along Coronation Boulevard, downstream of the proposed BPCS, has sufficient capacity to convey PHD flows. However, under fire flow conditions, a discharge HGL of approximately 349 meters (an additional 12 meters over the current targeted 337 meters) would be required to provide target 368 L/s fire flow to the existing industrial properties along Industrial Road and Langs Drive. This increase in discharge HGL can be attributed to high headlosses in the existing single 450 mm watermain along Coronation Boulevard.
  - Twinning of the existing 450mm watermain along Coronation Boulevard, downstream of the proposed BPCS, would provide sufficient capacity to provide target 368 L/s fire flow to the existing industrial properties along Industrial Road and Langs Drive while maintaining a target BPCS discharge HGL to remain at 337 m.
  - As an alternative to twinning, as an interim measure, flow based pressure controls can be implemented to automatically increase the pressure setpoint at the pumping station to offset the anticipated distribution system pressure losses during high flow events. Empirical hydrant testing to confirm the model suggested setpoints should be included in the commissioning stage.
  - At the target HGL of 332 meters, the Kress Hill PRV can support the Cam 1W zone peak flow rate of MDD + Fire Flow while maintaining adequate pressures within the majority of the zone. However, due to overall distribution system limitations, the target 368 L/s fire flow to the existing industrial properties along Industrial Road and Langs Drive would not be met (approximately 16 psi under design 368 L/s fire flow).
  - The New Dundee PRV does not have sufficient capacity to support Cam 1W zone peak flow rate of MDD + Fire Flow.

7.4 PRV Capacity Analysis

The water system model was used to assess the available pressures upstream of the New Dundee and Kress Hill PRVs. **Table 7** summarizes the available upstream system head at both the Kress Hill and New Dundee PRVs under key flow rates.

Table 7: Design Condition Scenarios

Flow Scenario	Available Upstream System HGL (mASL)	
	New Kress Hill PRV	New Dundee PRV
26 L/s – Existing MNF	364 (Freeport full)	360
173 L/s – Future PHD	359 (Freeport 50% full)	353
384 L/s	345 (Freeport 50% full)	336
434 L/s	340 (Freeport 50% full)	328
484 L/s – Future MDD+FF	334 (Freeport 50% full)	323
Target HGL	332	331

(1) metres above sea level

Key Findings

- The available pressure upstream of the new Kress Hill PRV is projected to be 334 meters under peak Cam 1W flows. This provides only two metres of allowable headloss through the PRV and site piping to achieve the target HGL of 332 meters. As such, to support full peak Cam 1W flow of MDD+FF, the use of both the Kress Hill and New Dundee PRVs is required, and efficient site piping at Kress Hill is recommended.
- There is insufficient capacity upstream of the existing New Dundee PRV to support peak Cam 1W flows (MDD+FF). The maximum flow available from New Dundee, in the current model, is ~ 405 L/s; therefore to support full peak Cam 1W flow of MDD+FF, the use of both the Kress Hill and New Dundee PRVs is required.
- Under PHD conditions, the system head upstream of the New Dundee PRV is projected to be 353 meters, which is above the New Dundee PRV target HGL of

331 identified in the HGL Analysis (see figures in **Appendix E** – HGL System Profiles). Therefore, the existing New Dundee PRV has sufficient capacity to meet typical flow conditions (MNF to PHD).

7.5 BPCS System Curves

Due to the phased implementation of the various Cambridge water system upgrade projects, it is expected that the new Cam 1W BPCS will need to operate under a range of Cam 1 system configurations. The following Cam 1 pressure zone scenarios were reviewed to aid in the development of the new Cam 1W BPCS System Curves, which will be used to support BPCS pump section and conceptual design.

A. Existing Cam 1 Configuration - Middleton ON (St. Andrews Full + Turnbull Valve Closed)

B. Future Cam 1 Configuration - Middleton ON (Turnbull Low)

C. Future Cam 1 Configuration - Middleton ON (Turnbull Full + Avenue/Franklin WM Upgrades)

D. Future Cam 1 Configuration - Middleton OFF (Turnbull Low)

E. Future Cam 1 Configuration - Middleton OFF (Turnbull Full + Avenue/Franklin WM Upgrades)It should be noted that each scenario was simulated with the inclusion of the new 450mm diameter watermain along Coronation Boulevard, supplying the booster pumping station.The results of the BPCS system curve review are summarized in **Table 8** and **Figure 8.Table 9** reviews the additional BPCS capacity required under the extreme condition of the BPCS supporting full fire flow to the Cam 1W zone. The two discharge conditions evaluated in the HGL analysis section consist of:

- Existing single downstream/discharge 450 mm watermain along Coronation Boulevard with a BPCS discharge HGL of 349 meters, and
- Twin downstream/discharge 450 mm watermain along Coronation Boulevard with a BPCS discharge HGL of 337 meters.

Table 8: BPCS Design Parameters (Flow and Head Gain)

Scenario	Total Head Gain (m)			
Demand Condition	**MNF 26 L/s**	**ADD 83 L/s**	**PHD 173 L/s**	**MDD+FF 484 L/s**
A. Existing Cam 1 Configuration Middleton ON (St. Andrews Full + Turnbull Valve Closed)	1	2	4	24
B. Future Cam 1 Configuration Middleton ON (Turnbull Low)	16	17	18	37
C. Future Cam 1 Configuration Middleton ON (Turnbull Full + Avenue/Franklin WM Upgrades)	8	9	11	25
D. Future Cam 1 Configuration Middleton OFF (Turnbull Low)	18	25	37	82
E. Future Cam 1 Configuration Middleton OFF (Turnbull Full + Avenue/Franklin WM Upgrades)	13	17	25	48

Figure 8

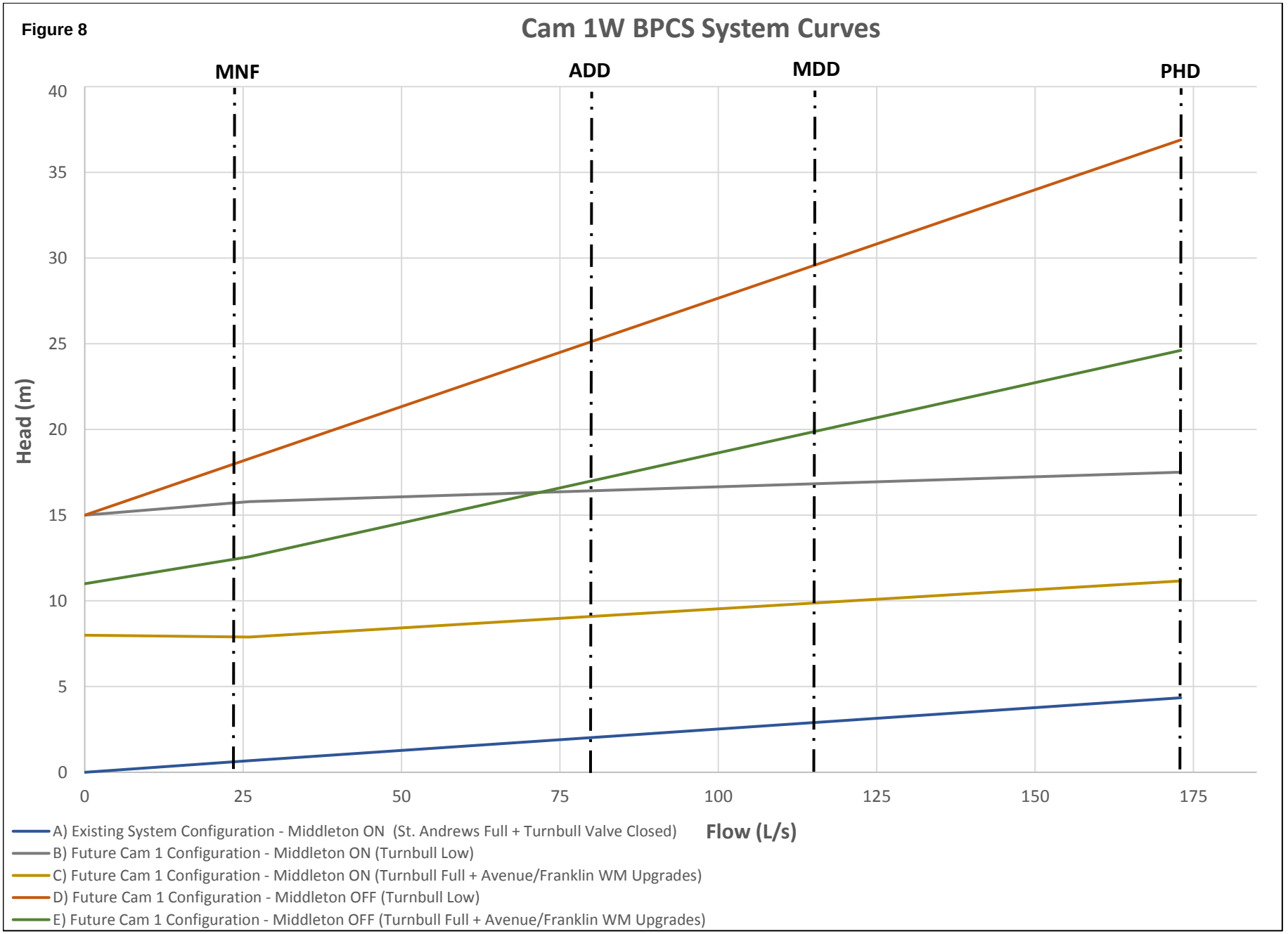

Cam 1W BPCS System Curves
MNF
ADD
MDD
PHD
Head (m)
40
35
30
25
20
15
10
5
0
0
25
50
75
100
125
150
175
Flow (L/s)
A) Existing System Configuration - Middleton ON (St. Andrews Full + Turnbull Valve Closed)
B) Future Cam 1 Configuration - Middleton ON (Turnbull Low)
C) Future Cam 1 Configuration - Middleton ON (Turnbull Full + Avenue/Franklin WM Upgrades)
D) Future Cam 1 Configuration - Middleton OFF (Turnbull Low)
E) Future Cam 1 Configuration - Middleton OFF (Turnbull Full + Avenue/Franklin WM Upgrades)

Table 9: BPCS Design Parameters under Extreme Fire Flow Conditions

Scenario	Flow (L/s)	Total Head Gain (m)	
		Twin Discharge 450mm Watermains	Single Discharge 450mm Watermain
A. Existing Cam 1 Configuration Middleton ON (St. Andrews Full + Turnbull Valve Closed)	484	24	36
B. Future Cam 1 Configuration Middleton ON (Turnbull Low)	484	37	49
C. Future Cam 1 Configuration Middleton ON (Turnbull Full + Avenue/Franklin WM Upgrades)	484	25	37
D. Future Cam 1 Configuration Middleton OFF (Turnbull Low)	-	-	-
E. Future Cam 1 Configuration Middleton OFF (Turnbull Full + Avenue/Franklin WM Upgrades)	484	48	60

Key Findings

- Under normal operating conditions, with supply to BPCS available from both Middleton and Turnbull, there appears to be sufficient capacity within the Cam 1 system to maintain consistent suction head.
- Phased implementation of upgrade works within the Cam 1 zone will impact the expected suction head. The BPCS pumps will need to be sized to accommodate these interim conditions:
    - Interim High suction head (low pump head gain): 5-7 m higher suction head than under ultimate conditions. This will be experienced in the first few years of the BPCS operations, until such time that the required Cam 1 works are completed to allow for the reduction in Cam 1 HGL.

- Interim Low suction head (high pump head gain): 5-7 m lower suction head than under ultimate conditions. This will be experienced during the period of time that the Cam 1 HGL change has been completed but not all identified trunk upgrades.

- Supply from the Middleton pump station is required to support peak system flows, indicating that an operational interlock between the new BPCS and Middleton PS will be required.

7.6 New BPCS Footprint Size

Based on the pump station building and site requirements previously identified in Section 7.1.5, it is estimated that:

- The desired pump station building and site requirements consist of:
  - An approximately 30 m x 15 m building is needed to accommodate all of the required BPCS features, and
  - An approximately 60 m x 30 m land parcel is required to accommodate the required site features.
  - Compact footprint to minimize operating costs, but sufficient space and accessibility for maintenance.
- A minimal footprint approach was also reviewed and the minimum required building and site requirements are listed below. However, it should be noted that these size requirements limit future site expansion/modification and increase typical operation and maintenance efforts due to the restricted site and building areas:
  - An approximately 15 m x 10 m building is needed to accommodate all of the required BPCS features, and,
  - An approximately 30 m x 20 m land parcel is required to accommodate the required site features.

Depending on the Cam 1W Zone Operational Strategies, the new BPCS will range from four to six pumps. Although this would reduce the building and land footprint, the majority of the building area is utilized for the supporting electrical and mechanical equipment, chemical storage, and other requirements. As such, any space savings would be minimal.

8 Water Treatment for Proposed Cam 1W Area

The majority of the Cambridge water system, excluding Cam 2W which is supplied directly from the City of Kitchener, utilizes free chlorine for secondary disinfection. The remaining IUS uses chloramine for secondary disinfection. Because of this difference in disinfection methods, the RoW typically limits the transfer of water between the Cambridge free chlorine system and the IUS remaining chloramine system. This separation under typical demand conditions limits some of the flexibility and redundancy provided by having an interconnected system. However, under emergency conditions, the Region will utilize these interconnections and allow for the mixing of disinfection residuals in an effort to maintain system pressures and operations.

The proposed Cam 1W operational strategy will utilize the new Cam 1W BPCS as the primary zone supply, drawing water directly from the existing Cam 1 Zone. However, as part of the new Cam 1W control and operation strategy, the Cam 1W will utilize chloramine for secondary disinfection. This change in secondary disinfection from free chlorine to chloramine will allow the Cam 1W zone to be supplied from the existing Cam 2W and Kit 2W pressure zones - both chloraminated zones - without the current disinfection residual mixing and water quality issues. This will provide enhanced supply security and operational flexibility to the Cam 1W zone.

8.1 Chlorination vs. Chloramination

Both chlorination and chloramination are commonly used methods of secondary disinfection within municipal water systems. The use of chloramination typically consists of the addition of ammonium sulfate to chlorinated water to form a combined chlorine residual referred to as chloramines. Chloramines comprise the following oxidizing chemicals: monochloramine (NH_2Cl), dichloramine ($NHCl_2$), and trichloramines (NCl_3). For municipal drinking water, the preferred form of chloramine is monochloramine.

Both chlorinated and chloraminated water provide the same disinfection function: to maintain high quality potable water and prevent bacterial regrowth in distribution systems after treated water has left a treatment plant. Chloramination provides the following benefits over chlorination:

- Chloramine is more stable residual disinfectant and does not dissipate quickly in water;
- Chloramine is typically less odorous than free chlorine; and,
- Monochloramine is more effective in killing Legionnaire bacteria that causes respiratory issues.

8.2 Potential Impacts of Changing from Chlorination to Chloramination

Chloramination is a proven method for secondary disinfection that has been in place for several years in Kitchener and Waterloo, as well as in the City of Toronto and York Region. Chloraminated water at controlled levels of approximately two parts per million is safe for general use in cooking and drinking, and for pregnant women, infants and children, and individuals on low-sodium diets.

The only issue related to the secondary disinfection change will be for sensitive water users. Generally, all users who are sensitive to chlorinated water will be sensitive to chloraminated water. As such, the change to chloramination is not expected to affect any new users when compared to chlorinated water. However, existing sensitive users will need to make changes to their current de-chlorination method to account for the more difficult de-chloramination process.

For endpoint users, free chlorine can be easily removed through either:

- Boiling;
- Aeration (letting the water sit for a period of time); or,
- Standard whole house or point-of-use filters.

To remove chloramines, more active processes are required such as:

- Activated carbon filters; and,
- Additional neutralizing chemicals, such as potassium or sodium metabisulfite.

Due to the nature of the change and the potential effects on these sensitive users, a robust public awareness program should be undertaken to ensure that all users (i.e., residents, employees, etc.) within the new Cam 1W zone are made aware of the new secondary disinfection residual and new removal process.

A summary of typical sensitive users is listed below:

- Kidney Dialysis: The dialysis process involves removing waste products from a patient's blood through using large amounts of purified water. All chemical disinfectants, including chlorine and chloramine must be removed during this process. Therefore, dialysis patients must ensure their equipment removes these chemicals by following up with their physicians and equipment suppliers.
- Pets and Other Animals: Chloraminated water is safe for animals to consume, with the exception of fish and amphibians. Similar to chlorine, chloramine must be removed before using tap water in a fresh or salt-water aquarium or pond. Chloramine treatment systems and chloramine test kits are available for purchase from aquarium supply stores.

- Industry*:* Existing industries with water dependent processes, including the food and beverage industry, may need to adjust their current filtration process to allow for the removal of chloramine. Major water users within the Cam 1W zone will need to be contacted well in advance to allow for implementation of their new filtration systems.

Other challenges associated with converting to chloramine are listed below. However, it is anticipated that they can be mitigated effectively through proper system operation and monitoring:

- Overdosing of chloramine: compared to chlorine, chloramine can more strongly oxidize some types of rubber hoses and gaskets, which typically include parts of washing machines and hot water heaters. The degraded material might show up as black or greasy particles. Proper ammonia dosing and control will ensure chloraminated water is not more corrosive to plumbing than chlorinated water.
- Water used at varying pH levels: at pH levels below 7.2 or above 7.8, dichloramine and trichloramine may arise. These chemicals can be irritable to sensitive skin and have a greater tendency to break down into disinfection by-products (DBPs). These issues are not anticipated in the distributed drinking water in Preston, as the water source emanates from groundwater in deep bedrock aquifers where the pH level is regularly between 7.2 and 7.8 throughout the year.

8.3 Cam 1W and Chloramination Implementation Plan

As part of the BPCS and Cam 1W zone commissioning, a Comprehensive Chloramination Changeover Implementation Plan will need to be developed to mitigate against the potential impacts related to changing from free chlorine to chloramine. This implementation plan should cover both pre-changeover activities, including public notice and end user preparation, as well as explicit Cam 1W implementation plan.

8.3.1 Pre-Implementation Plan

Prior to change over, the Region and City will need to undertake an extensive public information program to facilitate the changeover. It is recommended that the public information focus on answering the following key questions

1. Why does the Region provide secondary disinfection?
2. What is the Region currently doing?
3. What is changing?
4. Why the change?
5. Is chloramine safe?
6. Who else uses chloramine?

7. Has the Region done this before?
8. How will things change? Taste, filtration, etc.
9. How is chloramine filtration different from chlorine filtration?

The public information program should also highlight:

- The Region's successful chlorine to chloramine changeover in the St. Agatha, Baden, and New Hamburg areas.
- The Region's wider use of chloramination in Kitchener and Waterloo, as well as its use in other communities such as Ottawa, Toronto, and York.

Further, the program should be of wide distribution across the Cam 1W area, with additional targeting of known and potential sensitive water users. This information program should also include notices to City and Regional agencies that may need to make adjustments to their practices and procedures such as local health authority, school boards, community groups, the Ministry of Environment and Climate Change, and Grand River Conservation Authority.

8.3.2 Implementation Plan

A six step implementation plan will need to be developed to support the commissioning of the Cam 1W zone and its conversion to chloramine. The primary objectives of this implementation plan will be to:

- Ensure the functionally of the BPCS and establishment of new zone HGL.
- Minimize the extent and duration of secondary disinfection residual mixing.

The six step preliminary implementation plan is included in **Table 10**.

Table 10: Cam 1W Implementation Plan

Steps to Implementation	Key Activities	Monitoring Required	Proceed To Next Step
Step 1: Commission BPCS and Watermain	Construction of new watermain; Construction of new BPCS Commissioning of new BPCS	Pressure at Dundee and Kress Hill PRVs; In system pressure monitoring at hydrants; Pressure at Cam 1W BPCS	Once BPCS has been fully commissioned
Step 2: Initiated Chloramination of Cam 1W	Activation of chloramination facilities; Coordinated unidirectional flushing program	Chloramination levels at BPCS sample point Infield sampling; Pressure at Cam 1W BPCS	One month of successful operation
Step 3: Adjust Dundee PRV	Adjust Dundee PRV setting Nighttime testing of Dundee PRV operations with controlled BPCS rampdown/shutdown	Pressure and flow at Dundee PRV; Pressure at Kresshill PRV; In system pressure monitoring at hydrants. Pressure at Cam 1W BPCS	One week of successful operation
Step 4: Commission Kress Hill PRV	Construction of new Kress Hill PRVs Nighttime testing of Kress Hill PRV operations with controlled BPCS rampdown/shutdown	Pressure and flow at Kress Hill and Dundee PRVs; In system pressure monitoring at hydrants; Pressure at Cam 1W BPCS	One week of successful operation
Step 5: Implement normal Cam 1W operational controls	Implement recommended normal operational controls; Increase Cam 1W BPCS discharge pressure from 331m to 337m	Pressure and flow at Kress Hill and Dundee PRVs; In system pressure monitoring at hydrants	Stop monitoring after one month
Step 6: Cam 1 HGL change	Creation of Cam 1W Pressure Zone; Cam 1 Pressure Zone boundary adjustment including required valving and watermain work; Change in Middleton PS modifications	Normal system monitoring. Pressure at Cam 1W BPCS	Cam 1W Implementation Plan undertaken

Appendix A – Communication Plan

Communication and Consultation Plan

Creation of Cambridge Zone 1W Pressure Zone

Class Environmental Assessment

Prepared by
GM BluePlan for:

Region of Waterloo

Project No. 716015

June 2016

GM BluePlan ENGINEERING

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Appendices

A. Project Contact List

1 Introduction

1.1 Background

Identified in the Implementation Plan for Cambridge Water System Upgrades, the creation of the new Zone 1W is key to the implementation of the overall strategy across Cambridge. In particular, the new zone will allow the Region to better utilize the existing Turnbull Reservoir.

The Cambridge Zone 1W strategy addresses the following key servicing elements:

- A new booster pumping station (BPS) and new pressure reducing valve (PRV) and settings will improve system pressures and system reliability in the Preston service area.
- The BPS also provides an effective means to change the disinfection from chlorine, as supplied from Cam 1 Middleton WTP, to chloramine in Zone Cam 1W. The change to chloramine will allow the zone to access supply from the chloraminated Cam 2W and Kit 2E zones through new and existing PRVs, eliminating current mixing issues.

The alternatives developed and evaluated under this Zone 1W Class EA will need to address some fundamental considerations:

- The Cam 1/1W boundary and location of the BPS must be so that the hospital remains within Cam 1 zone in order to maintain free chlorine residual at the hospital and avoid costly implementation and upgrades to the hospital's operations.
- The watermain alignments feeding the BPS should maximize the security of supply to Cam 1W and the hospital. The watermain will need to provide capacity to support full Cam 1W design flows from either or both Middleton WTP / Turnbull Reservoir.
- Staging of the upgrades must be viable to maintain level of service in the area and specifically for the hospital during the implementation of the system-wide upgrades.
- The operation of the new BPS and balancing of flow rate changes with the PRV settings will need to consider and minimize impacts to suction-side system pressures.
- How the location of the BPS will impact the overall Cam 1W zone delineation, the sizing, length and alignment of the trunk watermains, and PRV sizing and setting needs.

The study will be undertaken as a Schedule B Class EA and will satisfy Phases 1 and 2 of the Municipal Engineers Association (MEA) Class EA process, which is a planning process approved under Ontario's Environmental Assessment Act.

As with any Environmental Assessment Process, it is as much about public relations as it is about technical solutions. Allowing either approach to dominate may impede the process as the study proceeds. Given that the level of service and impacts due to disinfection change will be at the forefront of public and stakeholder attention, the project team will ensure that the solution is developed in a way that gives the public and stakeholders the understanding, confidence and satisfaction necessary to satisfy any potential concerns.

The success of the study rests with the ability of the project team to solicit, process and respond to public input. This document outlines the Communication Plan that will be implemented for this study. The document will be a living document updated throughout the Class EA process and will ultimately become an integral part of the Public Consultation File supporting the Class EA Study.

A number of items were considered in developing the Communication and Consultation Plan, including:

- Project Website;
- Public Consultation Program;
- Public Consultation Centre;
- Stakeholder Contacts;
- Stakeholder Workshops; and
- Agency Meetings.

1.2 Purpose and Approach

The purpose of the Communication and Consultation Plan is to provide a framework for informing and obtaining input from parties involved in the study and any outside parties interested in providing input. This Plan will provide the necessary amount of guidance for all aspects of the communication and public consultation process for the project including areas where coordination with other project teams is required. The intent is to avoid encountering issues with communication such that it affects project schedule or budget.

In planning the communication and consultation program, the overall approach is to:

- Meet the public and agency notification and consultation requirements for Phases 1 and 2 of the MEA Class EA process (October 2000, as amended 2007, 2011 and 2015); and,
- Build on past communication protocols and consultation plans from previous Class EA and municipal planning initiatives the Region has undertaken to ensure consistency and continuity.

1.3 Goals and Objectives of the Communication and Consultation Plan

Effective consultation with stakeholders, agencies, First Nations and the public will be one of the keys to success in this study. Thus, a primary goal and objective of this plan is to ensure meaningful consultation and to encourage two-way communication with the community, regulatory agencies, stakeholders and Region staff.

Methods outlined in this Plan are intended to:

- Present clear and concise information to stakeholders at key stages in the study process;
- Meet MEA Class EA consultation requirements;
- Solicit community, regulatory agency and Region staff input;
- Ensure that factual information is provided to interested and affected stakeholders as soon as reasonably possible; and,
- Make contact with external agencies to obtain legislative or regulatory approvals, or to collect pertinent technical information.

More specifically, the Communication and Consultation Plan will:

- Provide estimated timelines for meetings, workshops, presentations and Public Consultation Centre (PCC);
- Provide an outline of project documentation required, including comments management tracking, project website and a citizens document;
- Provide details on how and when external agencies will be able to be involved in the project; and,
- Provide details for First Nations consultation as required.

Clear and effective communication, coordination and cooperation with all stakeholders will start at the earliest stages and continue throughout. Different methods will be used to ensure effective and efficient two-way communication including public Notices (with full contact information and invitations to participate), direct mailings, informative website content, and meaningful and clear information available at the PCC.

2 Communication Plan

2.1 Class EA Study

2.1.1 Study Contact List

Any and all relevant agencies, stakeholders and interesed parties will be included in the project distribution list. A list of relevant review agencies and interested and affected parties has been prepared for this project based on the RFP, the Consultant's Project Team knowledge of the study area, and information provided by the Region. The list includes federal departments and agencies, provincial ministries and agencies, municipal departments and agencies, utilities, Hospitals, emergency services, First Nations, and other special interest groups who have previously enquired about similar studies. The contact list is attached in Appendix A.

Further to the study contact list, residents and local businesses within close proximity to the proposed sites in the City of Cambridge will receive notification via mail.

Throughout the Class EA process, the study contact list will be revised, as appropriate, to reflect only those agencies/parties who wish to continue to be directly notified. In this manner, the project contact list will constantly be updated to ensure that all possible effort is made to include all interested agencies/parties throughout the EA process.

2.1.2 Study Notifications

Public Notices for this project will be distributed to announce Commencement of the Study in Fall 2016, the Public Consultation Centre to be held in January 2017, and Completion of the Study in April 2017.

2.1.3 Notice of Study Commencement

GM BluePlan will prepare a Notice of Study Commencement to be issued in Fall 2016. Once approved, the Region will publish the Notice of Study Commencement in two rounds of the **Waterloo Region Record** (publishes daily) and the **Cambridge Times** (publishes on Tuesday and Thursday each week).

The Notice will also be published on the Region's website. Region and GM BluePlan PM contacts will be provided in the Notice, from whom interested parties can obtain additional information or request that they be added to the Study Contact List.

In addition to the newspaper Notices, the GM BluePlan Team will prepare a Notice in letter format and mail to the established list of stakeholders, local businesses and residents. The GM BluePlan Team will follow up with select agencies in person or by mail, e-mail or phone to facilitate the coordination of input into the study. The GM BluePlan Team will maintain a file of all correspondence sent and received. This documentation will be included in the final Citizens Document.

A summary of tasks and responsibilities for tasks associated with all Notices is provided below.

Task	Responsibility
Prepare draft Ad / Letter format Notices for review	GM BluePlan
Organize and place Notices in the papers	Region of Waterloo
Finalize and mail Ad / Letter format Notices	GM BluePlan
Distribute Notices to internal Region and City of Cambridge Staff (e.g. Fire & Emergency Services, Councillors)	Region of Waterloo
Prepare and maintain a Comment Tracking Sheet	GM BluePlan
Prepare any required written responses to questions and issues	GM BluePlan & Region of Waterloo

Internal contacts and notification will be coordinated via the Region's PM. The study will take an integrated project approach with Notices and PCC to ensure that the strategy, its project components and their relationship are clearly understood by stakeholders.

2.1.4 Notice of Public Consultation Centre

There is one PCC planned as part of this study. The GM BluePlan Team will prepare a Notice of PCC for the PCC event. Once approved, the Region will publish the Notice of PCC in two rounds of the local newspapers, as with the Notice of Commencement.

The Notice will also be published on the Region's website. The first Notice will be issued two to three weeks in advance of the PCC, the second the week following thereafter. In addition to the newspaper Notices, the GM BluePlan Team will prepare a Notice in letter format and mail to the established list of stakeholders, residents and local businesses, as with the Notice of Commencement.

2.1.5 Notice of Study Completion

Once the study draws completion in April 2017, a Notice of Study Completion will be prepared. The purpose of this Notice is to announce the study's completion, summarize the preferred solution, and begin the 30-day public review period for the final Class EA report. Copies of the final report will be filed at agreed public facilities and made available for the minimum 30-day review period.

The Notices will be published in two editions of the local newspapers, as with the Notices of Commencement and PCC. The Notice will also be published on the Region's website. The GM BluePlan Team will also prepare a Notice in letter format and mail to the established list of stakeholders, as with the Notices of Commencement and PCC.

3 Consultation Plan

3.1 Public Consultation Centre

There is one PCC planned for this study in January 2017 following identification of the preliminary preferred solution for the creation of the Cambridge Zone 1W Pressure Zone.

This PCC is a mandatory point of contact in the EA process and will satisfy Phases 1 and 2 of the Class EA process. The PCC will be located at a venue within or within close proximity to the study area and will follow an "Open House" format with display boards presenting project information.

In preparation for the PCC, the GM BluePlan Team will:

- Prepare the Notice of PCC for the Region to advertise in local newspapers;
- Provide two drafts of the PCC display board material for Region's review;
- Provide PCC boards in PDF format to the Region six weeks in advance;
- Prepare all coloured displays, sign-in sheets and comment forms;
- Provide professional staff and facilitate the PCC event;
- Prepare draft responses to written comments/concerns raised by attending public members and stakeholders for Region's review;
- Issue approved response letters; and,
- Update the project contact list to include additional public members and stakeholders who wish to be directly notified of future project related events.

3.2 Region Staff Input

3.2.1 Team Meetings

The GM BluePlan & Region Project Team will hold monthly team meetings (12 in total) to discuss the development of the project.

3.2.2 Stakeholder Workshops

Stakeholder meetings will be held to engage, inform and enable technical, policy and regulatory input at key decision-making points. These are intended to include a wider audience than the Project Team, such as the Region's Planning and Operations and Maintenance staff and City of Cambridge staff.

3.2.3 Regional Council and Committee Presentations

Members of the GM BluePlan Team will be available to present project information to Regional and City Councils. These meetings will be organized by and at the request of the Region PM.

3.3 External Agency Input

3.3.1 Conservation Authorities

There is one local conservation authority within the study area: Grand River Conservation Authority (GRCA). GRCA is considered a key stakeholder and will have particular interest in this project as the City of Cambridge is within its jurisdictional and regulatory limits. Moreover, the Grand River and some tributary creeks are in and around the new Cambridge Zone 1W.

3.3.2 Ministries

A number of provincial and federal Ministries will receive notifications related to this study throughout the process. Some of the key Ministries include:

- Ontario Ministry of the Environment and Climate Change
- Ontario Ministry of Aboriginal Affairs
- Ontario Ministry of Transportation
- Ontario Ministry of Natural Resources and Forestry
- Ontario Ministry of Culture, Tourism and Sport
- Aboriginal Affairs and Northern Development Canada
- Environment Canada
- Fisheries and Oceans Canada

3.3.3 Municipalities, Agencies, Special Interest Groups

Given the location of the study area and the integration of the water system with its lower tier and neighbouring municipalities, the following technical and review agency stakeholders will need to be consulted throughout the process:

- City Cambridge, and
- City of Kitchener.
- Local Hospital

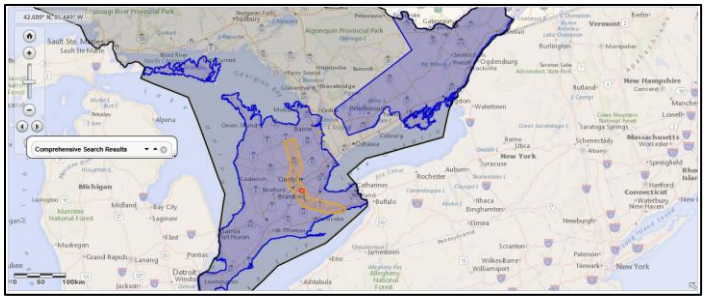
Other special interest groups and community/ratepayer/environmental groups will be informed via the public notification process.

3.3.4 Aboriginal Communities

With respect to consultation with Aboriginal communities (First Nations and Métis communities), the study will build off existing methods and protocol that the Region has used in past studies and provide awareness, understanding and opportunity to provide input into the study.

A list of Aboriginal communities pertinent to the study area was identified through the Government of Canada's web-based, geographic information system called the Aboriginal and Treaty Rights Information System (ATRIS). The search using ATRIS resulted in the following 23 Aboriginal groups being identified:

1. Métis Nation of Ontario
2. Zhiibaahaasing First Nation
3. Walpole Island
4. Six Nations of the Grand River
5. Sheguiandah
6. Saugeen
7. Mohawks of the Bay of Quinte
8. Mohawks of Akwesasne
9. Mississaugas of the Credit
10. Mississauga's of Scugog Island First Nation
11. M'Chigeeng First Nation
12. Hiawatha First Nation
13. Curve Lake
14. Chippewas of the Thames First Nation
15. Chippewas of Rama First Nation
16. Chippewas of Nawash First Nation
17. Chippewas of Kettle and Stony Point
18. Chippewas of Georgina Island
19. Beausoleil
20. Aundeck-Omni-Kaning
21. Alderville First Nation
22. Aamjiwnaang



Screen Capture of ATRIS Results for Study Area

These Aboriginal communities will be included in the study contact list.

3.4 Public Documentation

3.4.1 Comments Management Tracking

All the contact information will be contained in a database such that all comments received can be linked directly to it and stored easily and efficiently. It is expected that multiple comments will be received so maintaining an organized structure is key. All comments will be initially directed to Project Managers Kevin Dolishny and Julien Bell via the website, newspaper Notices, or letter correspondence.

3.4.2 Project Website

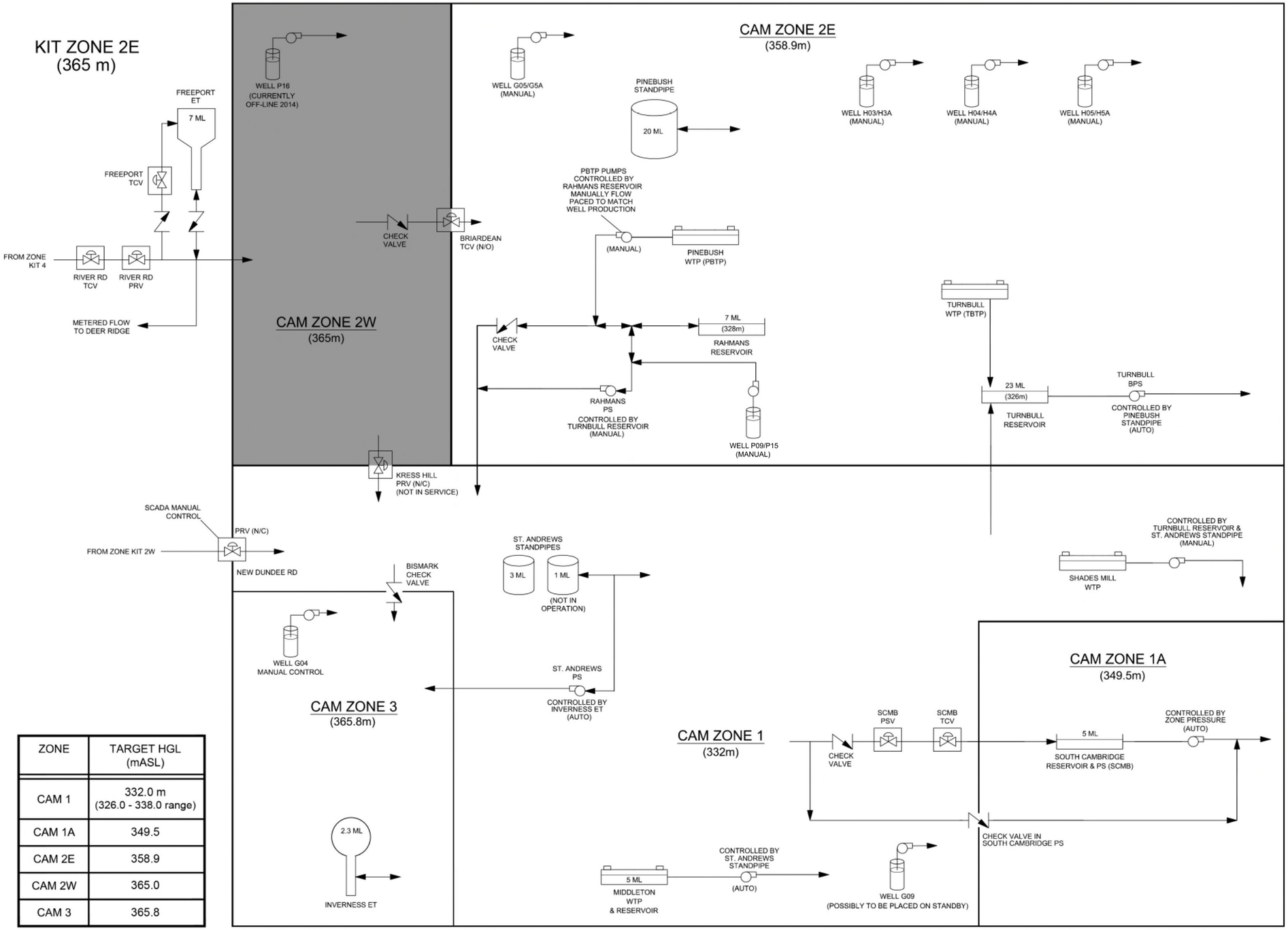
The Region of Waterloo will be setting up a page on their corporate website for this Class EA study. This website will provide a space for any interested party to obtain information on the project, upcoming events, and contact information. This website will be maintained by Region staff and the GM BluePlan will coordinate with the Region Communications team to provide content for posting when required.

Appendix B – Golder Reports

Please refer to Creation of Cambridge Zone 1W Pressure Zone - Environmental Assessment Project File for the respective Golder Associates files:

- **Appendix C** – Natural Environmental Features
- **Appendix D** – Archaeological Assessment
- **Appendix E** – Cultural Heritage Assessment

Appendix C – Process Flow Diagram



ZONE	TARGET HGL (mASL)
CAM 1	332.0 m (326.0 - 338.0 range)
CAM 1A	349.5
CAM 2E	358.9
CAM 2W	365.0
CAM 3	365.8

Region of Waterloo

N

EXISTING CAMBRIDGE DISTRIBUTION SYSTEM

Process Flow Diagram

- WELL
- PUMPING STATION (PS)
- RESERVOIR (GROUND LEVEL)
- STANDPIPE
- ELEVATED TANK (ET)
- WATER TREATMENT PLANT (WTP)
- FLOW CONTROL VALVE
  - PRV — PRESSURE REDUCING VALVE
  - TCV — THROTTLING CONTROL VALVE
  - PSV — PRESSURE SUSTAINING VALVE
  - N/C — NORMALLY CLOSED
- FREE CHLORINE
- COMBINED CHLORINE (CHLORAMINE)
- ML — MILLION LITRES

BluePlan ENGINEERING

May 2017
NAD 1983 UTM Zone

Appendix D – Demand Analysis

D.1. Existing Water System Cambridge Demands

D.1.1 Average Daily Demand

Table 11 summarizes the existing Cambridge ADD (L/s) by zone based on the existing "All Pipes" water system model and City of Cambridge 2014 water billing records.

Table 11: Existing Cambridge Average Day Demand – by Zone

Zone	Model ADD (L/s)	Billing 2014 (L/s)	% Difference
Cam 1	216	181	-16%
Cam 1A	17	14	-15%
Cam 2E	173	150	-13%
Cam 2W	48	63	32%
Cam 3	31	26	-17%
Total	**486**	**435**	

- The billing data is between 13% and 17% less than the demand in the model
    - This is in line with the forecasted Unaccounted for Water (UFW) of 17.5% presented in the WSDOMP Water Demand Forecasting Tech Memo.
    - The % difference for the Cam 2W zone is an outlier and is likely due to the high demands at the automotive assembly plants; the billing data shows ~50 L/s and the model is loaded with ~26 L/s.
- The billing data analysis confirms the average day demands in the model.

D.2.1 System Peaking Factors

Table 12 summarizes the existing Cambridge system annual Min Day and Max Day demands (L/s) based on bulk water production records.

Table 12: Cambridge System Peaking Factors

Year	Average Day (MLD)	Min Day (MLD)	Max Day (MLD)	Min Day Factor	Max Day Factor
2010	500	376	672	0.75	1.34
2011	475	363	673	0.76	1.42
2012	473	375	690	0.79	1.46
2013	495	394	615	0.80	1.24
Average/Extremes	**486**	**363**	**690**	**0.75**	**1.42**

Based on the 2010 to 2014 bulk billing records, the Cam 1W system can expect a Min Day peaking factor of **0.75** and a Max Day peaking factor of **1.42**. These factors will be used to estimate the Cam 1W design flows.

D.3.1 Daily Diurnal Demand

Figure 9 presents the aggregate Cam 1 water system diurnal demand pattern, taken from the existing "All Pipes" water system model. These diurnal patterns were derived through the WSDOMP and was summarized/averaged based on Municipality. Under typical conditions, a peak hour factor of **1.24** and min hour factor of **0.61** are projected. To support the design process, a 20% safety factor was applied to determine the system ultimate Peak Hour Demand (PHD) and Minimum Night Time Flow (MNF).

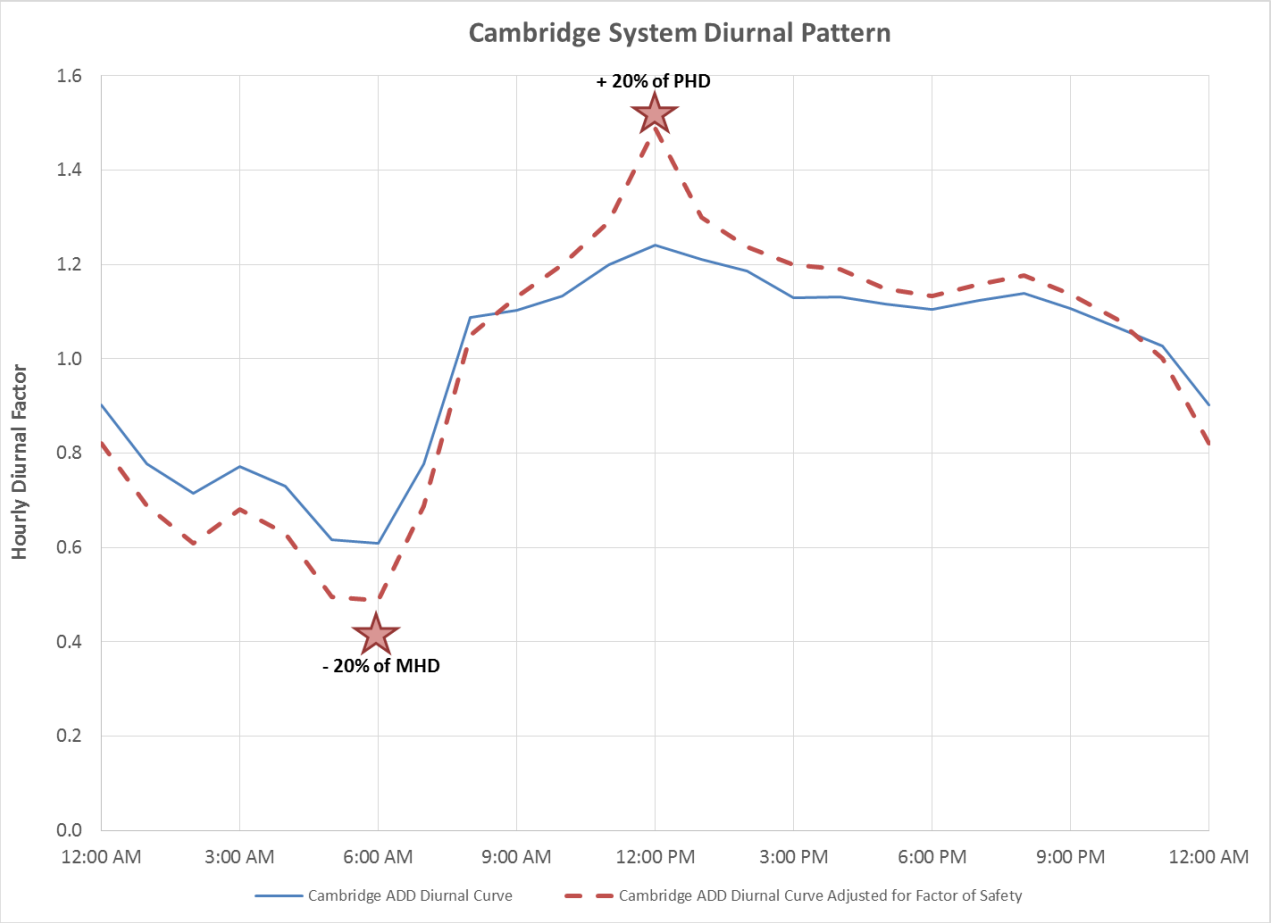


Figure 9 Cambridge System Diurnal Curve from All Pipe Model

D.4.1 Review of Cam 1W Demands

Table 13 summarizes the existing Cam 1W demands (L/s) for each of the boundary scenarios previously identified in **Figure 6**.

Table 13: Cam 1W Boundary Scenarios - Existing Demands

Scenario	BPCS Location	MHD (L/s)	ADD (L/s)	MDD (L/s)	PHD (L/s)
A	Near the Concession-King intersection	35	78	111	138
B	Along Coronation Boulevard, midway between the hospital and Concession-King intersection	36	79	112	139
C	Immediately after the Cambridge Memorial Hospital	37	81	115	143

The review of the Cam 1W demands identified that:

- The Cam 1W demands are ~37% of existing Cam 1 demands
- The location of the new BPCS will not significantly impact the ultimate Cam 1W design flow.

D.2. Projected 2031 Demands

Table 14 summarizes the future 2031 demands from the WSDOMP for Cam 1W and adjacent pressure zones. In addition to the "selected" 2031 demands, the WSDOMP identifies a system wide upper and lower limit to account for reductions in consumption, reduction in UFW, or impacts from other parameters that may result in a deviation from the demand projections.

Table 14: Projected 2031 Demands (WSDOMP)

	2031 – ADD (L/s)			2031 – MDD (L/s)		
Zone	**Lower Limit**	**Selected**	**Upper Limit**	**Lower Limit**	**Selected**	**Upper Limit**
Cam 1[1]	117	**137**	160	165	**193**	226
Cam 1W[2]	71	**83**	97	100	**116**	136
Cam 2W	40	**47**	55	54	**63**	74
Kit 2W	47	**55**	64	61	**72**	84

[1]Cam 1 equates to 63% of the Cam 1 demands identified in the WSDOMP.
[2]Cam 1W equates to 37% of the Cam 1 demands identified in the WSDOMP.

Key findings include:

- In general, the upper and lower limits for 2031 demands are +/- ~17%, and
- With the addition of fire flow (Section D.3), the Cam 1W MDD+FF upper and lower limits are +/- ~4% from the "selected" value. Therefore, only the "selected" 2031 demands will be used to confirm the design parameters, while the upper and lower limit scenarios will be considered during the design phase.

D.3. Cam 1W Fire Flow Requirements

The Cam 1W fire flow requirements were estimated using both the MOECC guidelines and the Fire Underwriter Survey (FUS).

Table 15 summarizes the fire flow required by MOECC for varying population numbers. The required fire flow values for Cam 1W were interpolated.

Table 15: Fire Flow Requirements

Population Equivalent	Fire Flow (L/s)
MOECC Fire Flow – 33,000 Pop & Emp	348
MOECC Fire Flow – 40,000 Pop & Emp	378
MOECC Fire Flow (Future Cam 1W) ~ 37,500	***368***

Table 16 summarizes typical FUS fire flows by building types. The Cam 1W zone is subject to a wide variety of land uses and likely has buildings covering the full range of fire flow requirements, from 33 L/s to > 500 L/s.

Table 16: Typical FUS Fire Flows by Building Types

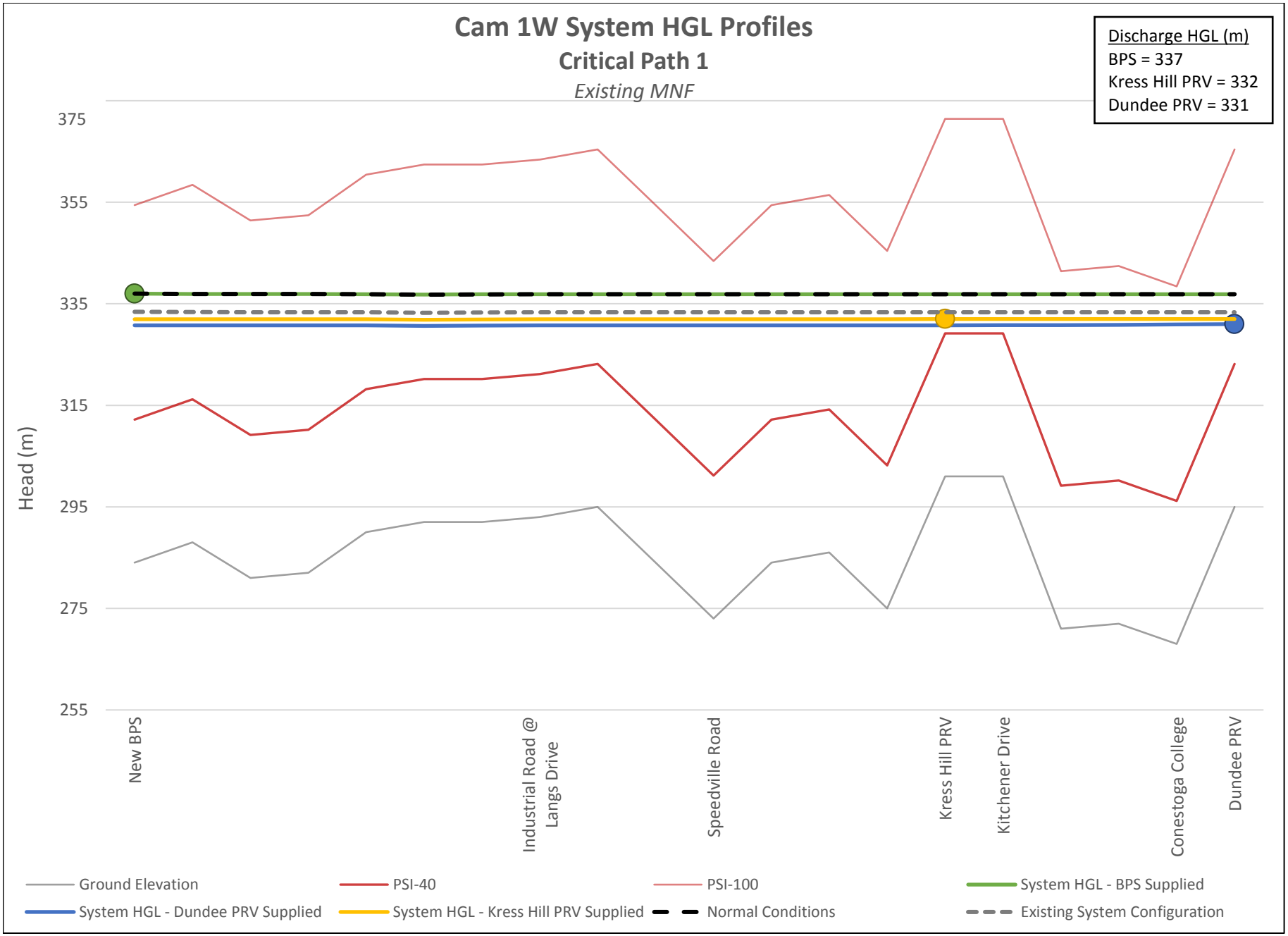
Design Building Type	Fire Flow Range (L/s)	Design Fire Flow (L/s)
Residential – Detached	33 to 83	75
Residential – Townhouses	100 to 167	125
Residential – Apartment	117 to 250	150
Institutional	83 to 250	150
Industrial	***233 to 583***	***378***
Commercial	200 to 433	378

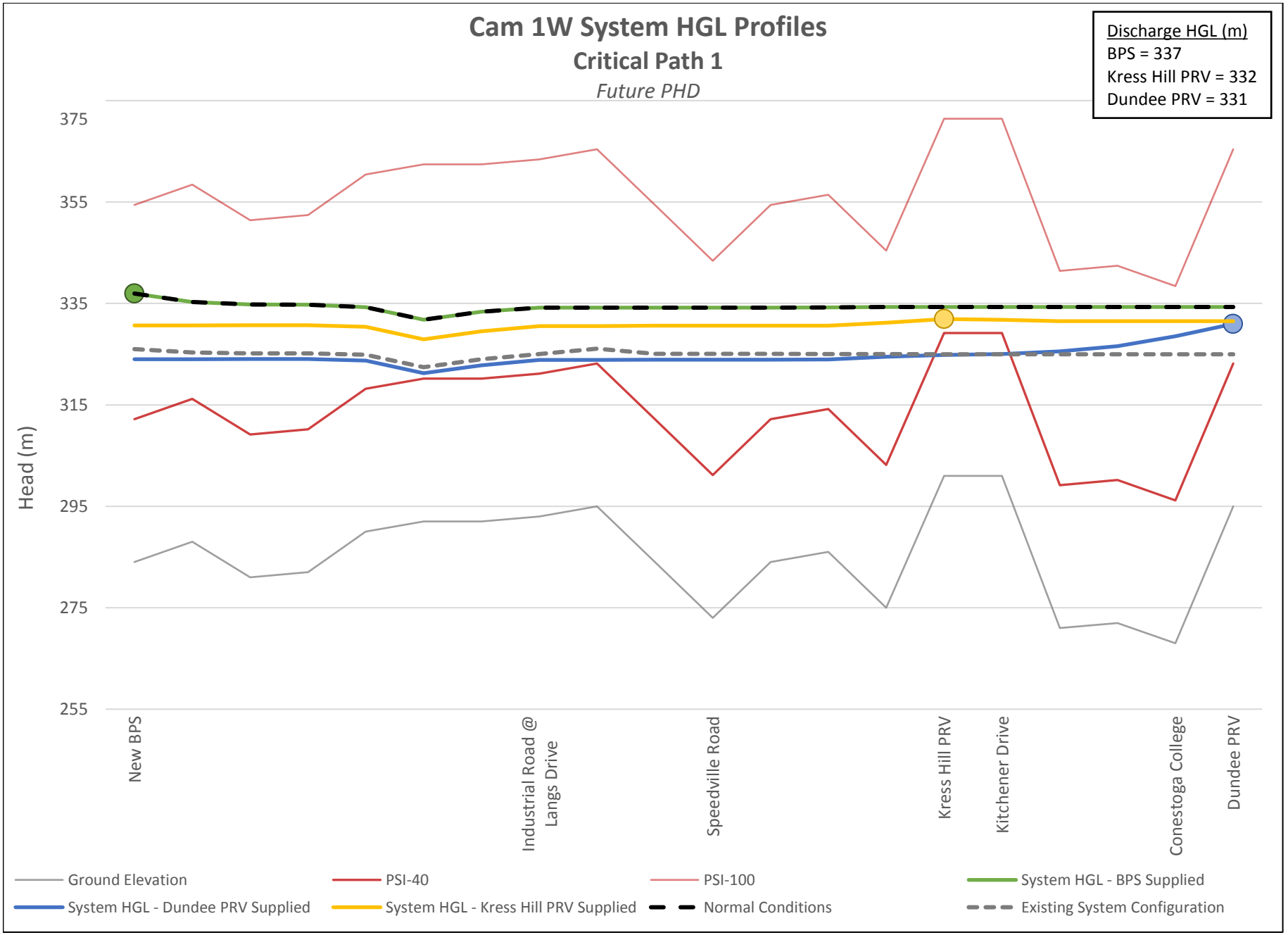
Table 17 summarizes the results of a Desktop FUS analysis of existing critical properties within Cam 1W. For each property both high and low fire flow were calculating using a upper and lower range of criteria for building constructing practices, internal fire prevention measures, and building contents based on an external assessment of the building and available occupation/use information. These FUS calculations were completed to assess the potential range of required FUS fire flows within the Cam 1W and do not represent the actual FUS fire flows for these properties or represent the actual design fire flow for the Cam 1W zone.

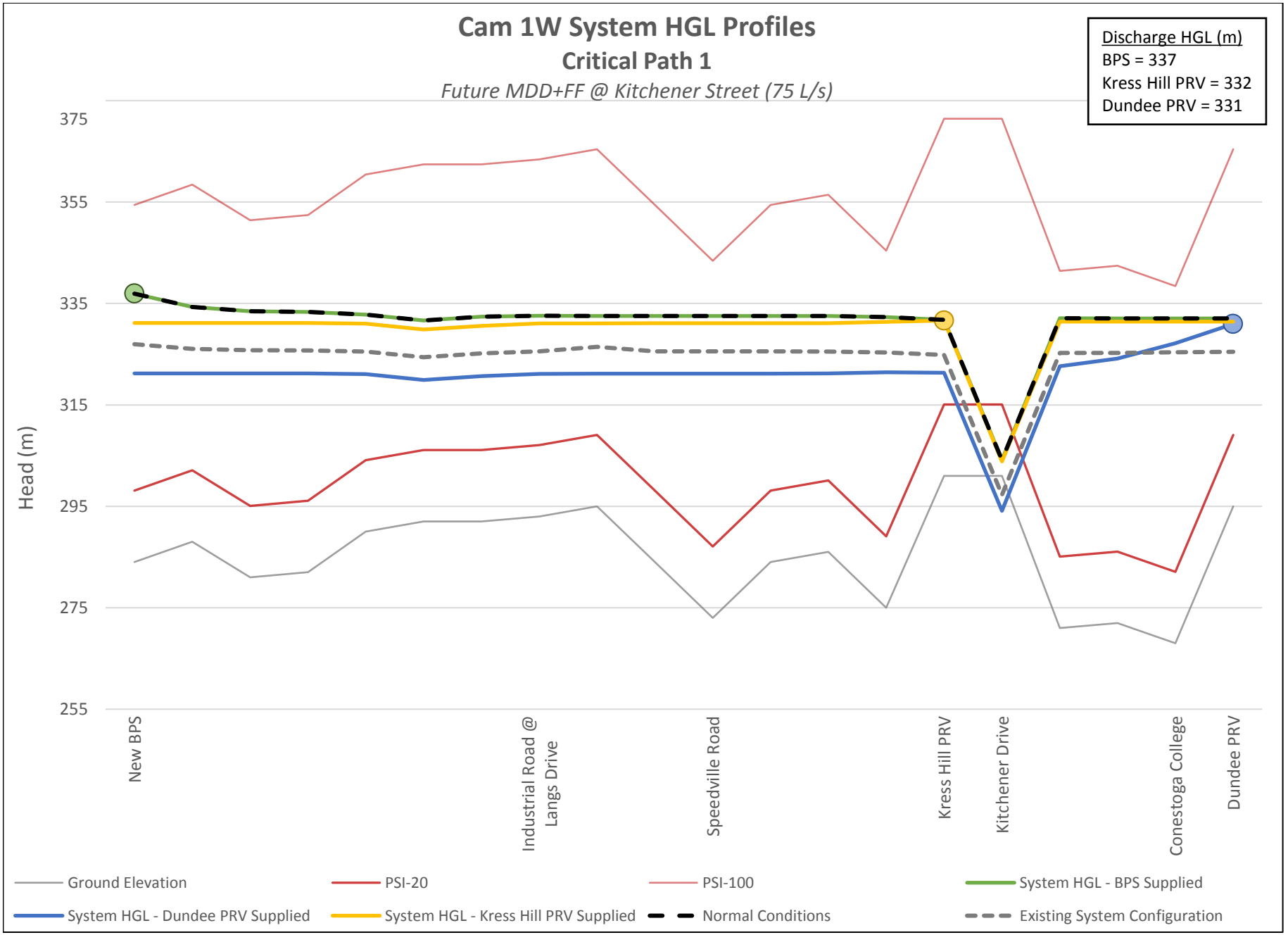
Table 17: Desktop FUS Fire Flows of Critical Buildings

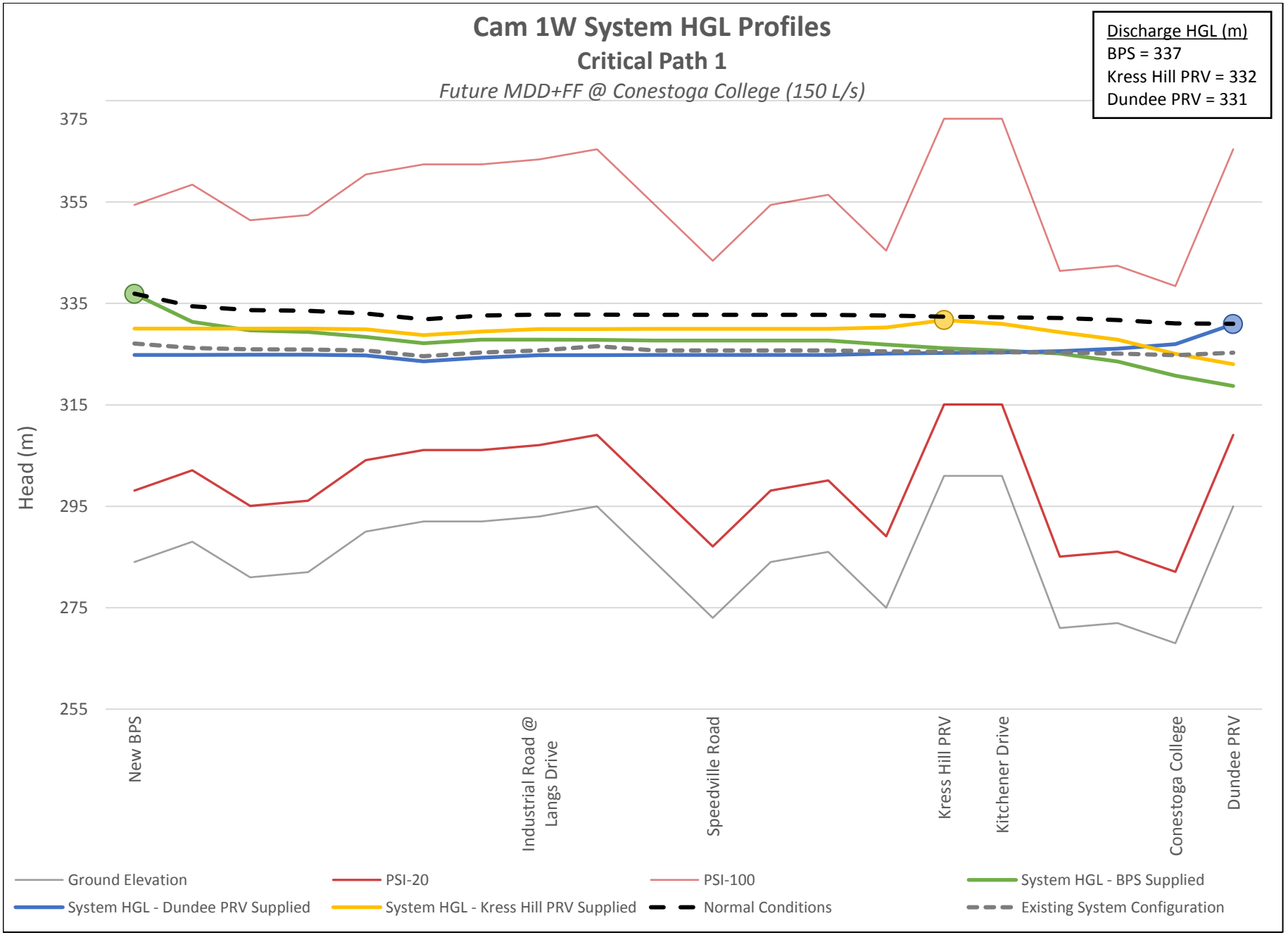
Building		A = Total Floor Area (m^2)	Type of Construction	Fire Hazard	Sprinklers	Exposure Proximity				Fire Flow (L/s)	Notes
PepsiCo Foods Canada	Food Processing	27,528	Ordinary	Free Burning	System	No	No	No	No	**490**	Combustibility of materials unknown
			Non-Combustible	Limited Combustibility	Supervised					**248**	
Hunt's Logistics	Warehouse	26,989	Ordinary	Free Burning	System	20-30	No	No	No	**554**	Warehousing materials unknown
			Non-Combustible	Limited Combustibility	Supervised					**287**	
Dimplex North America	Warehouse	18,130	Ordinary	Combustible	System	20-30	No	No	No	**395**	Warehousing industrial and residential heaters
			Non-Combustible	Limited Combustibility	Supervised					**235**	
Air Liquide Canada	Industrial Gases	14,931	Non-Combustible	Free Burning	System	10-20	No	No	No	**350**	Industrial gases, assumed high combustible material but fire resistive practices
			Fire-Resistive	Rapid Burning	Supervised					**252**	
Killam Properties	Residential	18,015	Non-Combustible	Limited Combustibility	System	3-10	10-20	30-40	No	**368**	Residential property, assumed fire resistive practices and low combustibility
			Fire-Resistive	Non-Combustible	Supervised					**221**	

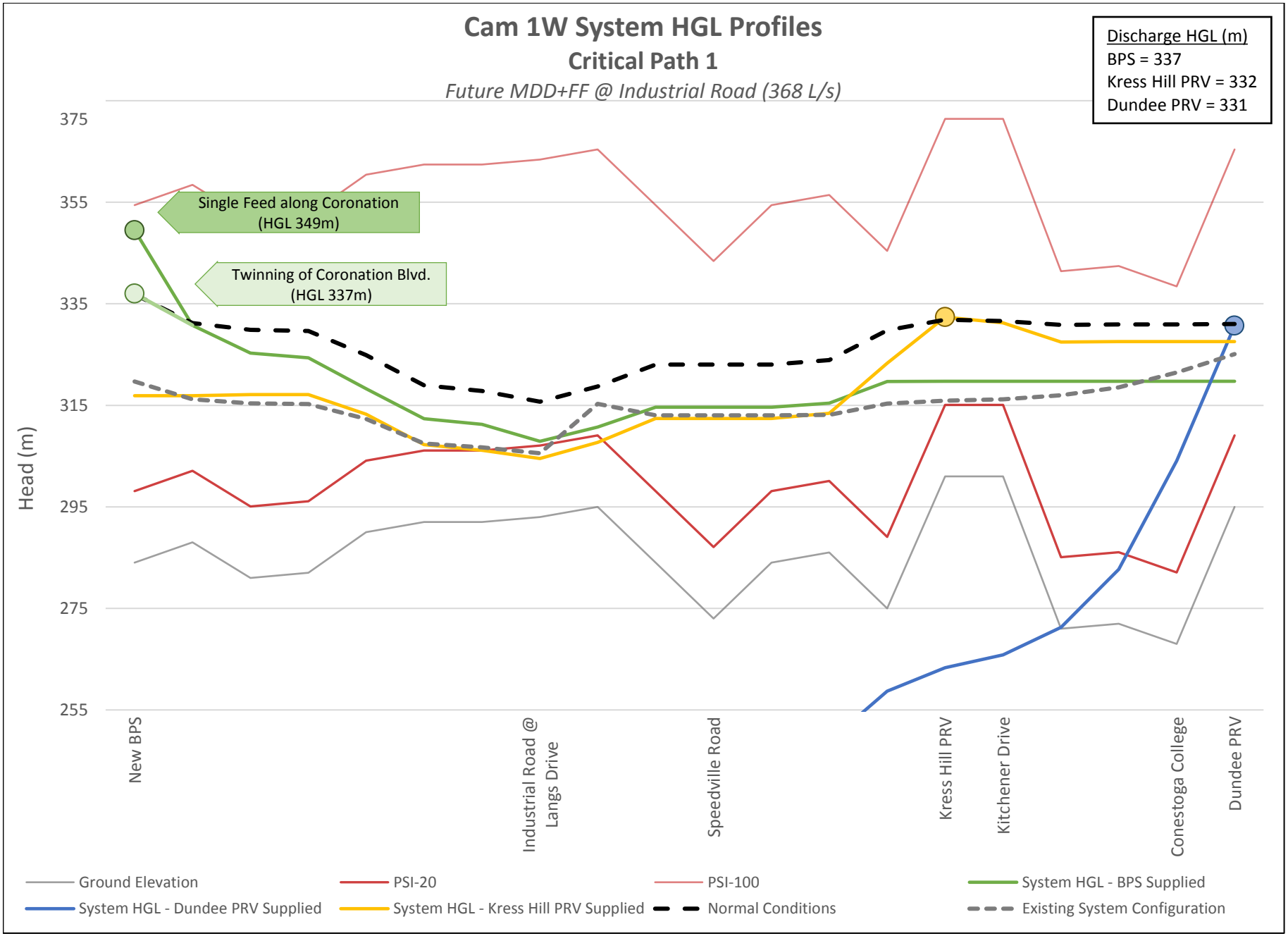
Appendix E – HGL System Profiles

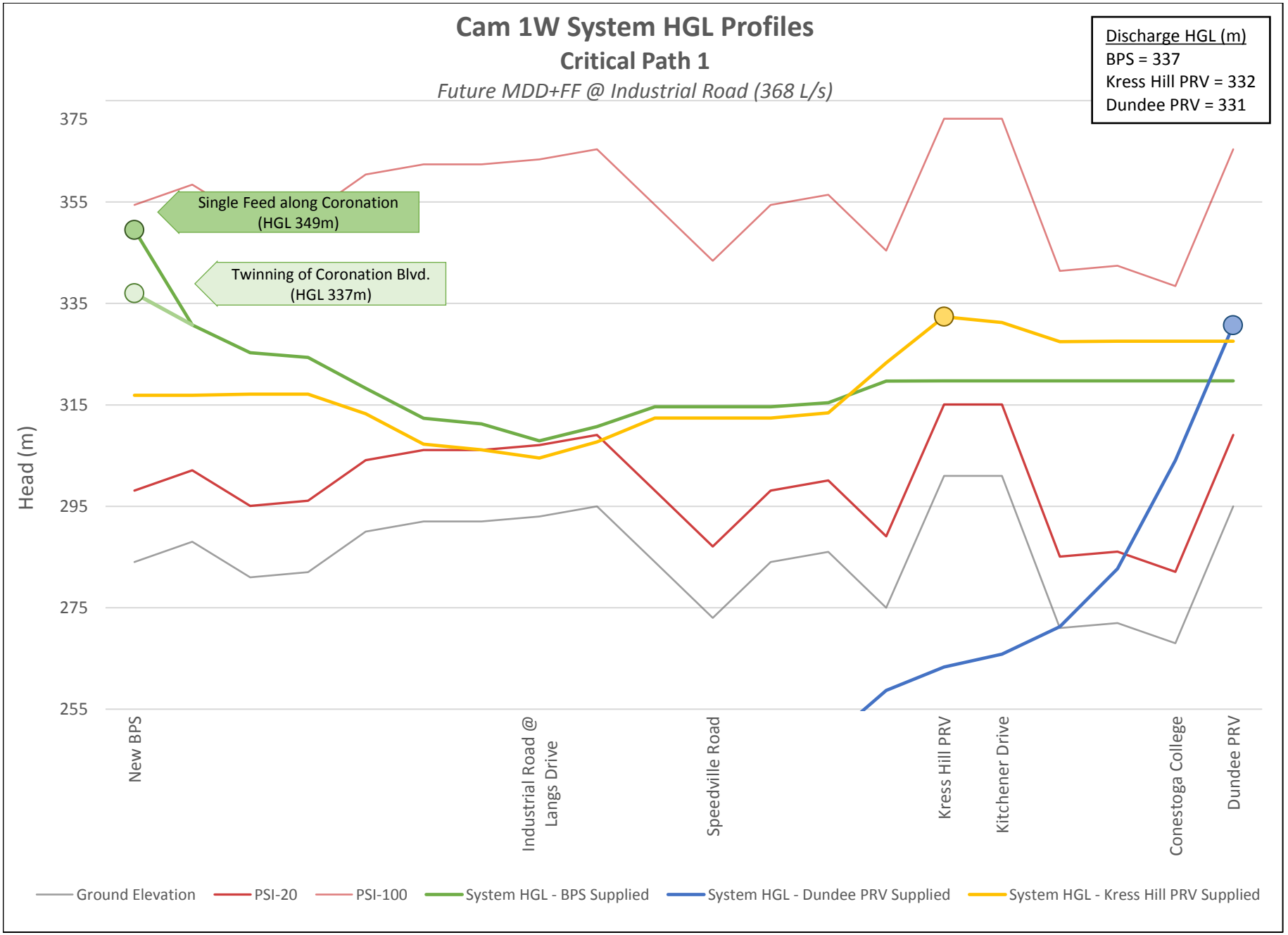

Cam 1W System HGL Profiles
Critical Path 1
Existing MNF
Discharge HGL (m)
BPS = 337
Kress Hill PRV = 332
Dundee PRV = 331
Head (m)
375
355
335
315
295
275
255
New BPS
Industrial Road @ Langs Drive
Speedville Road
Kress Hill PRV
Kitchener Drive
Conestoga College
Dundee PRV
Ground Elevation
PSI-40
PSI-100
System HGL - BPS Supplied
System HGL - Dundee PRV Supplied
System HGL - Kress Hill PRV Supplied
Normal Conditions
Existing System Configuration

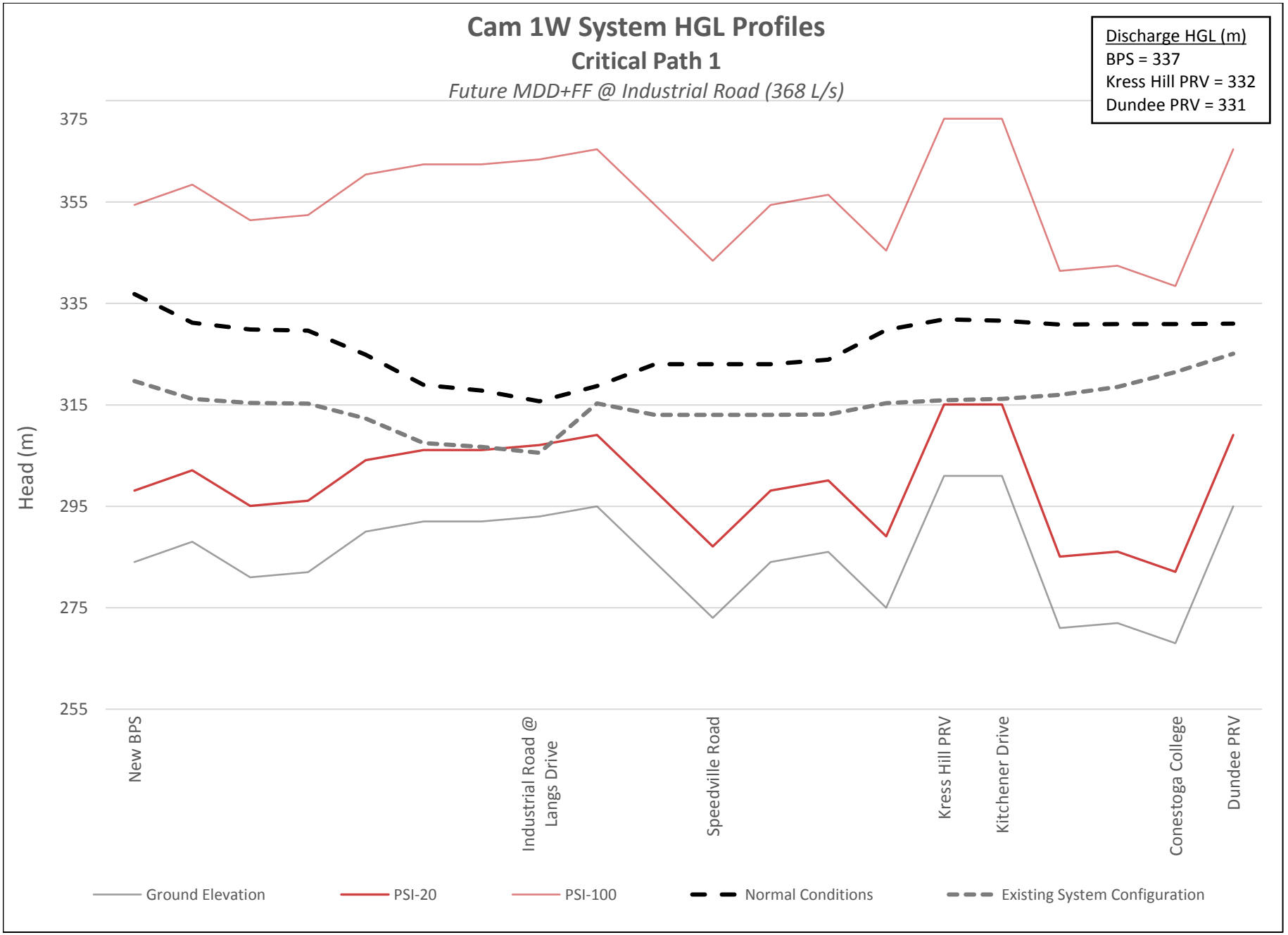

Cam 1W System HGL Profiles
Critical Path 1
Future PHD
Discharge HGL (m)
BPS = 337
Kress Hill PRV = 332
Dundee PRV = 331
Head (m)
375
355
335
315
295
275
255
New BPS
Industrial Road @ Langs Drive
Speedville Road
Kress Hill PRV
Kitchener Drive
Conestoga College
Dundee PRV
Ground Elevation
PSI-40
PSI-100
System HGL - BPS Supplied
System HGL - Dundee PRV Supplied
System HGL - Kress Hill PRV Supplied
Normal Conditions
Existing System Configuration

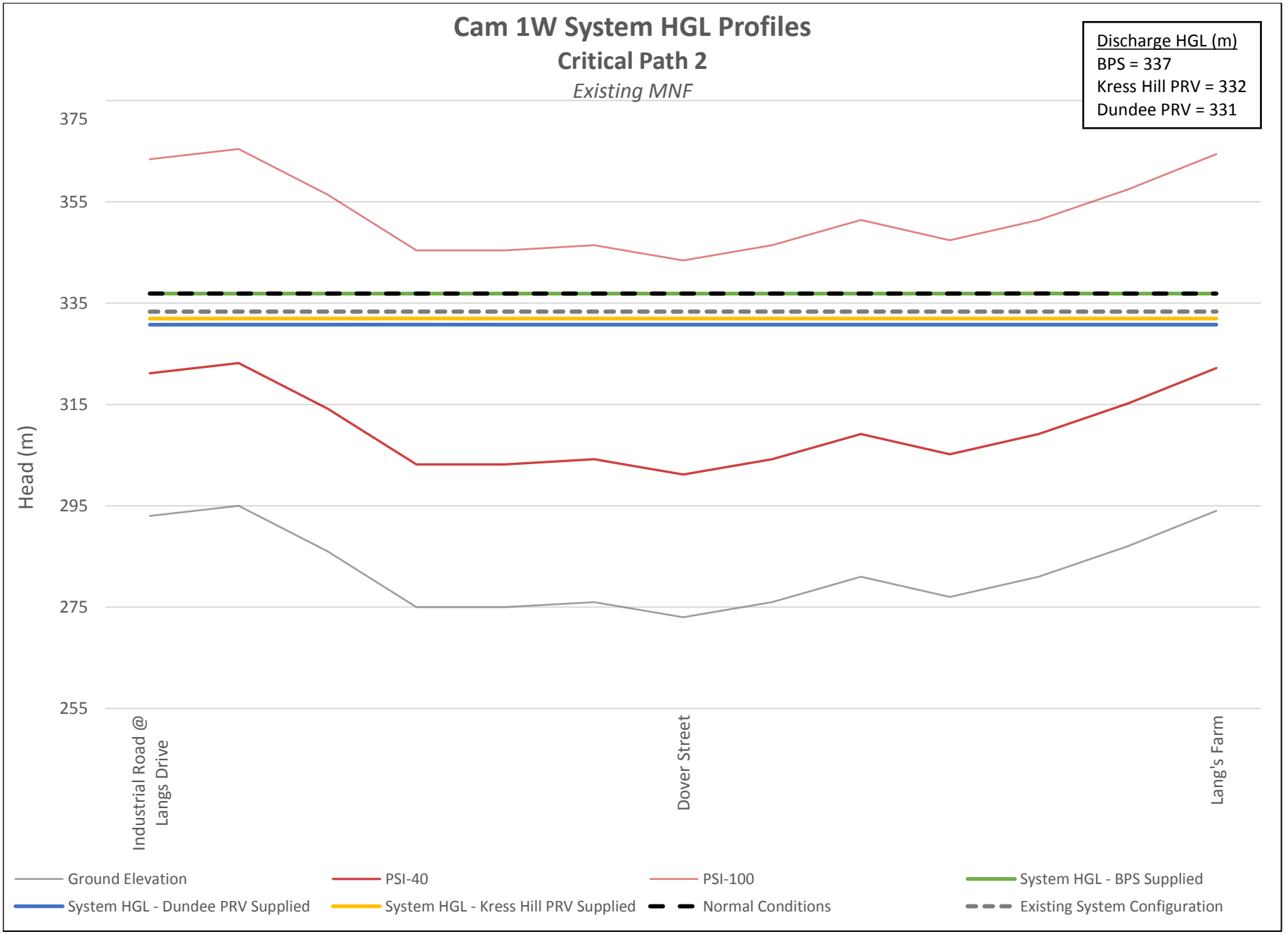

Cam 1W System HGL Profiles
Critical Path 1
Future MDD+FF @ Kitchener Street (75 L/s)
Discharge HGL (m)
BPS = 337
Kress Hill PRV = 332
Dundee PRV = 331
Head (m)
375
355
335
315
295
275
255
New BPS
Industrial Road @ Langs Drive
Speedville Road
Kress Hill PRV
Kitchener Drive
Conestoga College
Dundee PRV
Ground Elevation
PSI-20
PSI-100
System HGL - BPS Supplied
System HGL - Dundee PRV Supplied
System HGL - Kress Hill PRV Supplied
Normal Conditions
Existing System Configuration

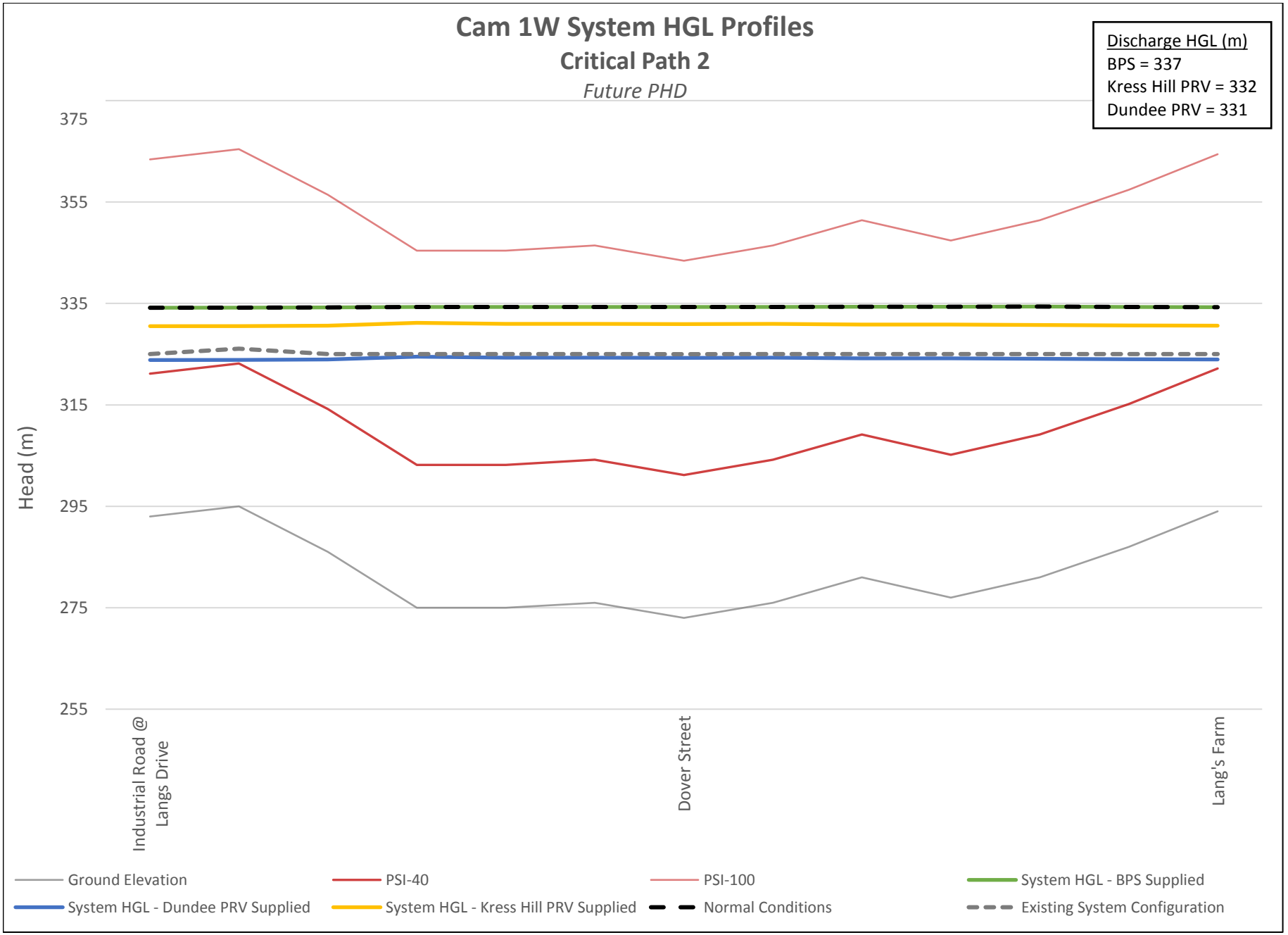

Cam 1W System HGL Profiles
Critical Path 1
Future MDD+FF @ Conestoga College (150 L/s)
Discharge HGL (m)
BPS = 337
Kress Hill PRV = 332
Dundee PRV = 331
Head (m)
375
355
335
315
295
275
255
New BPS
Industrial Road @ Langs Drive
Speedville Road
Kress Hill PRV
Kitchener Drive
Conestoga College
Dundee PRV
Ground Elevation
PSI-20
PSI-100
System HGL - BPS Supplied
System HGL - Dundee PRV Supplied
System HGL - Kress Hill PRV Supplied
Normal Conditions
Existing System Configuration

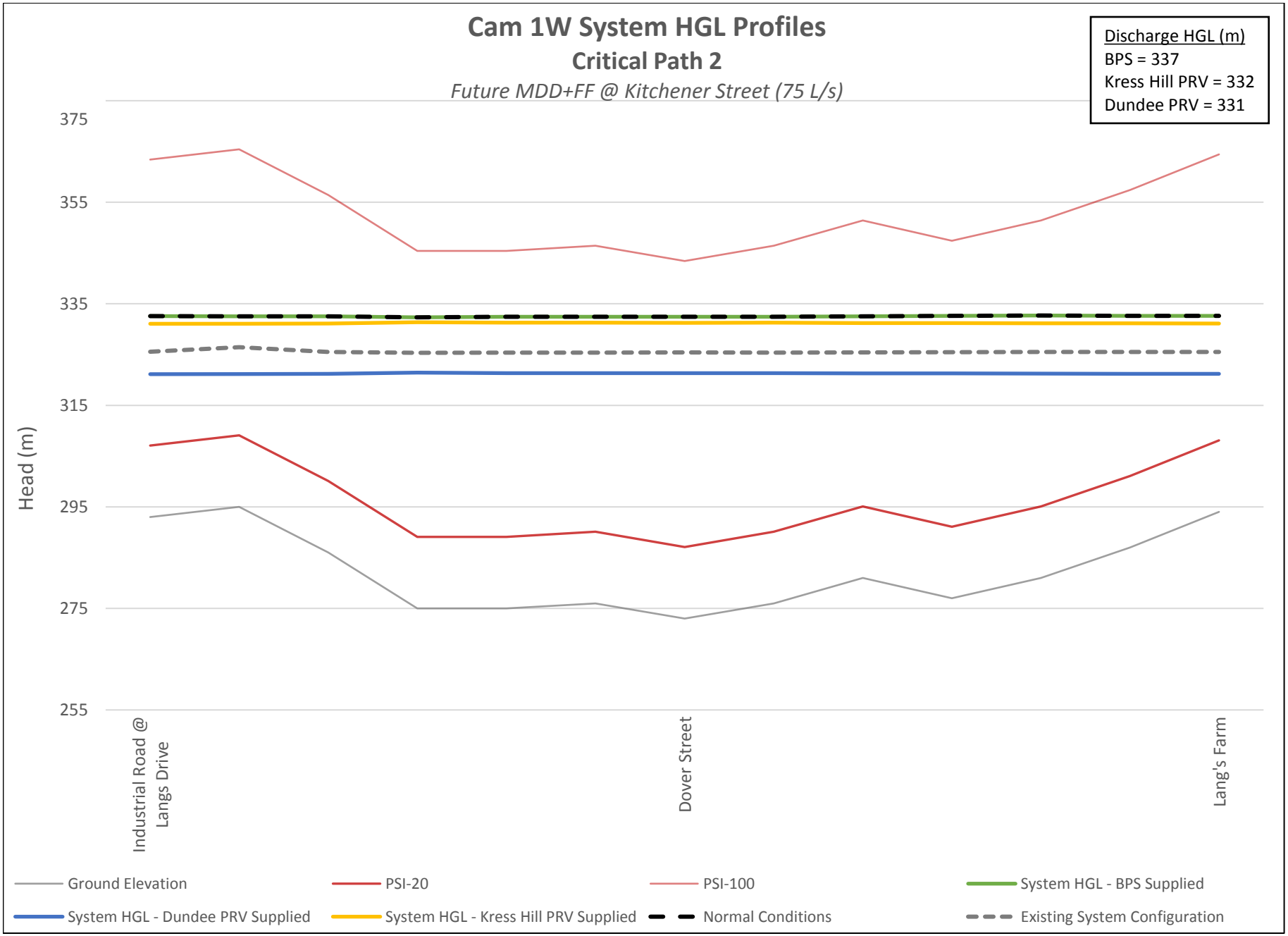

Cam 1W System HGL Profiles
Critical Path 1
Future MDD+FF @ Industrial Road (368 L/s)
Discharge HGL (m)
BPS = 337
Kress Hill PRV = 332
Dundee PRV = 331
Single Feed along Coronation (HGL 349m)
Twinning of Coronation Blvd. (HGL 337m)
Head (m)
375
355
335
315
295
275
255
New BPS
Industrial Road @ Langs Drive
Speedville Road
Kress Hill PRV
Kitchener Drive
Conestoga College
Dundee PRV
Ground Elevation
PSI-20
PSI-100
System HGL - BPS Supplied
System HGL - Dundee PRV Supplied
System HGL - Kress Hill PRV Supplied
Normal Conditions
Existing System Configuration

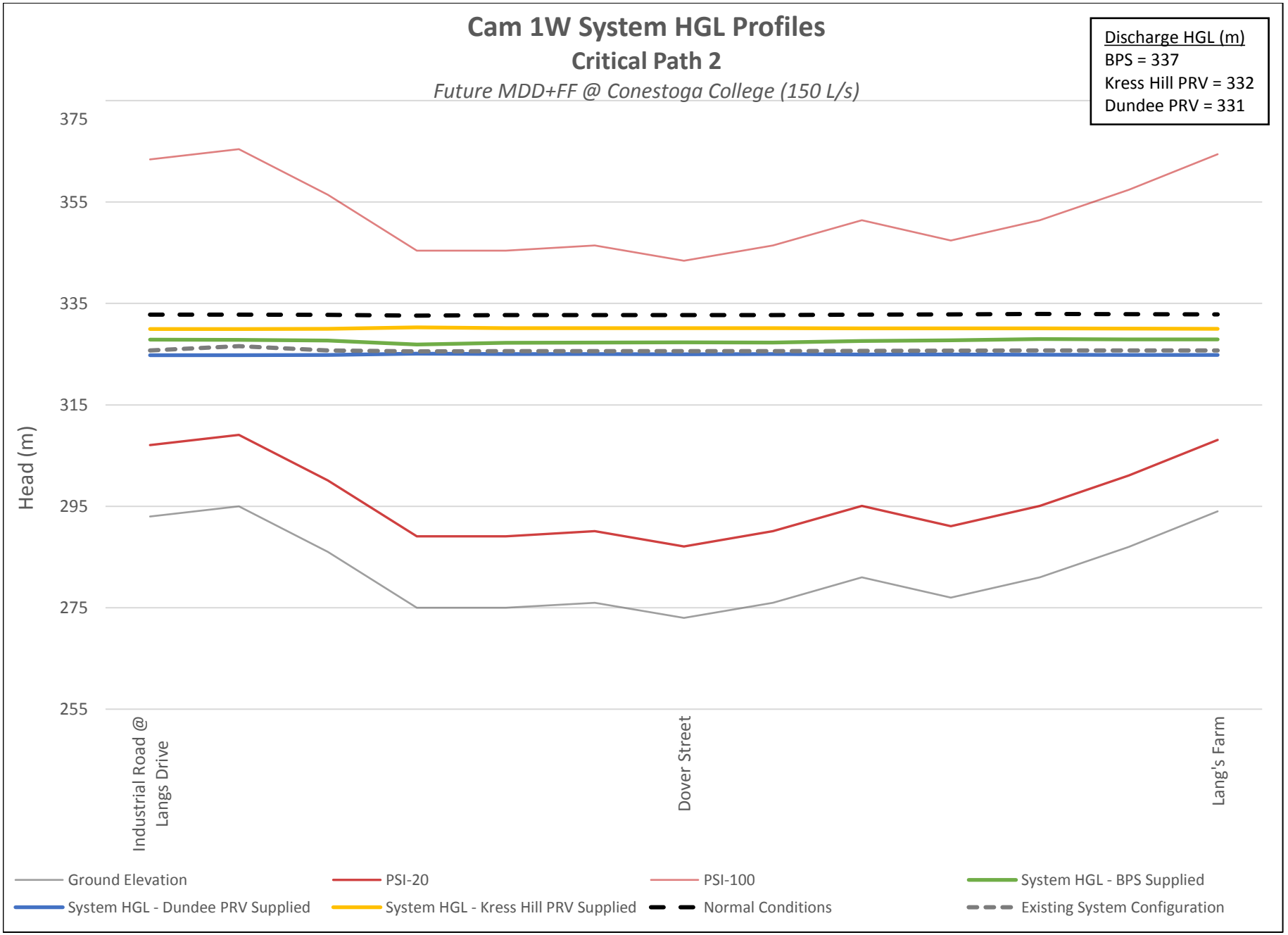

Cam 1W System HGL Profiles
Critical Path 1
Future MDD+FF @ Industrial Road (368 L/s)
Discharge HGL (m)
BPS = 337
Kress Hill PRV = 332
Dundee PRV = 331
Single Feed along Coronation (HGL 349m)
Twinning of Coronation Blvd. (HGL 337m)
Head (m)
375
355
335
315
295
275
255
New BPS
Industrial Road @ Langs Drive
Speedville Road
Kress Hill PRV
Kitchener Drive
Conestoga College
Dundee PRV
Ground Elevation
PSI-20
PSI-100
System HGL - BPS Supplied
System HGL - Dundee PRV Supplied
System HGL - Kress Hill PRV Supplied

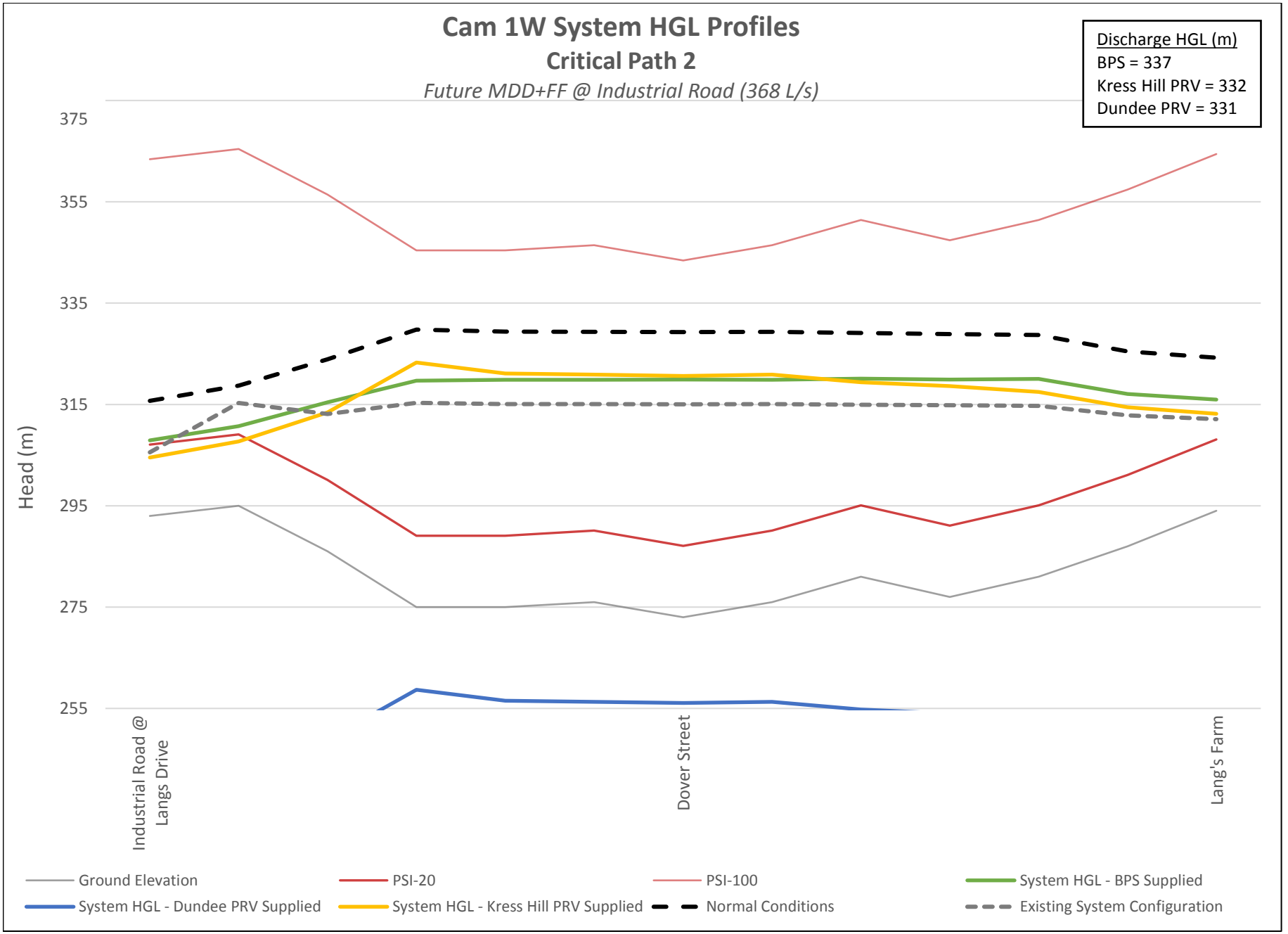

Cam 1W System HGL Profiles
Critical Path 1
Future MDD+FF @ Industrial Road (368 L/s)
Discharge HGL (m)
BPS = 337
Kress Hill PRV = 332
Dundee PRV = 331
Head (m)
375
355
335
315
295
275
255
New BPS
Industrial Road @ Langs Drive
Speedville Road
Kress Hill PRV
Kitchener Drive
Conestoga College
Dundee PRV
Ground Elevation
PSI-20
PSI-100
Normal Conditions
Existing System Configuration


Cam 1W System HGL Profiles
Critical Path 2
Existing MNF
Discharge HGL (m)
BPS = 337
Kress Hill PRV = 332
Dundee PRV = 331
Head (m)
375
355
335
315
295
275
255
Industrial Road @ Langs Drive
Dover Street
Lang's Farm
Ground Elevation
PSI-40
PSI-100
System HGL - BPS Supplied
System HGL - Dundee PRV Supplied
System HGL - Kress Hill PRV Supplied
Normal Conditions
Existing System Configuration


Cam 1W System HGL Profiles
Critical Path 2
Future PHD
Discharge HGL (m)
BPS = 337
Kress Hill PRV = 332
Dundee PRV = 331
Head (m)
375
355
335
315
295
275
255
Industrial Road @ Langs Drive
Dover Street
Lang's Farm
Ground Elevation
PSI-40
PSI-100
System HGL - BPS Supplied
System HGL - Dundee PRV Supplied
System HGL - Kress Hill PRV Supplied
Normal Conditions
Existing System Configuration


Cam 1W System HGL Profiles
Critical Path 2
Future MDD+FF @ Kitchener Street (75 L/s)
Discharge HGL (m)
BPS = 337
Kress Hill PRV = 332
Dundee PRV = 331
Head (m)
375
355
335
315
295
275
255
Industrial Road @ Langs Drive
Dover Street
Lang's Farm
Ground Elevation
PSI-20
PSI-100
System HGL - BPS Supplied
System HGL - Dundee PRV Supplied
System HGL - Kress Hill PRV Supplied
Normal Conditions
Existing System Configuration


Cam 1W System HGL Profiles
Critical Path 2
Future MDD+FF @ Conestoga College (150 L/s)
Discharge HGL (m)
BPS = 337
Kress Hill PRV = 332
Dundee PRV = 331
Head (m)
375
355
335
315
295
275
255
Industrial Road @ Langs Drive
Dover Street
Lang's Farm
Ground Elevation
PSI-20
PSI-100
System HGL - BPS Supplied
System HGL - Dundee PRV Supplied
System HGL - Kress Hill PRV Supplied
Normal Conditions
Existing System Configuration


Cam 1W System HGL Profiles
Critical Path 2
Future MDD+FF @ Industrial Road (368 L/s)
Discharge HGL (m)
BPS = 337
Kress Hill PRV = 332
Dundee PRV = 331
Head (m)
375
355
335
315
295
275
255
Industrial Road @ Langs Drive
Dover Street
Lang's Farm
Ground Elevation
PSI-20
PSI-100
System HGL - BPS Supplied
System HGL - Dundee PRV Supplied
System HGL - Kress Hill PRV Supplied
Normal Conditions
Existing System Configuration

Appendix C - Natural Environment Features

May 2017

CAMBRIDGE ZONE 1W ENVIRONMENTAL ASSESSMENT

Natural Environment Report

Submitted to:
Chris Campbell, MTP, MCIP, RPP, MRTPI
Infrastructure Planning, Partner
GM BluePlan Engineering Limited
Royal Centre | 3300 Highway No. 7, Suite 402 | Vaughan
ON L4K 4M3

REPORT

Report Number: 1653341

Distribution:

GM BluePlan - e-copy (PDF)
Golder Associates - e-copy (PDF)

Golder Associates

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Figure 1: Study Area

APPENDICES

APPENDIX A
Species at Risk (SAR) Screening

1.0 INTRODUCTION

Golder Associates Ltd. (Golder) was retained by GM BluePlan Engineering Limited (BluePlan) to conduct natural heritage studies to support the overall Schedule B - Class Environmental Assessment (EA) for the Cambridge Pressure Zone 1W (the Project), in the City of Cambridge, Region of Waterloo, Ontario.

1.1 Site Description

The preferred alignment for the Project was provided by BluePlan in an email dated January 11, 2017. The alignment includes a twinned trunk water main and service connections, and is generally confined to the right-of-way (ROW) along Coronation Blvd. A recommended location for the pumping station was also identified on a parcel of land on the north side of Coronation Blvd. in the west end of the study area (Figure 1).

The study area considered for the Project included a 300 metre (m) wide corridor along Coronation Blvd that extends northwest of Cambridge General Hospital to approximately Pinewood Ave. The study area also included a 150 m buffer around the pumping station.

The study area is primarily developed for residential land use. In the west end of the study area, the Galt County Club occurs south of Coronation Blvd., and commercial and industrial buildings occur to the north. A small area of deciduous woodland also occurs north of Coronation Blvd., adjacent to the proposed pumping station location. Groff Mill Creek crosses Coronation Blvd. just north of the Galt Country Club, adjacent to the proposed pumping station location

2.0 POLICY CONTEXT

2.1 Provincial Policy Statement (PPS)

The PPS was issued under Section 3 of the *Planning Act*, and came into effect on April 30, 2014.

The natural heritage policies of the PPS (MMAH 2014) indicate that:

- 2.1.1 Natural features and areas shall be protected for the long term;
- 2.1.2 The diversity and connectivity of natural features in an area, and the long-term ecological function and biodiversity of natural heritage systems, should be maintained, restored or, where possible, improved, recognizing linkages between and among natural heritage features and areas, surface water features and ground water features;
- 2.1.3 Natural heritage systems shall be identified in Ecoregions 6E and 7E, recognizing that natural heritage systems will vary in size and form in settlement areas, rural areas, and prime agricultural areas;
- 2.1.4 Development and Site alteration shall not be permitted in:

a) Significant wetlands in Ecoregions 5E, 6E and 7E; and

b) Significant coastal wetlands.

- 2.1.5 Unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions, development and Site alteration shall not be permitted in:

a) Significant wetlands in the Canadian Shield north of Ecoregions 5E, 6E and 7E;

b) Significant woodlands in Ecoregions 6E and 7E (excluding islands in Lake Huron and the St. Mary's River);

c) Significant valleylands in Ecoregions 6E and 7E (excluding islands in Lake Huron and the St. Mary's River);

d) Significant wildlife habitat;

e) Significant areas of natural and scientific interest; and

f) Coastal wetlands in Ecoregions 5E, 6E and 7E that are not subject to policy 2.1.4(b).

- 2.1.6 Development and Site alteration shall not be permitted in fish habitat except in accordance with provincial and federal requirements;
- 2.1.7 Development and Site alteration shall not be permitted in habitat of endangered species and threatened species, except in accordance with provincial and federal requirements; and
- 2.1.8 Development and Site alteration shall not be permitted on adjacent lands to the natural heritage features and areas identified in policies 2.1.3, 2.1.4 and 2.1.5 unless the ecological function of the adjacent lands has been evaluated and it has been demonstrated that there will be no negative impacts on the natural features or on their ecological functions.

2.2 Species at Risk

2.2.1 Species at Risk Act (SARA)

At a federal level, species at risk designations for species occurring in Canada are initially determined by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). If approved by the federal Minister of the Environment, species are added to the federal List of Wildlife Species at Risk (Government of Canada 2002). Species that are included on Schedule 1 as endangered or threatened are afforded protection of critical habitat on federal lands under the *Species at Risk Act* (SARA). On private or provincially-owned lands, only aquatic species listed as endangered, threatened or extirpated and migratory birds are protected under SARA, unless ordered by the Governor in Council.

2.2.2 Endangered Species Act (ESA)

Species at risk designations for species in Ontario are initially determined by the Committee on the Status of Species at Risk in Ontario (COSSARO), and if approved by the provincial Minister of Natural Resources and Forestry, species are added to the provincial *Endangered Species Act* (ESA), which came into effect June 30, 2008 (Ontario 2007). The legislation prohibits the killing or harming of species identified as 'endangered' or 'threatened' in the various schedules to the Act. The ESA also provides habitat protection to all species listed as threatened or endangered. As of June 30, 2008, the Species at Risk in Ontario (SARO) List is contained in O. Reg. 230/08.

Subsection 9(1) of the ESA prohibits the killing, harming or harassing of species identified as 'endangered' or 'threatened' in the various schedules to the Act. Subsection 10(1) (a) of the ESA states that *"No person shall*

damage or destroy the habitat of a species that is listed on the SARO *List as an endangered or threatened species"*.

General habitat protection is provided by the ESA to all threatened and endangered species. Species-specific habitat protection is only afforded to those species for which a habitat regulation has been prepared and passed into law under the ESA. The ESA has a permitting process where alterations to protected species or their habitats may be considered.

2.3 Fisheries Act

The purpose of the *Fisheries Act* is to maintain healthy, sustainable and productive Canadian fisheries through the prevention of pollution, and the protection of fish and their habitat. In 2012, changes were made to the *Fisheries Act* to enhance Fisheries and Oceans Canada's (DFO) ability to manage threats to Canada's commercial, recreational and Aboriginal (CRA) fisheries.

Projects affecting waterbodies supporting Canada's CRA fisheries must comply with the provisions of the *Fisheries Act*. The proponent is responsible for determining if the project is likely to cause impacts to CRA fish and if these impacts can be avoided or mitigated. The proponent must gather information on the type and scale of impact on the fishery and determine if the impacts will result in *serious harm to fish.* Proponents have a duty to maintain records of self-assessments completed for projects they undertake, and need to provide this information to DFO upon request. Serious harm to fish is defined as: the death of fish; and/or any permanent alteration to, or destruction of, fish habitat. If it is determined that the impacts cannot be avoided or mitigated and will result in serious harm to fish, an application for authorization must be submitted to the DFO. Projects that have the potential to obstruct fish passage or, affect flows needed by fish also require an authorization; even if these occur outside of CRA fishery areas (DFO 2013a).

Proponents of projects requiring a Fisheries Act Authorization are required to submit a Habitat Offsetting Plan, which provides details of how the serious harm to fish will be offset, as well as outlining associated costs and monitoring commitments (DFO 2013b). Proponents also have a duty to notify DFO of any unforeseen activities that cause serious harm to fish and outline the steps taken to address them.

2.4 Migratory Birds Convention Act

The *Migratory Birds Convention Act* (MBCA) (Canada, 1994) prohibits the killing or capturing of migratory birds, as well as any damage, destruction, removal or disturbance of active nests. It also allows the Canadian government to pass and enforce regulations to protect various species of migratory birds, as well as their habitats. While Environment and Climate Change Canada (ECCC) can issue permits allowing the destruction of nests for scientific or agricultural purposes, or to prevent damage being caused by birds, it does not typically allow for permits in the case of industrial or construction activities.

2.5 Grand River Conservation Authority

The study area is within the jurisdiction of the Grand River Conservation Authority (GRCA). Any work proposed within watercourses (including Groff Mill Creek), wetlands or waterbodies, or within the GRCA regulated limits, must be in compliance with the regulations of O. Reg. 150/06 Grand River Conservation Authority: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses.

The preferred alignment is outside of GRCA regulated areas according to available mapping (GRCA 2016). Likewise, the proposed pumping station location occurs outside of the regulated limits, based on online GRCA mapping referenced by Golder. However, based on the exact location of the pumping station likely to be finalized during the detailed design phase of the Project, future consultation with the GRCA may be required to confirm the regulated area boundary in relation to the pumping station footprint and if applicable, necessary studies and information prepared to address applicable permitting requirements of the GRCA.

2.6 City of Cambridge Official Plan

The study area is located within the City of Cambridge and the Project must comply with the policies of the City of Cambridge Official Plan (OP) (2012). Development and site alteration within or adjacent to designated natural features may be prohibited. In some cases, development and site alteration may be permitted with the completion of appropriate environmental studies, such as an Environmental Impact Study (EIS).

The Galt County Club is designated as a Recreation, Cemetery and Open Space according to the Cambridge OP (2012). The deciduous woodland north of Coronation Blvd. and the riparian buffer along Groff Mill Creek is designated as a Natural Open Space by the Cambridge OP (2012).

The Natural Open Space System includes Core Environmental Features, watercourses and shorelines, and the regulatory floodplain. Maintenance of existing uses within this land use designation is permitted. Any proposed expansions to existing uses requires the completion of an EIS.

Dumfries Conservation Area, located north of Coronation Blvd. and north of the railway tracks (Figure 1), is designated as a Core Environmental Feature. Core Environmental Features are features identified as provincially or regionally significant, and include provincially significant wetlands (PSW), environmentally sensitive policy areas, significant woodlands and environmentally significant valley features. Development and site alteration within these areas are prohibited, except as in accordance with the policies of the Regional Official Plan Section 7.2. Development and site alteration on lands adjacent to these features is permitted where it is shown that no adverse impacts to the features or functions will occur. A minimum buffer width of 10 m from all Core Environmental Features must be implemented (Cambridge 2012).

2.7 Region of Waterloo Official Plan

The study area is also located within the Region of Waterloo. The study area includes portions of the Region's Greenlands Network. The Greenlands Network is composed of Environmentally Sensitive Landscapes, Core Environmental Features, fish habitat, and supporting environmental features and linkages (Region of Waterloo 2015).

Dumfries Conservation Area is designated as a Core Environmental Feature under the Regional OP (2015). Core Environmental Features include PSWs, significant woodlands, environmentally sensitive policy areas, significant valley features, significant Areas of Natural and Scientific Interest (ANSI), and significant habitat of threatened and endangered species (Region of Waterloo 2015).

Development and site alteration within Core Environmental Features is prohibited, with some exceptions for activities such as construction or upgrades to trunk sewers, watermains, wastewater treatment facilities and groundwater taking (Region of Waterloo 2015). Development and site alteration on lands adjacent to Core Environmental Features is permitted where it is shown that no adverse impacts to the features or functions will occur (Region of Waterloo 2015).

3.0 METHODS

3.1 Background Review

The investigation of existing conditions in the study area included a background information search and literature review to gather data about the local area and provide context for the evaluation of the natural features.

As part of the background review, a number of resources were used to evaluate the existing conditions in the study area including:

- Natural Heritage Information Centre (NHIC) database maintained by the Ontario Ministry of Natural Resources (MNRF) (NHIC 2016);
- Species at Risk Public Registry (EC 2016);
- Species At Risk in Ontario List (MNRF 2016a);
- Atlas of Breeding Birds of Ontario (Cadman et al. 2007);
- Atlas of the Mammals of Ontario (Dobbyn 1994);
- Royal Ontario Museum (ROM) range maps (ROM 2010);
- Bat Conservation International (BCI) range maps (BCI 2016);
- Ontario's Reptile and Amphibian Atlas (Ontario Nature 2016);
- Ontario Butterfly Atlas (Jones et al. 2016);
- Land Information Ontario (MNRF 2016b);
- City of Cambridge Official Plan (2012);
- Region of Waterloo Official Plan (2015); and
- Existing aerial imagery.

To develop an understanding of the ecological communities, wildlife habitat and potential natural heritage features that may be affected by the proposed Project, MNRF Land Information Ontario (LIO) data were used to create base layer mapping for the study area. A geographic query of the NHIC database was conducted to identify element occurrences of any natural heritage features, including wetlands, Areas of Natural and Scientific Interest (ANSIs), life science sites, rare vegetation communities, rare, threatened or endangered species and other natural heritage features within the study area.

3.2 Species at Risk Screening

SAR considered for this report includes those species listed under SARA and the ESA, as well as species ranked S1-S3 (NHIC). An assessment was conducted to determine which SAR had potential habitat within the study area. A screening of all SAR which have the potential to be found in the study area was conducted as a desktop exercise, using the sources listed above. Species with ranges overlapping the study area, or recent occurrence records in the vicinity, were screened by comparing their habitat requirements to habitat conditions in the study area.

The potential for the species to occur was determined through a probability of occurrence. A ranking of low indicates no suitable habitat availability for that species in the study area and no specimens identified. Moderate probability indicates more potential for the species to occur, as suitable habitat appeared to be present in the study area, but no occurrence of the species has been recorded. High potential indicates a known species record in the study area (as determined through the background data review) and good quality habitat is present.

3.3 Field Reconnaissance

Field surveys to confirm the presence of natural features, including SAR and wildlife habitat, in the study area were completed on January 25, 2017 and May 10, 2017. A high-level plant community assessment was conducted in the natural areas on and adjacent to the proposed pumping station location using the Ecological Land Classification (ELC) for southern Ontario (Lee et al. 1998). Due to the timing of the field surveys outside of the core growing season for plants, species identification was limited.

Any wildlife seen and identified were recorded. In addition, potential habitat for wildlife and SAR identified during the background review or in the field, was assessed.

The aquatic habitat of Groff Mill Creek was assessed, and parameters recorded included water flow, morphology, in-stream vegetation and substrates, and riparian conditions.

4.0 EXISTING CONDITIONS

An assessment was conducted to determine if any significant environmental features or SAR exist, or have moderate or high potential to exist, in the study area.

4.1 Designated Natural Areas

No natural features that have been designated provincially or federally, such as PSWs or ANSIs, were identified within the study area.

One Conservation Area (Dumfries Conservation Area) is in the west end of the study area, north of Coronation Blvd. and the railway tracks (Figure 1). Neither the preferred alignment nor proposed pumping station overlap the Dumfries Conservation Area. However, the proposed pumping station is within 120 m of the Conservation Area. According to both the City's OP (Cambridge 2012) and the Region's OP (Region of Waterloo 2015), development and site alteration on adjacent lands is permitted where it is shown that no adverse impacts to the features or functions will occur. In addition, a minimum buffer width of 10 m from the Conservation Area must be implemented (Cambridge 2012).

4.2 Significant Woodlands

Although the City of Cambridge and Region of Waterloo Official Plans provide criteria for identifying significant woodlands, these features are not mapped. Significant woodlands are defined in both OPs as woodlands that are:

- Greater than 4 ha in size (excluding adjoining hedgerows);
- Consisting primarily of indigenous (i.e. native) species of trees; and

- Meets the criteria of a woodland in accordance with the provisions of the Regional Woodland Conservation By-Law.

Based on this criteria, the woodland located within the Dumfries Conservation Area north of the proposed pumping station location may be considered a significant woodland.

Significant woodlands are considered Core Environmental Features under both the City's OP (Cambridge 2012) and the Region's OP (Region of Waterloo 2015). Development or site alteration on adjacent lands are permitted where it is shown that no adverse impacts to the features or functions will occur. In addition, a minimum buffer width of 10 m from all Core Environmental Features must also be implemented according to policies of the City's OP (Cambridge 2012).

4.3 Plant Communities

The site of the proposed pumping station is classified as a black walnut cultural woodland (CUW1-3). It contains scattered black walnut (*Juglans nigra*) trees in the canopy and sub-canopy. It also contains a sparse shrub layer composed of staghorn sumac (*Rhus typhina*), grey dogwood (*Cornus racemosa*) and Tartarian honeysuckle (*Lonicera tatarica*). The ground layer was dominated by terrestrial grasses and also contained the non-native, invasive species crown vetch (*Securigera varia*) and Fuller's teasel (*Dipsacus fullonum*).

Immediately south of the proposed pumping station location is a small patch of disturbed upland forest, classified as dry-fresh Manitoba maple (*Acer negundo*) deciduous forest (FOD4-4). It appears that at least part of this forest was growing on construction fill, which included large concrete blocks. Norway spruce (*Picea abies*) and Austrian pine (*Pinus nigra*) were also observed in the canopy layer of this plant community. The understory contained common buckthorn (*Rhamnus cathartica*), staghorn sumac, and Tartarian honeysuckle. Ground cover at the time of the site visit was sparse and included garlic mustard (*Alliaria petiolata*), forget-me-nots (*Myosotis sp*.) and motherwort (*Leonurus cardiaca*).

Southwest of the FOD4-4 and CUW1-3 plant communities along Groff Mill Creek is a riparian forest. It was classified as a fresh-moist willow lowland deciduous forest (FOD7-3). The canopy was dominated by three large crack or hybrid white willows (*Salix sp*.), and also contained Manitoba maple and dead green ash (*Fraxinus pennsylvanica*). The willows were >100 cm diameter-at-breast height (DBH) and approximately 18 meters in height. The sub-canopy was sparse and contained black walnut and Manitoba maple. The understory was also sparse and contained red-osier dogwood (*Cornus sericea*), wild black current (*Ribes americanum*), eastern white cedar (*Thuja occidentalis*), and willow (*Salix sp*.). The ground layer contained skunk cabbage (*Symplocarpus foetidus*), ground ivy (*Glechoma hederacea*), coltsfoot (*Tussilago farfara*), marsh marigold (*Caltha palustris*) and rough bedstraw (*Galium asprellum*).

North of the proposed pumping station and north of the train tracks, is a variable mosaic of Scots pine cultural plantation (CUP3-3) and common buckthorn cultural thicket (CUT1-7). Other trees observed in this area included: eastern red cedar (*Juniperus virginiana*), dead white ash (*Fraxinus americana*), and pear trees (*Pyrus communis*). In addition to abundant common buckthorn, the shrub layer also contained grey dogwood, red-osier dogwood and ninebark (*Physocarpus opulifolius*).

Planted boulevard and residential trees, including some large, mature trees, occur along the majority of the preferred alignment associated with Coronation Blvd.

4.4 Aquatic and Fish Habitat

Groff Mill Creek is located adjacent to the proposed pumping station, within approximately 50 m. Groff Mill Creek is considered fish habitat (Figure 1). Although Groff Mill Creek historically supported coldwater species, it has since transitioned to a warmwater thermal regime. The creek now supports small-bodied warmwater fish of minnow, dace and creek chub species, including common shiner (*Luxilus cornutus*), bluntnose minnow (*Pimephales notatus*), fathead minnow (*Pimephales promelas*), blacknose dace (*Rhinichthys atratulus*), creek chub (*Semotilus atromaculatus*), and pearl dace (*Margariscus margarita*) (Tupman 2004).

The creek is approximately 4 m wide with a wetted width of 2 m, and water depth of less than 0.2 m. Substrates are coarse and primarily consists of cobble, boulders, gravel and sand. The creek has a moderate flow with areas of riffles and runs. Riparian vegetation consists of mature willows and other deciduous trees, as well as immature sugar maple (*Acer saccharum*), red osier dogwood (*Cornus stolonifera*), teasel (*Dipsacus fullonum*) and terrestrial grasses. The riparian vegetation provides approximately 70% cover, of which canopy cover accounts for between 10-20%.

Although no work is proposed within the creek, Best Management Practices should be implemented during construction to avoid indirect impacts to the creek, such as sedimentation and erosion. Best Management Practices are discussed further in Section 6.2.

4.5 Wildlife

The following species of wildlife were observed on this site visit: American robin (*Turdus migratorius*), northern cardinal (*Cardinalis cardinalis*), ring-billed gull (*Larus delawarensis*), blue jay (*Cyanocitta cristata*), song sparrow (*Melospiza melodia*), European starling (*Sturus vulgaris*), mourning dove (*Zenaida macroura*), American goldfinch (*Spinus tristis*), black-capped chickadee (*Poecile atricapillus*), osprey (*Pandion haliaetus*), mallard (*Anas platyrhynchos*), and house sparrow (*Passer domesticus*).

4.6 Species at Risk

4.6.1 Threatened and Endangered Species

Based on the results of the SAR screening and field surveys, there is moderate potential for three bat species designated as endangered under the ESA (Appendix A): tri-colored bat (*Perimyotis subflavus*), northern myotis (*Myotis septentrionalis*) and little brown myotis (*Myotis lucifugus*).

Tri-colored bat may roost in foliage, in clumps of old leaves, hanging moss or squirrel nests. They typically feed over aquatic areas with an affinity to large-bodied water and will likely roost in close proximity to these. Little brown myotis will roost in both natural and man-made structures. Little brown myotis require a number of large dead trees, in specific stages of decay and that project above the canopy in relatively open areas. Northern myotis usually roosts in hollows, crevices, and under loose bark of mature trees. Roosts of northern myotis may be established in the main trunk or a large branch of either living or dead trees. All three bat species typically use caves or abandoned mines as hibernaculum, but high humidity and stable above freezing temperatures are required (ECCC 2015). The deciduous woodland and riparian woodland along Groff Mill Creek north of Coronation Blvd and adjacent to the proposed pumping station location may provide suitable roosting habitat for these three bat species. The large willow trees in the riparian forest along Groff Mill Creek may function as maternity roosts. Cavities and exfoliating bark were observed on these trees. However, it is understood that there are no plans to

remove any trees in the riparian woodland and there are no expected impacts to the individual or habitat for these three bat species.

4.6.2 Special Concern Species and Species of Conservation Concern

A total of five species designated as special concern under the ESA or considered a species of conservation concern (SOCC) were assessed to have a moderate or high potential to occur in the study area. SOCC represent species designated under SARA as special concern, threatened or endangered, but not under the ESA, as well as species with a provincial rarity ranking of S1-S3, as decided by the NHIC.

These species do not have regulatory protection, but habitat for these species must be considered under the PPS significant wildlife habitat criteria.

Monarch (*Danaus plexippus*), designated special concern under both the ESA and SARA, was assessed to have a moderate potential to occur in the study area. Monarch is found throughout the northern and southern regions of the province. This butterfly is found wherever there are milkweed (*Asclepius* spp.) plants for its caterpillars and wildflowers that supply a nectar source for adults. It is often found on abandoned farmland, meadows, open wetlands, prairies and roadsides, but also in city gardens and parks. Important staging areas during migration occur along the north shores of the Great Lakes (COSEWIC 2010). Potential suitable foraging habitat may occur along roadsides or in the golf course south of Coronation Blvd. This type of edge habitat is not limiting in the region and the habitat in the study area is too small to support a large concentration of individuals and would not be considered significant. Monarch is not carried forward to the impact assessment.

Eastern wood-pewee (*Contopus virens*), designated special concern under the ESA, was assessed to have a low to moderate potential to occur in the study area. Eastern wood-pewee inhabits a wide variety of wooded upland and lowland habitats, including deciduous, coniferous, or mixed forests. It occurs most frequently in forests with some degree of openness. Also occurs in anthropogenic habitats providing an open forested aspect such as parks and suburban neighborhoods (COSEWIC 2012). The deciduous woodland north of Coronation Blvd may provide suitable habitat. However, eastern wood-pewee tends to avoid areas of dense residential development. In addition, it is understood that there are no plans to remove any trees in the riparian woodland and there are no expected impacts to the individual or habitat.

Red-headed woodpecker (*Melanerpes erythrocephalus*), designated special concern under the ESA and threatened under the SARA, was assessed to have a moderate potential to occur in the study area. Red-headed woodpecker breeds in open, deciduous woodlands or woodland edges and are often found in parks, cemeteries, golf courses, orchards and savannahs (Woodliffe 2007). They may also breed in forest clearings or open agricultural areas provided that large trees are available for nesting. They prefer forests with little or no understory vegetation. They are often associated with beech or oak forests, beaver ponds and swamp forests where snags are numerous. Nests are excavated in the trunks of large dead trees (Smith et al. 2000). Large willows along Groff Mill Creek may provide suitable nesting habitat or roosts. However, it is understood that there are no plans to remove any trees in the riparian woodland and there are no expected impacts to the individual or habitat.

Milksnake (*Lampropeltis triangulum*), designated not at risk under the ESA and special concern under the SARA, was assessed to have a moderate potential to occur in the study area. Milksnake uses a wide range of habitats including prairies, pastures, hayfields, wetlands and various forest types, and is well-known in rural areas where it frequents older buildings. Proximity to water and cover enhances habitat suitability. Hibernation takes place in mammal burrows, hollow logs, gravel or soil banks, and old foundations (COSEWIC 2014). The riparian woodland

along Groff Mill Creek may provide suitable habitat. However, the feature is somewhat isolated from other natural features by development and a railway, which reduces suitability. The construction fill that underlays part of the FOD4-4 along Groff Mill Creek contains large concrete blocks and rubble of variable sizes and dimensions. Openings into the construction fill was observed along the bank east of the watercourse. It is understood that no alterations to Groff Mill Creek and no vegetation removal within the riparian woodland is expected as part of the proposed Project. General best management practices to prevent harm to individuals should they be in the study area is provided in Section 6.1.

Woodland flax (*Linum virginianum*), with a S2 (Imperiled) provincial ranking, was assessed to have a moderate potential to occur in the study area. Woodland flax grows in woodlands, thickets and along stream banks. The riparian woodland along Groff Mill Creek may provide suitable habitat (MNFI 2007). The riparian woodland along Groff Mill Creek may provide suitable habitat. However, vegetation removal within the riparian woodland is not expected as part of the proposed Project and potential habitat for this vascular plan species is not expected to be impacted.

5.0 IMPACT ASSESSMENT

Dumfries Conservation Area and a candidate significant woodland are located within 120 m of the proposed pumping station location. No vegetation removal is proposed in these areas. In addition, no alterations to the hydrological or hydrogeological systems in the area are expected as part of the proposed Project that would cause indirect impacts on vegetation or wetland systems in these two areas. With the implementation of a 10 m buffer between the proposed pumping station location and these two areas as required by the City's policies, no impacts are expected to the Dumfries Conservation Area or candidate significant woodland.

6.0 MITIGATION AND RECOMMENDATIONS

The following mitigation should be considered during preliminary and detailed design to minimize any potential effects of the Project on natural features.

6.1 Vegetation and Wildlife

- Tree removal will be conducted in accordance with the City of Cambridge's Tree By-law (By-law #71-06).
- Post-construction planting will be undertaken to restore vegetation cover in all areas disturbed by construction activities, where reasonable.
- All vegetation clearing should occur outside of the breeding bird season (April 15 – August 15). If this is not possible, a nest search should be completed by a qualified biologist in all areas to be cleared prior to clearing activities.
- Rehabilitate, re-stabilize and re-vegetate all disturbed areas upon completion of the construction works to restore the Project site to its pre-construction condition, where possible.
- Because there is potential for milksnake to occur in the study area, it is recommended that exclusion fencing be installed around the active construction area during construction of the proposed pumping station to prevent individuals from entering the construction site. Barriers installed as part of sediment and erosion control may also function as an exclusion barrier with minor adjustments to the design.

6.2 Fish Habitat

The following mitigation measures should be implemented during construction to minimize harm to fish and fish habitat:

- Implement standard and accepted mitigation measures outlined in the Land Development Guidelines for the Protection of Aquatic Habitat (DFO 1993), Fisheries Protection Policy Statement (DFO 2013a) and Measures to Avoid Causing Harm to Fish and Fish Habitat (DFO 2013c) during construction.
- **Erosion and Sediment Control**: An erosion and sediment control plan will be developed to minimize the risk of sedimentation of Groff Mill Creek during all phases of the project. These include installation of sediment barriers on all catch basin and maintenance holes and a silt fence barrier along all areas that sheet drain off-site, etc. Exposed soils will be stabilized if above the high water mark. All sedimentation and erosion control measures will be regularly inspected and adapted to meet needs.
- **Contamination and Spill Management**: A response plan will be developed that will be implemented immediately in the event of a sediment release or spill of a deleterious substance and an emergency spill kit will be kept on site.
- **Operation of Machinery**: Machinery will be operated on land above the high water mark where possible. All refueling, washing, and servicing of machinery will be completed beyond 30 m of the water courses where fish are present.

7.0 SUMMARY AND CONCLUSIONS

The proposed Project study area, including the preferred alignment and proposed pumping station location, has been assessed for potential impacts to natural features, wildlife and SAR. Broad level ecological impacts relevant to legislation including the ESA, SARA, the *Fisheries Act,* and the MBCA were assessed and considered as potential constraints to the Project. In addition, potential ecological impacts under the Provincial Policy Statement, the policies of the Region of Waterloo and City of Cambridge Official Plans, and the *Conservation Authorities Act* were also reviewed to provide ecological context to the report and discussion of impacts.

Based on the surveys and assessments completed for this Natural Environment Report, it is expected that there will be no negative impacts to the significant natural features and functions in the study area. These conclusions are based on the following recommendations and assumptions:

- There will be no vegetation removal within the riparian deciduous woodland along Groff Mill Creek adjacent to the proposed pumping station. If vegetation removal is proposed, additional mitigation measures or permits may be required to address impacts to habitat of SAR;
- Potential impacts to locally rare or special concern species under the ESA that have been identified in the study area can be avoided through a combination of Project planning, design and construction mitigation measures;
- Sediment/erosion controls during construction will be implemented adjacent to natural features, including Groff Mill Creek, during construction;

- Tree removal will be conducted in accordance with the City of Cambridge's Tree By-law (By-law #71-06);
- Discussion with the GRCA may be required during detailed design to confirm appropriate set-backs and/or mitigation measures for work within the GRCA regulated area adjacent to Groff Mill Creek.

Report Signature Page

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FIGURE



NOTE(S)

REFERENCE(S)

1. BASE DATA: LIO MNRF, 2016
2. IMAGERY: © 2017 DIGITALGLOBE IMAGE COURTESY OF USGS EARTHSTAR GEOGRAPHICS SIO © 2017 MICROSOFT CORPORATION
3. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD83 COORDINATE SYSTEM: UTM ZONE 17N

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BLUEPLAN

PROJECT
CAMBRIDGE 1W EA

TITLE
STUDY AREA

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-05-12
DESIGNED	CGE
PREPARED	CGE/MM
REVIEWED	AS
APPROVED	AS

PROJECT NO. 1653341 | CONTROL | REV. | FIGURE 1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 0 25mm

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APPENDIX A

Species at Risk (SAR) Screening

Common Name	Scientific Name	Species At Risk Act (Sch 1)[1]	Endangered Species Act[2]	COSEWIC[3]	Provincial (SRank)[4]	Habitat Requirements[5]	Potential to Occur in the Study Area	Rationale for Potential to Occur in the Study Area
Jefferson X Blue-spotted salamander, Jefferson genome dominates	*Ambystoma hybrid pop. 1*	—	—	—	S2	In Ontario, Jefferson x blue-spotted salamander prefers moist, well-drained deciduous and mixed forests with a closed canopy. It overwinters underground in mammal burrows and rock fissures, and moves to vernal pools and ephemeral wetlands in the early spring to breed. Breeding ponds are typically located in or near to forested habitats, and contain submerged debris (i.e., sticks, vegetation) for egg attachment sites. Ephemeral breeding pools need to have water until at least mid-summer (mid to late July) (Jefferson Salamander Recovery Team 2010).	Low	The small area of deciduous woodland north of Coronation Blvd is too small to provide suitable habitat. It is also fragmented from the larger area of forest north of the site by a railway which presents a barrier to movement.
Western chorus frog - Great Lakes St. Lawrence/Canadian Shield Population	*Pseudacris triseriata*	THR	—	THR	S3	In Ontario, habitat of this amphibian species typically consists of marshes or wooded wetlands, particularly those with dense shrub layers and grasses, as this species is a poor climber. They will breed in almost any fishless pond including roadside ditches, gravel pits and flooded swales in meadows. This species hibernates in terrestrial habitats under rocks, dead trees or leaves, in loose soil or in animal burrows. During hibernation, this species is tolerant of flooding (Environment Canada 2015).	Low	Aquatic habitat within the study area is primarily riverine and does not represent the preferred breeding habitat of this species.
Monarch	*Danaus plexippus*	SC	SC	SC	S2N, S4B	In Ontario, monarch is found throughout the northern and southern regions of the province. This butterfly is found wherever there are milkweed (*Asclepius* spp.) plants for its caterpillars and wildflowers that supply a nectar source for adults. It is often found on abandoned farmland, meadows, open wetlands, prairies and roadsides, but also in city gardens and parks. Important staging areas during migration occur along the north shores of the Great Lakes (COSEWIC 2010).	Moderate	Potential suitable foraging habitat may occur along roadsides or in the golf course south of Coronation Blvd.
Rusty-patched bumble bee	*Bombus affinis*	END	END	END	S1	In Ontario, rusty-patched bumble bee is found in areas from the southern Great Lakes – St. Lawrence forest region southwards into the Carolinian forest. It is a habitat generalist, but it is typically found in open habitats, such as mixed farmland, savannah, marshes, sand dunes, urban and lightly wooded areas. It is cold –tolerant and can be found at high elevations. Most recent sightings in Ontario have been in oak savannah habitat with well-drained, sandy soils and moderately open canopy. It requires an abundance of flowering plants for forage. This species most often builds nests underground in old rodent burrows, but also in hollow tree stumps and fallen dead wood (Colla and Taylor-Pindar 2011). The only recent sightings in Ontario are from the Pinery Provincial Park.	Low	Although potentially suitable foraging habitat may occur in the study area, there are no occurrence records in the region. The only current populations are known from Pinery Provincial Park.
Tawny emperor	*Asterocampa clyton*	—	—	—	S2S3	In Ontario, tawny emperor occurs in wooded habitat, including riparian woodlands, open, dry woodlands, fencerows and occasionally in parks and cities. Habitat must include the food plant of this species - hackberry (Lotts and Naberhaus 2015).	Low	Although the deciduous woodland north of Coronation Blvd may provide suitable habitat, this species was last recorded in the area in 1981.
West Virginia white	*Pieris virginiensis*	—	SC	—	S3	In Ontario, West Virginia white is found primarily in the central and southern regions of the province. This butterfly lives in moist, mature, deciduous and mixed woodlands, and the caterpillars feed only on the leaves of toothwort (*Cardamine* spp.), which are small, spring-blooming plants of the forest floor. These woodland habitats are typically maple-beech-birch dominated. This species is associated with woodlands growing on calcareous bedrock or thin soils over bedrock (Burke 2013).	Low	The deciduous woodland north of Coronation Blvd is too small to provide preferred mature forest habitat. In addition, there are no occurrence records in the area.

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Yellow-banded bumble bee	*Bombus terricola*	—	SC	—	S5	It is an early emerging species, making it likely an important pollinator of early blooming wild flowering plants (e.g., wild blueberry) and agricultural crops (e.g., apple). This species is a forage and habitat generalist. Nest sites are mostly abandoned rodent burrows.	Low	There are no large open areas in the study area to provide suitable foraging or nesting habitat.
Acadian flycatcher	*Empidonax virescens*	END	END	END	S2S3B	In Ontario, the Acadian flycatcher breeds in the understory of large, mature, closed-canopy forests, swamps and forested ravines. This bird prefers forests greater than 40 ha in size, and exhibits edge sensitivity preferring the deep interior of the forest. Its nest is loosely woven and placed near the tip of branch in a small tree or shrub often, but not always, near water (Whitehead and Taylor 2002).	Low	There are no large forests in the study area to provide suitable nesting habitat. In addition, there are no occurrence records in the area.
Bank swallow	*Riparia riparia*	—	THR	THR	S4B	In Ontario, the bank swallow breeds in a variety of natural and anthropogenic habitats, including lake bluffs, stream and river banks, sand and gravel pits, and roadcuts. Nests are generally built in a vertical or near-vertical bank. Breeding sites are typically located near open foraging sites such as rivers, lakes, grasslands, agricultural fields, wetlands and riparian woods. Forested areas are generally avoided (Garrison 1999).	Low	There are no steep slopes or banks in the study area to provide suitable nesting habitat. Individuals are more likely to occur along the Grand River south of the study area.
Barn swallow	*Hirundo rustica*	—	THR	THR	S4B	In Ontario, barn swallow breeds in areas that contain a suitable nesting structure, open areas for foraging, and a body of water. This species nests in human made structures including barns, buildings, sheds, bridges, and culverts. Preferred foraging habitat includes grassy fields, pastures, agricultural cropland, lake and river shorelines, cleared right-of-ways, and wetlands (COSEWIC 2011). Mud nests are fastened to vertical walls or built on a ledge underneath an overhang. Suitable nests from previous years are reused (Brown and Brown 1999).	Low	There are no suitable structures in the study area to provide nesting habitat. No nests were observed in the culvert beneath Coronation Blvd.
Black tern	*Chlidonias niger*	—	SC	NAR	S3B	In Ontario, black tern breeds in freshwater marshlands where it forms small colonies. It prefers marshes or marsh complexes greater than 20 ha in area and which are not surrounded by wooded area. Black terns are sensitive to the presence of agricultural activities. The black tern nests in wetlands with an even combination of open water and emergent vegetation, and still waters of 0.5-1.2 m deep. Preferred nest sites have short dense vegetation or tall sparse vegetation often consisting of cattails, bulrushes and occasionally burreed or other marshland plants. Black terns also require posts or snags for perching (Weseloh 2007).	Low	There is no suitable wetland habitat in the study area. In addition, there are no occurrence records in the area.
Bobolink	*Dolichonyx oryzivorus*	—	THR	THR	S4B	In Ontario, bobolink breeds in grasslands or graminoid dominated hayfields with tall vegetation (Gabhauer 2007). Bobolink prefers grassland habitat with a forb component and a moderate litter layer. They have low tolerance for presence of woody vegetation and are sensitive to frequent mowing within the breeding season. They are most abundant in established, but regularly maintained, hayfields, but also breed in lightly grazed pastures, old or fallow fields, cultural meadows and newly planted hayfields. Their nest is woven from grasses and forbs. It is built on the ground, in dense vegetation, usually under the cover of one or more forbs (Martin and Gavin 1995).	Low	There are no large open grasslands in the study area to provide nesting habitat.

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Canada warbler	*Cardellina canadensis*	THR	SC	THR	S4B	In Ontario, breeding habitat for Canada warbler consists of moist mixed forests with a well-developed shrubby understory. This includes low-lying areas such as cedar and alder swamps, and riparian thickets (McLaren 2007). It is also found in densely vegetated regenerating forest openings. Suitable habitat often contains a developed moss layer and an uneven forest floor. Nests are well concealed on or near the ground in dense shrub or fern cover, often in stumps, fallen logs, overhanging stream banks or mossy hummocks (Reitsma et al. 2010).	Low	The deciduous woodland north of Coronation Blvd is likely too small to provide preferred forest habitat.
Cerulean warbler	*Setophaga cerulea*	SC	THR	END	S3B	In Ontario, breeding habitat of cerulean warbler consists of second-growth or mature deciduous forest with a tall canopy of uneven vertical structure and a sparse understory. This habitat occurs in both wet bottomland forests and upland areas, and often contains large hickory and oak trees. This species may be attracted to gaps or openings in the upper canopy. The cerulean warbler is associated with large forest tracks, but may occur in woodlots as small as 10 ha (COSEWIC 2010). Nests are usually built on a horizontal limb in the mid-story or canopy of a large deciduous tree (Buehler et al. 2013).	Low	The deciduous woodland north of Coronation Blvd is likely too small and disturbed to provide preferred mature forest habitat. In addition, there are no occurrence records in the area.
Chimney swift	*Chaetura pelagica*	THR	THR	THR	S4B, S4N	In Ontario, chimney swift breeding habitat is varied and includes urban, suburban, rural and wooded sites. They are most commonly associated with towns and cities with large concentrations of chimneys. Preferred nesting sites are dark, sheltered spots with a vertical surface to which the bird can grip. Unused chimneys are the primary nesting and roosting structure, but other anthropogenic structures and large diameter cavity trees are also used (COSEWIC 2007).	Low	There are no suitable anthropogenic structures in the study area to provide nesting habitat. There are no suitable large diameter trees in the study area to provide natural nesting sites.
Common nighthawk	*Chordeiles minor*	THR	SC	THR	S4B	These aerial foragers require areas with large open habitat. This includes farmland, open woodlands, clearcuts, burns, rock outcrops, alvars, bog ferns, prairies, gravel pits and gravel rooftops in cities (Sandilands 2007)	Low	There are no large, open, undisturbed areas in the study area to provide suitable nesting habitat.
Eastern meadowlark	*Sturnella magna*	—	THR	THR	S4B	In Ontario, eastern meadowlark breeds in pastures, hayfields, meadows and old fields. Eastern meadowlark prefers moderately tall grasslands with abundant litter cover, high grass proportion, and a forb component (Hull 2003). They prefer well drained sites or slopes, and sites with different cover layers (Roseberry and Klimstra 1970)	Low	There are no large open grasslands in the study area to provide nesting habitat.
Eastern wood-pewee	*Contopus virens*	—	SC	SC	S4B	In Ontario, the eastern wood-pewee inhabits a wide variety of wooded upland and lowland habitats, including deciduous, coniferous, or mixed forests. It occurs most frequently in forests with some degree of openness. Intermediate-aged forests with a relatively sparse midstory are preferred. In younger forests having a relatively dense midstory, it tends to inhabit the edges. Also occurs in anthropogenic habitats providing an open forested aspect such as parks and suburban neighborhoods. Nest is constructed atop a horizontal branch, 1-2 m above the ground, in a wide variety of deciduous and coniferous trees.	Low - Moderate	The deciduous woodland north of Coronation Blvd may provide suitable habitat. However, eastern wood-pewee tends to avoid areas of dense residential development.

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Golden-winged warbler	*Vermivora chrysoptera*	THR	SC	THR	S4B	In Ontario, golden-winged warbler breeds in regenerating scrub habitat with dense ground cover and a patchwork of shrubs, usually surrounded by forest. Their preferred habitat is characteristic of a successional landscape associated with natural or anthropogenic disturbance such as right-of-ways, and field edges or openings resulting from logging or burning. The nest of the golden-winged warbler is built on the ground at the base of a shrub or leafy plant, often at the shaded edge of the forest or at the edge of a forest opening (Confer et al. 2011).	Low	There is no suitable shrub or successional habitat in the study area. In addition, there are no occurrence records in the area.
Henslow's sparrow	*Ammodramus henslowii*	END	END	END	SHB	In Ontario, Henslow's sparrow breeds in large grasslands with low disturbance, such as lightly grazed and ungrazed pastures, fallow hayfields, grassy swales in open farmland, and wet meadows. Preferred habitat contains tall, dense grass cover, typically over 30 cm high, with a high percentage of ground cover, and a thick mat of dead plant material. Henslow's sparrow generally avoids areas with emergent woody shrubs or trees, and fence lines. Areas of standing water or ephemerally wet patches appear to be important. This species breeds more frequently in patches of habitat greater than 30 ha and preferably greater than 100 ha (COSEWIC 2011).	Low	There are no large open grasslands in the study area to provide nesting habitat. In addition, there are no occurrence records in the area.
Hooded warbler	*Setophaga citrina*	THR	NAR	NAR	S4B	In Ontario, the hooded warbler breeds in large, mature, mixed hardwood forests, usually dominated by maple, beech, and oak with canopy gaps. They are most often found in forests greater than 100 ha, but may breed in smaller woodlands that are part of a region of high overall forest cover (Environment Canada 2012). The nest is built in a dense shrub patch in a forest opening, and is often along the edge of the forest or of the shrub patch (Badzinski 2007).	Low	The deciduous woodland north of Coronation Blvd is too small to provide preferred forest habitat. In addition, there are no occurrence records in the area.
Least bittern	*Ixobrychus exilis*	THR	THR	THR	S4B	In Ontario, the least bittern breeds in marshes, usually greater than 5 ha, with emergent vegetation, relatively stable water levels and areas of open water. Preferred habitat has water less than 1 m deep (usually 10 – 50 cm). Nests are built in tall stands of dense emergent or woody vegetation (Woodliffe 2007). Clarity of water is important as siltation, turbidity, or excessive eutrophication hinders foraging efficiency (COSEWIC 2009).	Low	There is no suitable wetland habitat in the study area. In addition, there are no occurrence records in the area.
Louisiana waterthrush	*Parkesia motacilla* (formerly *Seiurus motacilla*)	SC	SC	THR	S3B	The Louisiana waterthrush inhabits mature forests along steeply sloped ravines adjacent to running water. It prefers clear, cold streams and densely wooded swamps. Trees, bushes, exposed roots, cliffs, banks and mossy logs are favoured nesting spots. Riparian woodlands are preferred stopover sites during migration. Nests are concealed from view at the base of uprooted trees, among mosses, or under logs and in cavities along the stream bank (COSEWIC 2006).	Low	The deciduous woodland north of Coronation Blvd occurs along Groff Mill Creek is not suitable for nesting habitat. In addition, there are no occurrence records in the area.
Prothonotary warbler	*Protonotaria citrea*	END	END	END	S1B	In Ontario, the prothonotary warbler breeds in mature and semi-mature, deciduous swamp forest with a closed canopy, and large expanses of relatively deep, open standing water. Swamps are typically dominated by silver maple, black ash, yellow birch, and black gum. These birds nest in tree cavities, favouring small, shallow holes often situated at low heights in dead or dying trees. Nests are typically situated over standing or slow-moving water. Artificial nest boxes are also readily accepted. This species is area sensitive and is seldom found in forests less than 100 ha in size (COSEWIC 2007).	Low	There is no suitable open-water swamp habitat in the study area. In addition, there are no occurrence records in the area.

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Red-headed woodpecker	*Melanerpes erythrocephalus*	THR	SC	THR	S4B	In Ontario, the red-headed woodpecker breeds in open, deciduous woodlands or woodland edges and are often found in parks, cemeteries, golf courses, orchards and savannahs (Woodliffe 2007). They may also breed in forest clearings or open agricultural areas provided that large trees are available for nesting. They prefer forests with little or no understory vegetation. They are often associated with beech or oak forests, beaver ponds and swamp forests where snags are numerous. Nests are excavated in the trunks of large dead trees (Smith et al. 2000).	Moderate	Large willows along Groff Mill Creek may provide suitable nesting habitat or roosts.
Short-eared owl	*Asio flammeus*	SC	SC	SC	S2N,S4B	In Ontario, the short-eared owl breeds in a variety of open habitats including grasslands, tundra, bogs, marshes, clearcuts, burns, pastures and occasionally agricultural fields. The primary factor in determining breeding habitat is proximity to small mammal prey resources (COSEWIC 2008). Nests are built on the ground at a dry site and usually adjacent to a clump of tall vegetation used for cover and concealment (Gahbauer 2007).	Low	There are no large open grasslands in the study area to provide nesting habitat. In addition, there are no occurrence records in the area.
Eastern whip-poor-will	*Antrostomus vociferus*	THR	THR	THR	S4B	In Ontario, the whip-poor-will breeds in semi-open forests with little ground cover. Breeding habitat is dependent on forest structure rather than species composition, and is found on rock and sand barrens, open conifer plantations and post-disturbance regenerating forest. Territory size ranges from 3 to 11 ha (COSEWIC 2009). No nest is constructed and eggs are laid directly on the leaf litter (Mills 2007).	Low	The deciduous woodland north of Coronation Blvd does not have the correct structure or composition to provide suitable habitat. In addition, there are no occurrence records in the area.
Wood thrush	*Hylocichla mustelina*	—	SC	THR	S4B	In Ontario, wood thrush breeds in moist, deciduous hardwood or mixed stands that are often previously disturbed, with a dense deciduous undergrowth and with tall trees for singing perches. This species selects nesting sites with the following characteristics: lower elevations with trees less than16 m in height, a closed canopy cover (>70%), a high variety of deciduous tree species, moderate subcanopy and shrub density, shade, fairly open forest floor, moist soil, and decaying leaf litter (COSEWIC 2012).	Low	The understory of the deciduous woodland north of Coronation Blvd is too sparse to provide preferred habitat structure.
Yellow-breasted chat	*Icteria virens virens*	SC	END	END	S2B	In Ontario, yellow-breasted chat breeds in early successional, shrub-thicket habitats including woodland edges, regenerating old fields, railway and hydro right-of-ways, young coniferous reforestations, and wet thickets bordering wetlands. Tangles of grape (*Vitis* spp.) and raspberry (*Rubus* spp.) vines are features of most breeding sites. There is some evidence that the yellow-breasted chat is an area sensitive species. Nests are located in dense shrubbery near to the ground (COSEWIC 2011).	Low	There is no suitable shrub or successional habitat in the study area. In addition, there are no occurrence records in the area.
American eel	*Anguilla rostrata*	—	END	THR	S1?	In Ontario, the American eel is native to the Lake Ontario, St. Lawrence River and Ottawa River watersheds. Their current distribution includes lakes Huron, Erie, and Superior and their tributaries. The Ottawa River population is considered extirpated. The preferred habitat of the American eel is cool water of lakes and streams with muddy or silty substrates in water temperatures between 16 and 19°C. The American eel is a catadromous fish that lives in fresh water until sexual maturity then migrates to the Sargasso Sea to spawn (Eakins 2012; Burridge et al. 2010).	Low	Golf Mill Creek is too small and shallow to provide suitable aquatic habitat. In addition, there are no records of this species in the watercourse.

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Lake sturgeon - Great Lakes / upper St.Lawrence Population	*Acipenser fulvescens*	—	THR	THR	S2	In Ontario, the lake sturgeon, a large prehistoric freshwater fish, is found in all the Great Lakes and in all drainages of the Great Lakes and of Hudson Bay. This species typically inhabits highly productive shoal areas of large lakes and rivers. They are bottom dwellers, and prefer depths between 5-10 m and mud or gravel substrates. Small sturgeons are often found on gravelly shoals near the mouths of rivers. They spawn in depths of 0.5 to 4.5 m in areas of swift water or rapids. Where suitable spawning rivers are not available, such as in the lower Great Lakes, they are known to spawn in wave action over rocky ledges or around rocky islands (Golder Associates Ltd. 2011).	Low	Golf Mill Creek is too small and shallow to provide suitable aquatic habitat. In addition, there are no records of this species in the watercourse.
Redside dace	*Clinostomus elongatus*	—	END	END	S2	In Ontario, the redside dace, a small coolwater species common in the USA but less so in Canada, is found in tributaries of western Lake Ontario, Lake Erie, Lake Huron and Lake Simcoe. They are found in pools and slow-moving areas of small headwater streams with clear to turbid water. Overhanging grasses, shrubs, and undercut banks, are an important part of their habitat, as are instream boulders and large woody debris. Preferred substrates are variable and include silt, sand, gravel and boulders. Spawning occurs in shallow riffle areas (Redside Dace Recovery Team 2010).	Low	Golf Mill Creek is too small and shallow to provide suitable aquatic habitat. In addition, the watercourse has not been identified as current or recovery habitat for this species.
Silver shiner	*Notropis photogenis*	—	THR	THR	S2S3	In Ontario, the silver shiner is found in the Thames and Grand Rivers, and it has been recently reported in Bronte Creek and Sixteen Mile Creek which flow into Lake Ontario. They prefer moderately-flowing sections of larger streams with clear water and moderate currents. Usual substrates include gravel, rubble, boulder, and sand. Aquatic vegetation may be present or absent. The silver shiner most frequently occurs in deep, swift riffles and faster currents of pools below riffles. Spawning habitat is suggested to occur in relatively deep riffles (COSEWIC 2011).	Low	Golf Mill Creek is too small and shallow to provide suitable aquatic habitat. In addition, there are no records of this species in the watercourse.
American badger *jacksoni* subspecies (southwestern population)	*Taxidea taxus jacksoni*	END	END	END	S2	In Ontario, American badger's preferred habitats include undisturbed grasslands, shrubby areas and open woodlands, but the species will also use old fields, pastures, edges of agricultural fields and roadsides. The key factor for habitat suitability for this species is presence of prey, comprised mainly of woodchuck and eastern cottontail, and Franklin's ground squirrel in northwestern Ontario (Ontario American Badger Recovery Team 2010).	Low	The study area is too developed to provide suitable habitat. There are no large, open areas and the deciduous woodland north of Coronation Blvd is too small and fragmented.
Eastern cougar	*Puma concolor couguar*	—	END	DD	SU	This species historically inhabited extensive forested areas in Ontario. It is found in habitats suitable for white-tailed deer and mule deer, which are the preferred prey of the cougar. Dense cover is considered the key habitat feature for cougar. An average home range for males is 300 square kilometers, and for females, 150 square kilometers (Environment Canada and Canadian Wildlife Federation 2013).	Low	There are no large tracts of forest in the study area to provide suitable habitat. The general region is too developed and populated to support this species.

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Grey fox	*Urocyon cinereoargenteus*	THR	THR	THR	S1	While the Ontario range of this species extends across much of southern and southeastern Ontario, the only known population in the province is on Pelee Island, with very rare sightings elsewhere in the province at points close to the border with the United States. This species inhabits deciduous forests and marshes, and will den in a variety of features including rock outcroppings, hollow trees, burrows or brush piles, usually where dense brush provides cover and in close proximity to water. This species is considered a habitat generalist (COSEWIC 2002).	Low	This speices is only currently known to occur on Pelee Island.
Eastern small-footed myotis	*Myotis leibii*	—	END	—	S2S3	This species is not known to roost within trees, but there is very little known about its roosting habits. The species generally roosts on the ground under rocks, in rock crevices, talus slopes and rock piles. It occasionally inhabits buildings. Areas near the entrances of caves or abandoned mines may be used for hibernaculum, where the conditions are drafty with low humidity, and may be subfreezing.	Low	There are no suitable talus slopes, rock piles or exposed bedrock in the study area to provide roosting habitat.
Woodland vole	*Microtus pinetorum*	SC	SC	SC	S3?	In Ontario, woodland vole is associated with mature deciduous forests with soft, often sandy soils and a deep litter and humic layer, suitable for burrowing. Common associates include oaks, hickory, black walnut, American beech and tulip tree. This species is often found at woodland edges near roads, railway tracks and field edges. Woodland vole is restricted to the Carolinian forest zone (COSEWIC 2010).	Low	Although deciduous woodland occurs within the study area, the study area may be too far north of the current range of this species. In addition, there are no occurrence records in the area.
Little brown myotis	*Myotis lucifugus*	END	END	END	S4	In Ontario, this species range is extensive and covers much of the province. It will roost in both natural and man-made structures. They require a number of large dead trees, in specific stages of decay and that project above the canopy in relatively open areas. May form nursery colonies in the attics of buildings within 1 km of water. Caves or abandoned mines may be used for hibernaculum, but high humidity and stable above freezing temperatures are required.	Moderate	Suitable cavity trees were observed in the riparian deciduous woodland along Groff Mill Creek adjacent to the proposed pumping station that may provide roosting habitat.
Tri-colored bat	*Perimyotis subflavus*	END	END	END	S3?	In Ontario, tri-colored bat may roost in foliage, in clumps of old leaves, hanging moss or squirrel nests. They are occasionally found in buildings although there are no records of this in Canada. They typically feed over aquatic areas with an affinity to large-bodied water and will likely roost in close proximity to these. Hibernation sites are found deep within caves or mines in areas of relatively warm temperatures. These bats have strong roost fidelity to their winter hibernation sites and may choose the exact same spot in a cave or mine from year to year.	Moderate	Suitable cavity trees were observed in the riparian deciduous woodland along Groff Mill Creek adjacent to the proposed pumping station that may provide roosting habitat.
Northern myotis	*Myotis septentrionalis*	END	END	END	S3	In Ontario, this species range is extensive and covers much of the province. It will usually roost in hollows, crevices, and under loose bark of mature trees. Roosts may be established in the main trunk or a large branch of either living or dead trees. Caves or abandoned mines may be used for hibernaculum, but high humidity and stable above freezing temperatures are required.	Moderate	Suitable cavity trees were observed in the riparian deciduous woodland along Groff Mill Creek adjacent to the proposed pumping station that may provide roosting habitat.
Rainbow mussel	*Villosa iris*	—	THR	SC	S2S3	In Ontario, the rainbow mussel is found in shallow, well- oxygenated waters of small to medium-sized rivers and sometimes lakes. It is most abundant in waters less than 1 m deep. Preferred substrates are cobble, gravel, sand and occasionally mud (COSEWIC 2006).	Low	Golf Mill Creek is too small and shallow to provide suitable aquatic habitat. In addition, there are no records of this species in the watercourse.

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Wavy-rayed lampmussel	*Lampsilis fasciola*	END	THR	SC	S1	In Ontario, wavy-rayed lampmussel inhabits clear, medium-sized rivers and streams, with steady flow and stable substrate. It is typically found in clean sand or gravel substrates, often stabilized with cobble or boulders, in and around riffle areas up to 1 m in depth. It may also be found in large creeks and rivers (Morris 2011).	Low	Golf Mill Creek is too small and shallow to provide suitable aquatic habitat. In addition, there are no records of this species in the watercourse.
Pygmy pocket moss	*Fissidens exilis*	SC	SC	SC	S1	In Ontario, pygmy pocket moss grows in the southwestern region of the province. Pygmy pocket moss typically grows on bare, moist, clay soil. It occurs primarily in woodlands, but also on disturbed soils, such as in floodplains (COSEWIC 2005).	Low	There is no suitable habitat in the study area. In addition, there are no occurrence records in the area.
Blanding's turtle - Great Lakes/St.Lawrence population	*Emydoidea blandingii*	THR	THR	THR	S3	In Ontario, Blanding's turtle will use a range of aquatic habitats, but favor those with shallow, standing or slow-moving water, rich nutrient levels, organic substrates and abundant aquatic vegetation. They will use rivers, but prefer slow-moving currents and are likely only transients in this type of habitat. This species is known to travel great distances over land in the spring in order to reach nesting sites, which can include dry conifer or mixed forests, partially vegetated fields, and roadsides. Suitable nesting substrates include organic soils, sands, gravel and cobble. They hibernate underwater and infrequently under debris close to water bodies (COSEWIC 2005).	Low	Golf Mill Creek does not provide preferred aquatic habitat for this species.
Eastern hog-nosed snake	*Heterodon platirhinos*	THR	THR	THR	S3	Eastern hog-nosed snake can be classified as a habitat generalist as it uses a variety of habitats across its range. In Ontario, this snake typically uses habitat with open vegetation cover, including open woodlands, wetlands, fields, forest edges, beaches and dunes, and disturbed sites, most often near water. In the Georgian Bay area, disturbed fields, rock barrens and forests appear to be preferred habitats. This species relies on sandy well drained soils. Hibernation occurs in sandy soils below the frost line. This species has been observed excavating hibernation sites in mixed intolerant upland forests. Nesting and oviposition has been noted in upland sandy areas and rock outcrops under large flat rocks. The majority of their diet is comprised of American toad and Fowler's toad (Kraus 2011).	Low	The study area is likely too developed to provide preferred habitat. The deciduous woodland north of Coronation Blvd is separated from the Dumfries Conservation Area to the north by a railway that represents a barrier to movement. In addition, there are no occurrence records in the area.
Eastern ribbonsnake - (Great Lakes population)	*Thamnophis sauritius*	SC	SC	SC	S3	In Ontario, eastern ribbonsnake is semi-aquatic, and is rarely found far from shallow ponds, marshes, bogs, streams or swamps bordered by dense vegetation. They prefer sunny locations and bask in low shrub branches. Hibernation occurs in mammal burrows, rock fissures or even ant mounds (COSEWIC 2012).	Low	This species is only historically known from the region. In addition, there is no suitable wetland habitat in the study area.
Milksnake	*Lampropeltis triangulum*	SC	NAR	SC	S3	In Ontario, milksnake uses a wide range of habitats including prairies, pastures, hayfields, wetlands and various forest types, and is well-known in rural areas where it frequents older buildings. Proximity to water and cover enhances habitat suitability. Hibernation takes place in mammal burrows, hollow logs, gravel or soil banks, and old foundations (COSEWIC 2014).	Moderate	The deciduous woodland north of Coronation Blvd. may provide suitable habitat. However, the feature is somewhat isolated from other natural features by development and a railway, which reduces suitability.

Common Name	Scientific Name	Species At Risk Act (Sch 1)[1]	Endangered Species Act[2]	COSEWIC[3]	Provincial (SRank)[4]	Habitat Requirements[5]	Potential to Occur in the Study Area	Rationale for Potential to Occur in the Study Area
Queensnake	*Regina septemvittata*	END	END	END	S2	In Ontario, queensnake requires permanent aquatic habitat with large flat rocks, either submerged or on the bank/shoreline. Individuals rarely leave the shoreline of permanent bodies of water with abundant shoreline cover and a healthy population of crayfish. They are fairly intolerant of silty substrates and most commonly are found in streams with bedrock and gravel substrates. The best sites have water temperatures that remain at or above 18◦C during the active season, have a swift to moderate current and woodland surroundings. Hibernacula may occur in the abutments of old bridges, in clay slopes above the high water mark and in bedrock fissures (Gillingwater 2011).	Low	Groff Mill Creek does not provide suitable habitat. This species is only known to occur along the Grand River in the region.
Northern map turtle	*Graptemys geographica*	SC	SC	SC	S3	In Ontario, the northern map turtle prefers large waterbodies with slow-moving currents, soft substrates, and abundant aquatic vegetation. Ideal stretches of shoreline contain suitable basking sites, such as rocks and logs. Along Lakes Erie and Ontario, this species occurs in marsh habitat and undeveloped shorelines. It is also found in small to large rivers with slow to moderate flow. Hibernation takes place in soft substrates under deep water (COSEWIC 2012).	Low	Golf Mill Creek does not provide suitable aquatic habitat. In addition, there are no occurrence records in the area.
Snapping turtle	*Chelydra serpentina*	SC	SC	SC	S3	In Ontario, snapping turtle utilizes a wide range of waterbodies, but shows preference for areas with shallow, slow-moving water, soft substrates and dense aquatic vegetation. Hibernation takes place in soft substrates under water. Nesting sites consist of sand or gravel banks along waterways or roadways (COSEWIC 2008).	Low	Golf Mill Creek does not provide suitable aquatic habitat. In addition, there are no occurrence records in the area.
American ginseng	*Panax quinquefolius*	END	END	END	S2	In Ontario, American ginseng is found in moist, undisturbed and relatively mature deciduous woods often dominated by sugar maple. It is commonly found on well-drained, south-facing slopes. American ginseng grows under closed canopies in neutral, loamy soils (COSEWIC 2000).	Low	The deciduous woodland north of Coronation Blvd is too small and disturbed to provide preferred forest habitat conditions. In addition, No individuals were observed during field surveys.
Broad beech fern	*Phegopteris hexagonoptera*	—	SC	SC	S3	In Ontario, broad beech fern inhabits rich, undisturbed mature deciduous forest dominated by beech and maple. It typically grows in moist to wet, sandy soils of lower valley slopes and occasionally swamps (van Overbeeke et al. 2013).	Low	The deciduous woodland north of Coronation Blvd is too small and disturbed to provide preferred forest habitat conditions.
Burning bush	*Euonymus atropurpureus*	—	—	—	S3	Burning bush grows in deciduous woods and thickets.	Low	No individuals were observed during field surveys.
Butternut	*Juglans cinerea*	END	END	END	S3?	In Ontario, butternut is found along stream banks, on wooded valley slopes, and in deciduous and mixed forests. It is commonly associated with beech, maple, oak and hickory (Voss and Reznicek 2012). Butternut prefers moist, fertile, well-drained soils, but can also be found in rocky limestone soils. This species is shade intolerant (Farrar 1995).	Low	Although the deciduous woodland and riparian area of Groff Mill Creek may provide suitable habitat, no individuals were observed during field surveys.
Downy yellow false foxglove	*Aureolaria virginica*	—	—	—	S1	Downy yellow false foxglove occurs in dry open woods and savannas.	Low	The deciduous woodland north of Coronation Blvd does not provide preferred habitat conditions.

Common Name	Scientific Name	Species At Risk Act (Sch 1)[1]	Endangered Species Act[2]	COSEWIC[3]	Provincial (SRank)[4]	Habitat Requirements[5]	Potential to Occur in the Study Area	Rationale for Potential to Occur in the Study Area
False hop sedge	*Carex lupuliformis*	END	END	END	S1	In Ontario, false hop sedge occurs in marshes, riverine swamps, borders of vernal pools, and wet depressions of forests. It occasionally occurs in shallow water or very wet floodplain forests. Usually grows under a moderately open canopy but can tolerate high levels of sunshine. Substrates are calcareous or neutral and include moist wet mucks, silt loams, or alluvial deposits with a sandy texture (Environment Canada 2014).	Low	The deciduous woodland north of Coronation Blvd does not provide preferred habitat conditions. In addition, this species is only historically known from the region.
Green dragon	*Arisaema dracontium*	—	SC	SC	S3	In Ontario, green dragon occurs in somewhat-wet to wet deciduous forests along streams. In particular, it grows in maple forest and forest dominated by red ash and white elm trees. Green dragon is restricted to shaded or partially shaded seasonally inundated floodplains (Donley et al. 2013). It is primarily restricted to southwestern Ontario.	Low	Although the deciduous woodland north of Coronation Blvd may provide suitable habitat, there are no occurrence records in the area.
Hairy valerian	*Valeriana edulis*	—	—	—	S1	Hairy valerian grows in wetland habitat including wet meadows, calcareous fens and moist prairies.	Low	There is no suitable wetland habitat on the site.
Harbinger-of-spring	*Erigenia bulbosa*	—	—	—	S3?	Harbinger-of-spring grows in rich woods and moist deciduous woods. Often associated with flood plains, bottomlands and riverbanks. Also found along limestone shingle shorelines.	Low	The deciduous woodland north of Coronation Blvd does not provide suitable habitat. No individuals were observed during field surveys.
Long-stlyed Canadian sanicle	*Sanicula canadensis var. grandis*	—	—	—	S2	Long-stlyed Canadian sanicle grows in rich deciduous woodlands.	Low	The deciduous woodland north of Coronation Blvd does not provide suitable habitat
Moss phlox	*Phlox subulata*	—	—	—	S1?	Moss phlox grows on rocky ledges, slopes and clearings.	Low	There is no suitable rocky habitat in the study area.
Northern hawthorn	*Crataegus dissona*	—	—	—	S3	Northern hawthorn grows in old fields and neglected pastures and along fencelines and roadsides. It is mainly found in the Niagara Peninsula.	Low	The study area is outside the core range of this species, and no individuals were observed during the field surveys.
Pawpaw	*Asimina triloba*	—	—	—	S3	Pawpaw grows in rich moist deciduous woods, often found on floodplains and along stream banks.	Low	No individuals were observed during the field surveys.
Pignut hickory	*Carya glabra*	—	—	—	S3	In Ontario, pignut hickory grows in floodplains, well-drained sandy soils, rolling hills and slopes, dry rocky soils or thin soils on the edge of granite outcrops (FNA 1993).	Low	No individuals were observed during the field surveys.
Puttyroot	*Aplectrum hyemale*	—	—	—	S2	Puttyroot grows in rich, moist deciduous woods.	Low	The deciduous woodland north of Coronation Blvd does not provide suitable habitat
Ram's-head lady's-slipper	*Cypripedium arietinum*	—	—	—	S3	Ram's-head lady's-slipper can be found in moist coniferous swamps, dry sandy woods and limestone barrens.	Low	There is no suitable wetland or dry, sandy or limestone woodlands in the study area to provide habitat.
Scarlet beebalm	*Monarda didyma*	—	—	—	S3	Scarlet beebalm grows in moist woods and swampy thickets. It can also be found along roadsides.	Low	The deciduous woodland north of Coronation Blvd does not provide suitable habitat

Common Name	Scientific Name	Species At Risk Act (Sch 1)[1]	Endangered Species Act[2]	COSEWIC[3]	Provincial (SRank)[4]	Habitat Requirements[5]	Potential to Occur in the Study Area	Rationale for Potential to Occur in the Study Area
Sharp-fruited rush	*Juncus acuminatus*	—	—	—	S3	Sharp-fruited rush grows in old fields, prairies and ditches or along sand or gravel shorelines. It can also be found in gravel pits.	Low	The shoreline of Groff Mill Creek does not provide suitable habitat
Slim-flowered muhly	*Muhlenbergia tenuiflora*	—	—	—	S2	Slim-flowered muhly grows in rich deciduous woods with rocky or sandy soil.	Low	The deciduous woodland north of Coronation Blvd does not provide suitable habitat.
Smith's bulrush	*Schoenoplectus smithii*	—	—	—	S3	Smith's bulrush grows in moist, sandy or muddy shorelines or beaches	Low	There is no suitable sandy or muddy shorelines along Groff Mill Creek to provide habitat.
Soft-hairy false gromwell	*Onosmodium molle ssp. hispidissimum*	—	—	—	S2	Soft-hairy false gromwell grows in grasslands, woodlands, plains and valleys. It prefers dry, open, rocky or gravelly hillsides, fields, thickets, and prairies in calcareous regions.	Low	There is no suitable open, dry and rocky well-drained areas in the study area to provide preferred habitat conditions.
Stiff gentian	*Gentianella quinquefolia*	—	—	—	S2	Stiff gentian grows in wetland habitats, including wet meadows, swamps, fens, shorelines, ditches and along roadsides.	Low	There is no suitable wetland habitat in the study area.
Wild licorice	*Glycyrrhiza lepidota*	—	—	—	S3	Wild licorice grows in fields, prairies, roadsides, creek banks and other disturbed sites.	Low	There is no suitable open prairie or meadow-type habitat within the study area to provide suitable growing conditions.
Woodland flax	*Linum virginianum*	—	—	—	S2	Grows in woodlands, thickets and along stream banks.	Moderate	The riparian woodland along Groff Mill Creek may provide suitable habitat.

[1] *Species at Risk Act* (SARA), 2002. Schedule 1 (Last amended 17 Dec 2014); Part 1 (Extirpated), Part 2 (Endangered), Part 3 (Threatened), Part 4 (Special Concern)

[2] *Endangered Species Act* (ESA), 2007 (O.Reg 242/08 last amended 10 Dec 2015 as O.Reg 387/15). Species at Risk in Ontario List, 2007 (O.Reg 230/08 last amended 15 June 2016 as O. Reg 200/16, s. 1.); Schedule 1 (Extirpated - EXP), Schedule 2 (Endangered - END), Schedule 3 (Threatened - THR), Schedule 4 (Special Concern - SC); NAR = Not at Risk

[3] Committee on the Status of Endangered Wildlife in Canada (COSEWIC) http://www.cosewic.gc.ca/

[4] Provincial Ranks (SRANK) are Rarity Ranks assigned to a species or ecological communities, by the Natural Heritage Information Centre (NHIC). These ranks are not legal designations. SRANKS are evaluated by NHIC on a continual basis and updated lists produced annually. SX (Presumed Extirpated), SH (Possibly Extirpated - Historical), S1 (Critically Imperiled), S2 (Imperiled), S3 (Vulnerable), S4 (Apparently Secure), S5 (Secure), SNA (Not Applicable), S#S# (Range Rank), S? (Not ranked yet), SAB (Breeding Accident), SAN (Non-breeding Accident), SX (Apparently Extirpated). Last assessed August 2011.

[5] General References:

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Appendix D - Archaeological Assessment

ORIGINAL REPORT

15 May 2017

STAGE 1 AND 2 ARCHAEOLOGICAL ASSESSMENT

Cambridge Pressure Zone 1W Municipal Class EA
Various Lots and Concessions
Former Townships of Waterloo and North Dumfries
Now City of Cambridge
Regional Municipality of Waterloo, Ontario

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Report Number: 1653341-1000-R01

Distribution:

1 PDF Copy - GM BluePlan Engineering Ltd.
1 PDF Copy - Ministry of Tourism, Culture, and Sport
E-Copy - Golder Associates Ltd.

Golder Associates

Executive Summary

The Executive Summary highlights key points from the report only; for complete information and findings, as well as the limitations, the reader should examine the complete report.

Golder Associates Ltd. ("Golder") was contracted by GM BluePlan Engineering Limited ("GM BluePlan"), on behalf of the Regional Municipality of Waterloo ("the Region"), to conduct a Stage 1 and 2 Archaeological Assessment in support of the required Municipal Class Environmental Assessment (EA) study for the proposed creation of the new pressure zone, Cambridge Pressure Zone 1 West, in the City of Cambridge. The EA study is being performed to determine the necessary infrastructure requirements and system modifications in order to create the Cambridge Pressure Zone 1 West, and is proposed to include the installation of a new trunk watermain and pump station. The overall Study Area for the EA, which measures approximately 116 hectares in size, is located on Part of Lots 1 and 2, Concession 1 Beasley's Lower Block (BLB), and Lot 4, Beasley's Broken Front (BBF) Concession, in the former Township of Waterloo, and Part of Lots 2 and 3 East of the Grand River (EGR), Concession 12, in the former Township of North Dumfries, Now City of Cambridge, Regional Municipality of Waterloo, Ontario. Irregular in shape, the Study Area extends from just north of Brower Street at its northwestern limit to just west of the intersection between Brooklyne Road and Norfolk Avenue at its southwestern limit, running roughly parallel to Coronation Blvd. and the CN railway line. The recommended trunk watermain alignment is currently proposed to be installed below the paved surface of Coronation Boulevard from Hespeler Road to approximately 270 m northwest of Barrett Avenue, while the recommended pump station site is proposed to be constructed on a parcel measuring approximately 0.1 ha in size, located on part of Lot 3 EGR, Concession 12. The Stage 1 and 2 Archaeological Assessment was conducted to meet the standard requirements of the *Environmental Assessment Act* (Government of Ontario 1990a), and the *Ontario Heritage Act* (Government of Ontario 1990b).

The objectives of the Stage 1 background study, as outlined by the *Standards and Guidelines for Consultant Archaeologists* (Government of Ontario 2011), were to evaluate the Study Area's archaeological potential through an examination of its geography, history, previous archaeological fieldwork and current land conditions, and to recommend appropriate strategies for Stage 2 assessment for all or parts of the corridor, if required.

The Stage 1 background study determined that potentially undisturbed areas within the Study Area had archaeological potential and should be subject to a Stage 2 field assessment prior to any ground disturbing impacts associated with the creation of Cambridge Pressure Zone 1 West. Disturbed areas within the Study Area (i.e., the existing road surfaces, shoulders, drainage ditches, modern residential subdivisions, institutional buildings, commercial/industrial developments, and CN rail line) were determined to no longer retain archaeological potential and, as such, a Stage 2 field assessment was not recommended for these areas.

The only potentially undisturbed portion of the Study Area that will be impacted by the creation of Cambridge Pressure Zone 1 West is the proposed pump station site on part of Lot 3 EGR, Concession 12. As a result, the proposed pump station site was subjected to a Stage 2 field assessment. The objectives of the Stage 2 assessment were to provide an overview of archaeological resources they contained, determine whether any of the resources consisted of artifacts and archaeological sites with cultural heritage value or interest, and to provide specific direction for the protection, management and/or recovery of these resources, consistent with Ministry of Tourism, Culture and Sport's (MTCS) *Standards and Guidelines for Consultant Archaeologists* (MTCS 2011).

The Stage 2 Archaeological Assessment of the proposed pump station site did not result in the identification of any archaeological sites and no further archaeological assessment is recommended for this area. Stage 2 Archaeological Assessments were not performed for any other potentially undisturbed portions of the Study Area.

Given that there are potentially undisturbed areas within the Study Area that still retain archaeological potential, they should be subject to Stage 2 field assessment prior to any proposed ground disturbance. Areas of archaeological potential within the Study Area will not require Stage 2 field assessment if they will not be impacted by any proposed ground disturbance (i.e., construction). As the areas with archaeological potential within the Study Area cannot be ploughed, the Stage 2 assessment, if required, should consist of shovel test pitting at five metre intervals by a licensed archaeologist.

The Ontario Ministry of Tourism, Culture and Sport is asked to review the results and recommendations presented herein, accept this report into the Provincial Register of archaeological reports and issue a standard letter of compliance with the Ministry's 2011 *Standards and Guidelines for Consultant Archaeologists* and the terms and conditions for archaeological licencing.

Project Personnel

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Acknowledgments

Proponent Contact	Mr. Chris Campbell, GM BluePlan Engineering Limited

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1.0 PROJECT CONTEXT

1.1 Development Context

Golder Associates Ltd. ("Golder") was contracted by GM BluePlan Engineering Limited ("GM BluePlan"), on behalf of the Regional Municipality of Waterloo ("the Region"), to conduct a Stage 1 and 2 Archaeological Assessment in support of the required Municipal Class Environmental Assessment (EA) study for the proposed creation of the new pressure zone, Cambridge Pressure Zone 1 West, in the City of Cambridge. The EA study is being performed to determine the necessary infrastructure requirements and system modifications in order to create the Cambridge Pressure Zone 1 West, and is proposed to include the installation of a new trunk watermain and pump station. The overall Study Area for the EA, which measures approximately 116 hectares in size, is located on Part of Lots 1 and 2, Concession 1 Beasley's Lower Block (BLB), and Lot 4, Beasley's Broken Front (BBF) Concession, in the former Township of Waterloo, and Part of Lots 2 and 3 East of the Grand River (EGR), Concession 12, in the former Township of North Dumfries, Now City of Cambridge, Regional Municipality of Waterloo, Ontario. Irregular in shape, the Study Area extends from just north of Brower Street at its northwestern limit to just west of the intersection between Brooklyne Road and Norfolk Avenue at its southwestern limit, running roughly parallel to Coronation Blvd. and the CN railway line. The recommended trunk watermain alignment is currently proposed to be installed below the paved surface of Coronation Boulevard from Hespeler Road to approximately 270 m northwest of Barrett Avenue, while the recommended pump station site is proposed to be constructed on a parcel measuring approximately 0.1 ha in size, located on part of Lot 3 EGR, Concession 12. The Stage 1 and 2 Archaeological Assessment was conducted to meet the standard requirements of the *Environmental Assessment Act* (Government of Ontario 1990a), and the *Ontario Heritage Act* (Government of Ontario 1990b).

A section of the Regional Municipality of Waterloo's *Archaeological Facilities Master Plan* (Regional Municipality of Waterloo 1989) provided by Ms. Kate Hagerman of the Region of Waterloo indicates that various portions of the Study Area exhibit archaeological potential, and as such, will require an archaeological assessment prior to development.

Permission to enter the Study Area to conduct all required archaeological fieldwork activities, including the recovery of artifacts, was granted by Mr. Chris Campbell of GM BluePlan.

1.2 Objectives

The objectives of a Stage 1 assessment, as outlined by the *Standards and Guidelines for Consultant Archaeologists* (Government of Ontario 2011), are as follows:

- To provide information about the Study Area's geography, history, previous archaeological fieldwork and current land conditions;
- To evaluate in detail the Study Area's archaeological potential; and
- To recommend appropriate strategies for Stage 2 assessment for all or parts of the property, if required.

The objectives of a Stage 2 assessment, as outlined by the *Standards and Guidelines for Consultant Archaeologists* (Government of Ontario 2011), are as follows:

- To document all archaeological resources within the proposed pump station site;
- To determine whether the property contains archaeological resources requiring further assessment; and

- To recommend appropriate Stage 3 assessment strategies for archaeological sites identified.

1.3 Historical Context

The Study Area is situated in an area of Ontario that exhibits evidence of an extended period of human settlement dating back at least 11,000 years. To provide context to the following sections of this report, the nature of this settlement is summarized below beginning with the pre-contact Aboriginal period as it relates to the Regional Municipality of Waterloo area in general (Map 2). This is followed by a summary of the historical Euro-Canadian period for the historical Townships of Waterloo and North Dumfries in general and the Study Area in particular.

1.3.1 Pre-contact Period

Table 1 provides a general outline of the pre- and post-contact culture history for Region of Waterloo, drawn from Ellis and Ferris (1990).

Table 1: Cultural Chronology for Region of Waterloo, Ontario

Period	Characteristics	Time	Comments
Early Paleo	Fluted Projectiles	9000 - 8400 B.C.	spruce parkland/caribou hunters
Late Paleo	Hi-Lo Projectiles	8400 - 8000B.C.	smaller but more numerous sites
Early Archaic	Kirk and Bifurcate Base Points	8000 - 6000 B.C.	slow population growth
Middle Archaic	Brewerton-like points	6000 - 2500 B.C.	environment similar to present
Late Archaic	Narrow Points	2000 - 1800 B.C.	increasing site size
	Broad Points	1800 - 1500 B.C.	large chipped lithic tools
	Small Points	1500 - 1100B.C.	introduction of bow hunting
Terminal Archaic	Hind Points	1100 - 950 B.C.	emergence of true cemeteries
Early Woodland	Meadowood Points	950 - 400 B.C.	introduction of pottery
Middle Woodland	Dentate/Pseudo-Scallop Pottery	400 B.C. - A.D.500	increased sedentism
	Princess Point	A.D. 550 – 900	introduction of corn
Ontario Iroquoian Late Woodland	Early Ontario Iroquoian	A.D. 900 – 1300	emergence of agricultural villages
	Middle Ontario Iroquoian	A.D. 1300 – 1400	long longhouses (100m +)
	Late Ontario Iroquoian	A.D. 1400 – 1650	tribal warfare and displacement
Contact Aboriginal	Various Algonquian Groups	A.D. 1700 – 1875	early written records and treaties
Historic	Euro-Canadian	A.D. 1796 – present	European settlement

Paleo Period

The first human occupation of the southern Ontario area, known as the Paleo Period, begins just after the end of the Wisconsin Glacial Period. Although there was a complex series of ice retreats and advances which played a large role in shaping the local topography, southwestern Ontario was finally ice free by 12,500 years ago. The first human settlement can be traced back 11,000 years, when this area was settled by Native groups that had been living south of the Great Lakes.

Our current understanding of Early Paleo settlement patterns suggest that small bands, that consisted of probably no more than 25-35 individuals, followed a pattern of seasonal mobility extending over large territories. One of the most thoroughly studied of these groups followed a seasonal round that extended from as far south as Chatham to the Horseshoe Valley north of Barrie. Early Paleo sites tend to be located in elevated locations on well-drained loamy soils. Many of the known sites were located on former beach ridges associated with Lake Algonquin, the post-glacial lake occupying the Lake Huron/Georgian Bay basin. There are a few extremely large Early Paleo sites, such as one located close to Parkhill, Ontario, which covered as much as six hectares. It appears that these sites were formed when the same general locations were occupied for short periods of time over the course of many years. Given their placement in locations conducive to the interception of migratory mammals such as caribou, it has been suggested that they may represent communal hunting camps. There are also smaller Early Paleo camps scattered throughout the interior of southwestern Ontario, usually situated adjacent to wetlands.

The most recent research suggests that population densities were very low during the Early Paleo Period, with all of southwestern Ontario being occupied by perhaps only 100 to 200 people (Ellis and Deller 1990:54). Because this is the case, Early Paleo sites are exceedingly rare.

While the Late Paleo Period (8400-8000 B.C.) is more recent, it has been less well researched, and is consequently more poorly understood. By this time the environment of southwestern Ontario was coming to be dominated by closed coniferous forests with some minor deciduous elements. It seems that many of the large game species that had been hunted in the early part of the Paleo Period had either moved further north, or as in the case of the mastodons and mammoths, become extinct.

During the late Paleo Period people continued to cover large territories as they moved about in response to seasonal resource fluctuations. On a province wide basis Late Paleo projectile points are far more common than Early Paleo materials, suggesting a relative increase in population.

The end of the Paleo Period was heralded by numerous technological and cultural innovations that appeared throughout the Archaic Period. These innovations may be best explained in relation to the dynamic nature of the post-glacial environment and region-wide population increases.

Archaic Period

During the Early Archaic Period (8000-6000 B.C.), the jack and red pine forests that characterized the Late Paleo environment were replaced by forests dominated by white pine with some associated deciduous trees (Ellis, Kenyon and Spence 1990:68-69). One of the more notable changes in the Early Archaic Period is the appearance of side and corner-notched projectile points. Other significant innovations include the introduction of ground stone tools such as celts and axes, suggesting the beginnings of a simple woodworking industry. The presence of these often large and not easily portable tools suggests there may have been some reduction in the degree of seasonal movement, although it is still suspected that population densities were quite low, and band territories large.

During the Middle Archaic Period (6000-2500 B.C.) the trend to more diverse toolkits continued, as the presence of netsinkers suggest that fishing was becoming an important aspect of the subsistence economy. It was also at this time that "bannerstones" were first manufactured. Bannerstones are carefully crafted ground stone devices that served as a counterbalance for "atlatls" or spear-throwers. Another characteristic of the Middle Archaic is an increased reliance on local, often poor quality chert resources for the manufacturing of projectile points. It seems that during earlier periods, when groups occupied large territories, it was possible for them to visit a primary outcrop of high quality chert at least once during their seasonal round. However, during the Middle Archaic, groups inhabited smaller territories that often did not encompass a source of high quality raw material. In these instances lower quality materials which had been deposited by the glaciers in the local till and river gravels were utilized.

This reduction in territory size was probably the result of gradual region-wide population growth which led to the infilling of the landscape. This process resulted in a reorganization of Native subsistence practices, as more people had to rely on resources from smaller areas. During the latter part of the Middle Archaic, technological innovations such as fish weirs have been documented as well as stone tools especially designed for the preparation of wild plant foods.

It is also during the latter part of the Middle Archaic Period that long distance trade routes began to develop, spanning the northeastern part of the continent. In particular, native copper tools manufactured from a source located northwest of Lake Superior were being widely traded (Ellis, Kenyon and Spence 1990:66). By 3500 B.C. the local environment had stabilized in a near modern form (Ellis, Kenyon and Spence 1990:69).

During the Late Archaic (2500-950 B.C.) the trend towards decreased territory size and a broadening subsistence base continued. Late Archaic sites are far more numerous than either Early or Middle Archaic sites, and it seems that the local population had definitely expanded. It is during the Late Archaic that the first true cemeteries appear. Before this time individuals were interred close to the location where they died. During the Late Archaic, if an individual died while his or her group happened to be at some distance from their group cemetery, the bones would be kept until they could be placed in the cemetery. Consequently, it is not unusual to find disarticulated skeletons, or even skeletons lacking minor elements such as fingers, toes or ribs, in Late Archaic burial pits.

The appearance of cemeteries during the Late Archaic has been interpreted as a response to increased population densities and competition between local groups for access to resources. It is argued that cemeteries would have provided strong symbolic claims over a local territory and its resources. These cemeteries are often located on heights of well-drained sandy/gravel soils adjacent to major watercourses.

This suggestion of increased territoriality is also consistent with the regionalized variation present in Late Archaic projectile point styles. It was during the Late Archaic that distinct local styles of projectile points appear. Also during the Late Archaic the trade networks which had been established during the Middle Archaic continued to flourish. Native copper from northern Ontario and marine shell artifacts from as far away as the Mid-Atlantic coast are frequently encountered as grave goods. Other artifacts such as polished stone pipes and banded slate gorgets also appear on Late Archaic sites. One of the more unusual and interesting of the Late Archaic artifacts is the "birdstone". Birdstones are small, bird-like effigies usually manufactured from green banded slate.

Woodland Period

The Early Woodland Period (950-400 B.C.) is distinguished from the Late Archaic Period primarily by the addition of ceramic technology. While the introduction of pottery provides a useful demarcation point for archaeologists, it may have made less difference in the lives of the Early Woodland peoples. The first pots were very crudely

constructed, thick walled, and friable. It has been suggested that they were used in the processing of nut oils by boiling crushed nut fragments in water and skimming off the oil (Spence, Pihl and Murphy 1990:137).

These vessels were not easily portable, and individual pots must not have sustained a long use life. There have also been numerous Early Woodland sites located at which no pottery was found, suggesting that these poorly constructed, undecorated vessels had yet to assume a central position in the day-to-day lives of Early Woodland peoples.

Other than the introduction of this rather limited ceramic technology, the life-ways of Early Woodland peoples show a great deal of continuity with the preceding Late Archaic Period. For instance, birdstones continue to be manufactured, although the Early Woodland varieties have "pop-eyes" which protrude from the sides of their heads. Likewise, the thin, well-made projectile points which were produced during the terminal part of the Archaic Period continue in use. However, the Early Woodland variants were side-notched rather than corner-notched, giving them a slightly altered and distinctive appearance.

The trade networks which were established in the Middle and Late Archaic also continued to function, although there does not appear to have been as much traffic in marine shell during the Early Woodland Period. During the last 200 years of the Early Woodland Period, projectile points manufactured from high quality raw materials from the American Midwest begin to appear.

In terms of settlement and subsistence patterns, the Middle Woodland (AD 400 B.C.-900) provides a major point of departure from the Archaic and Early Woodland Periods. While Middle Woodland peoples still relied on hunting and gathering to meet their subsistence requirements, fish became an even more important part of the diet. This is especially true in the nearby London area, where some Middle Woodland sites have produced literally thousands of bones from spring spawning species such as walleye and sucker. In addition, Middle Woodland peoples relied much more extensively on ceramic technology. Middle Woodland vessels are often garishly decorated with hastily impressed designs covering the entire exterior surface and upper portion of the vessel interior. Consequently, even very small fragments of Middle Woodland vessels are easily identifiable.

It is also at the beginning of the Middle Woodland Period that rich, densely occupied sites appear on the valley floor of major rivers. These sites were repeatedly used over several hundred years, which often resulted in an accumulation of rich artifact deposits.

Unlike earlier seasonally utilized locations, these Middle Woodland sites appear to have functioned as base camps, occupied off and on over the course of the year. There are also numerous small upland Middle Woodland sites, many of which can be interpreted as special purpose camps from which localized resource patches were exploited. This shift towards a greater degree of sedentism continues the trend witnessed from at least Middle Archaic times, and provides a prelude to the developments that follow during the Late Woodland Period.

The Late Woodland Period began with a shift in settlement and subsistence patterns involving an increasing reliance on corn horticulture (Fox 1990:185; Smith 1990; Williamson 1990:312). Corn may have been introduced into southwestern Ontario from the American Midwest as early as AD 600. However, it did not become a dietary staple until at least three to four hundred years later.

The first agricultural villages in southern Ontario date to the 10th century. Unlike the riverine base camps of the Middle Woodland Period, these sites are located in the uplands, on well-drained sandy soils. Categorized as "Early Ontario Iroquoian" (AD 900-1300), many archaeologists believe that it is possible to trace a direct line from the

Iroquoian groups which inhabited southwestern Ontario at the time of first European contact, to these early villagers.

Village sites dating between AD 900 and 1300, share many attributes with the historically reported Iroquoian sites, including the presence of longhouses and sometimes palisades. However, these early longhouses were actually not all that large, averaging only 12.4 metres in length (Dodd et al 1990:349; Williamson 1990:304-305). It is also quite common to find the outlines of overlapping house structures, suggesting that these villages were occupied long enough to necessitate re-building. The Jesuits reported that the Huron moved their villages once every 10-15 years, when the nearby soils had been depleted by farming and conveniently collected firewood grew scarce (Pearce 2010). It seems likely that Early Ontario Iroquoians occupied their villages for considerably longer, as they relied less heavily on corn than did later groups, and their villages were much smaller, placing less demand on nearby resources.

Judging by the presence of carbonized corn kernels and cob fragments recovered from sub-floor storage pits, agriculture was becoming a vital part of the Early Ontario Iroquoian economy. However, it had not reached the level of importance it would in the Middle and Late Ontario Iroquoian Periods. There is ample evidence to suggest that more traditional resources continued to be exploited, and comprised a large part of the subsistence economy. Seasonally occupied special purpose sites relating to deer procurement, nut collection, and fishing activities, have all been identified. While beans are known to have been cultivated later in the Late Woodland Period, they have yet to be identified on Early Ontario Iroquoian sites.

The Middle Ontario Iroquoian Period (AD 1300-1400) witnessed several interesting developments in terms of settlement patterns and artifact assemblages. Changes in ceramic styles have been carefully documented, allowing the placement of sites in the first or second half of this 100-year period. Moreover, villages, which averaged approximately 0.6 hectares in extent during the Early Ontario Iroquoian Period, now consistently range between one and two hectares.

House lengths also change dramatically, more than doubling to an average of 30 metres, while houses of up to 45 metres have been documented. This radical increase in longhouse length has been variously interpreted. The simplest possibility is that increased house length is the result of a gradual, natural increase in population (Dodd et al 1990:323, 350, 357; Smith 1990). However, this does not account for the sudden shift in longhouse lengths around 1300 A.D. Other possible explanations involve changes in economic and socio-political organization (Dodd et al 1990:357). One suggestion is that during the Middle Ontario Iroquoian Period small villages were amalgamating to form larger communities for mutual defense (Dodd et al 1990:357). If this was the case, the more successful military leaders may have been able to absorb some of the smaller family groups into their households, thereby requiring longer structures. This hypothesis draws support from the fact that some sites had up to seven rows of palisades, indicating at least an occasional need for strong defensive measures. There are, however, other Middle Ontario Iroquoian villages which had no palisades present (Dodd et al 1990). More research is required to evaluate these competing interpretations.

The lay-out of houses within villages also changes dramatically by AD 1300. During the Early Ontario Iroquoian Period villages were haphazardly planned at best, with houses oriented in various directions. During the Middle Ontario Iroquoian Period villages are organized into two or more discrete groups of tightly spaced, parallel aligned, longhouses. It has been suggested that this change in village organization may indicate the initial development of the clans which were a characteristic of the historically known Iroquoian peoples (Dodd et al 1990:358).

Initially at least, the Late Ontario Iroquoian Period (AD 1400-1650) continues many of the trends which have been documented for the proceeding century. For instance, between AD 1400 and 1450 house lengths continued to grow, reaching an average length of 62 metres. One longhouse excavated on a site southwest of Kitchener stretched an incredible 123 metres (Lennox and Fitzgerald 1990:444-445). After AD 1450, house lengths begin to decrease, with houses dating between AD 1500-1580 averaging only 30 metres in length.

Why house lengths decrease after AD 1450 is poorly understood, although it is believed that the even shorter houses witnessed on historic period sites can be at least partially attributed to the population reductions associated with the introduction of European diseases such as smallpox (Lennox and Fitzgerald 1990:405, 410).

Village size also continued to expand throughout the Late Ontario Iroquoian Period, with many of the larger villages showing signs of periodic expansions. The Late Middle Ontario Iroquoian Period and the first century of the Late Ontario Iroquoian Period was a time of village amalgamation. One large village situated just north of Toronto has been shown to have expanded on no fewer than five occasions. These large villages were often heavily defended with numerous rows of wooden palisades, suggesting that defence may have been one of the rationales for smaller groups banding together. The ongoing excavations at the Lawson site, a large Late Iroquoian village located on the grounds of the Museum of Ontario Archaeology, has shown that the original village had expanded by at least twenty percent to accommodate the construction of nine additional longhouses (Anderson 2009).

After AD 1525 communities of pre-contact Aboriginals of the Late Ontario Iroquoian Period who had formerly lived throughout southwestern Ontario as far west as the Chatham area moved further east to the Hamilton area. During the late 17th and 18th century, the French explorers and missionaries reported a large population of Iroquoian peoples clustered around the western end of Lake Ontario. They called these people the "Neutral", because they were not involved in the ongoing wars between the Huron and the League Iroquois located in upper New York State.

It has been satisfactorily demonstrated that the Late Ontario Iroquoian communities which were located in southwestern Ontario as far west as the Chatham area were ancestral to at least some of the Neutral Nation groups (Lennox and Fitzgerald 1990; Smith 1990:283). For this reason the Late Ontario Iroquoian groups which occupied southwestern Ontario prior to the arrival of the French are often identified as "Prehistoric Neutral". They occupied a large area extending along the Grand River and throughout the Niagara Peninsula as far east as Fort Erie and Niagara Falls (Lennox and Fitzgerald 1990:448).

1.3.2 Post-Contact Period

At the time of European contact, the area that would later become Waterloo Township was occupied by the Neutral Iroquoians. After the Six Nations Iroquois from present day New York State defeated, dispersed and amalgamated the Neutral Iroquoians in the late seventeenth century, large portions of southern Ontario including the area of Waterloo Township were occupied by the Algonkian-speaking Mississaugas.

During the American War of Independence, some factions within the New York State Six Nations Iroquois sided with the British. After the British defeat, United Empire Loyalists were granted land in southern Ontario. One proponent of the First Nation allies was the former Swiss mercenary, Sir Frederick Haldimand, Governor of Québec. Haldimand made preparations to grant a large plot of land in southwestern Ontario to those Six Nations who were allies of the Crown (Weaver 1978:525). Haldimand arranged for the purchase of territory in southwestern Ontario from the Mississaugas. This is known as the Haldimand Tract land grant, or the 1793 Crown Grant to the Six Nations, provided for in the Haldimand Proclamation of October 25th, 1784, which:

> *...is a parcel or tract of land given to the Six Nations Indians, by Governor Haldimand October 25th, 1784, and conveyed by Grant the 14th of January, 1793. This Grant was composed of the following Townships: Dunn, Sherbrooke, Moulton, Canborough, North and South Cayuga, Oneida and Seneca in Haldimand County; Tusc[aro]ra, Onondaga, Brantford and South Dumfries in Brant County; North Dumfries, Waterloo and Woolwich in Waterloo County; Pilkington and Nichol in Wellington County; and is described as a parcel or tract of land six miles on each side of the Ouse or Grand River from its mouth toward its source, to be bounded by the tract of land deeded December the 7th, 1792 by the Mississa[u]ga Chiefs and people to the Crown. This part was set aside as a suitable retreat for the Six Nation Indians who had shewn attachment and Fidelity to the British Government during the troublous times 1759 to 1783 and was granted to the Chiefs, Warriors, Women and People of the Six nations and their heirs forever.*
>
> Morris 1943: 19-21

Following this land grant, the upper part of the Haldimand Tract, north of Governor's Road, was surveyed into four blocks. In the late 1790s, Joseph Brant (Thayendanaga) – a Six Nations Iroquois chief and ally to the British during the American War of Independence (1775-1783) – proceeded to sell some of the Haldimand Tract land grant to Euro-Canadian settlers.

Waterloo Township

In 1796, Block Two (later known as Waterloo Township) was sold to Richard Beasley and a group of merchants (Bloomfield 2006:20). Beasley divided the block into Upper, Middle, and Lower Blocks and began selling tracts of land and individual lots. In 1800, George Bechtel purchased a large tract of land (1,275 hectares) from Beasley, located in the Lower Block west of the Grand River, which would later be known as Bechtel's Tract (Bloomfield 2006:404). Following this sale, a group of Pennsylvania Mennonites, who would later form the German Company, purchased a large tract of land (24,281 hectares) mainly located in the Upper and Middle Blocks from Beasley in 1805 (Bloomfield 2006:23). The northern portion of the German Company Tract was subdivided into 128 lots, while the southern portion of the Tract (located in the Lower Block) was divided into 32 smaller lots, known as the German Company Tract Small Lots (Bloomfield 2006:24). The remainder of the Lower Block was subdivided into four different surveyed areas, including Beasley's Old Survey, Beasley's New Survey, Beasley's Broken Front, and Biehn's Tract, which were sold throughout the early 1800s. As a result of these land purchases and sales, Waterloo Township had the most complex survey system and associated pattern of land ownership of the more than 500 townships present in southern Ontario during the 19th century.

The initial settlement of Waterloo Township between 1800 and 1820 proceeded slowly and typically consisted of Pennsylvania Mennonite farmers settling along the banks of the Grand River (Waterloo Region Museum 2013). By 1820, only one hundred families had settled in the area. Following this period, encouraged by the development of road and trail systems throughout the township, the population began to steadily rise, reaching 2,002 by 1831 (Waterloo Region Museum 2013). At this time, nearly all of Block Two had been sold, and the origins of settler groups began to diversify to include individuals of English, Irish, Scottish, and German descent.

Over the next few decades, the lots in the township were subdivided and resold, and by the second half of the 19th century, the majority of new settlers in the area were not land owners or farmers, but rather worked primarily as artisans, labourers, shopkeepers and millers (Waterloo Region Museum 2013). By 1851, the population in the

township had reached 8,878. Industrial businesses present in the township included mills, tanneries, and factories that manufactured agricultural equipment.

In 1856, the Grand Trunk Railway reached Waterloo Township; this event encouraged further settlement and development, allowing the township to thrive (Waterloo Region Museum 2013). During the late 19th century, a general shift away from agricultural production caused the pace of growth and development in Waterloo Township to plateau, with populations declining to 6,661 by 1881.

North Dumfries Township

Block One (now forming South and North Dumfries Townships) was sold to Philip Steadman in 1798, who obtained a patent from the Crown for all 94,305 acres. After Steadman's death in 1799, the ownership of Block One changed hands a number of times until it was eventually purchased in 1816 by the Hon. William Dickson of Niagara, who named the township Dumfries after his hometown in Scotland (Mulvany 1883). After purchasing Block One, Dickson travelled with Absalom Shade, a carpenter whom he had met in Niagara, to appraise the land in order to determine a site for settlement. Led by a First Nations guide, Dickson and Shade journeyed along the Grand River until they came upon the abandoned ruins of a mill located in present day Galt; they decided that this area was best suited for settlement. By 1819, Shade had rebuilt and expanded the abandoned mill, which assisted in attracting a number of settlers to the area in the following years.

The initial settlement of Dumfries Township proceeded slowly at first. By 1817, only 38 families had settled in the vicinity of the village of St. George (Mulvany 1883). In that year, 245 acres of land was cleared and the businesses of the township included one saw mill and one store, a distillery erected in St. George. In order to attract further settlers to the area, Mr. Dickson employed an agent to visit Scotland on his behalf in order to recruit what he believed to be the most desirable class of settlers. The agent's trip was a success, and from 1823 to 1830, the banks of the Grand River were slowly populated by Scotch Presbyterians. By 1841, there were 6,129 people living in the combined north and south portions of Dumfries Township, with several enterprises and social institutions operating in the area, including grist, flour and saw mills, distilleries, stores, taverns, farmsteads, schools, churches, township halls, libraries, and clubs (Smith 1846; Waterloo Region Museum 2013).

Throughout the 1840s and 1850s, a series of roads and highways were constructed to connect outlying settlements to the central villages of Ayr and Galt, allowing the township to establish a thriving economy and culture (Waterloo Region Museum 2013). By 1852, the northern half of Dumfries Township had become part of Waterloo County.

The arrival of the Great Western Railway in 1854 appears to have brought further growth to the area, with the population of North Dumfries Township reaching 4,161 in 1861 (Irwin and Burnham 1867). Similar to the pattern observed in Waterloo Township, during the late 19th century, a general shift away from agricultural production caused the pace of growth and development in North Dumfries Township to plateau, with populations declining to 3,283 by 1881.

Regional Municipality of Waterloo

In 1973, the County of Waterloo was reorganized into the Regional Municipality of Waterloo, comprised of the Cities of Kitchener, Waterloo, and Cambridge, and the Townships of Wellesley, Woolwich, Wilmot, and North Dumfries. The present Study Area falls within the limits of the City of Cambridge.

1.3.3 Study Area Specific Historical Context

Prior to the incorporation of the City of Cambridge in 1973, the Study Area fell within Part of Lots 1 and 2, Concession 1 Beasley's Lower Block (BLB), and Lot 1 (later renumbered as Lot 4), Beasley's Broken Front (BBF) Concession, in the former Township of Waterloo, and Part of Lots 2 and 3 East of the Grand River (EGR), Concession 12 in the former Township of North Dumfries. Bloomfield's *Waterloo Township through Two Centuries* (2006:404-406) provides a listing of the founding families of Waterloo Township up to 1830, organized by lot and concession. Inspection of this list indicates that all three of the lots corresponding to the portion of the Study Area lying in Waterloo Township were owned by 1830 (Table 2); however, it remains unclear whether any of these lots were actually occupied at the time.

Table 2: Pre-1830 Property Owners, Waterloo Township Lots (Bloomfield 2006:406-408)

Property	Owner
Lot 1, Concession 1, BLB	George Clemens
	Isaac Master
Lot 2, Concession 1, BLB	George Clemens
South half, Lot 1, BBF Concession	Henry Brower

According to Tremaine's *Map of the County of Waterloo* (Tremaine 1861), it appears that all of lots lying within the Study Area limits had all been purchased and subdivided (Map 3). The owners for the portions of these lots corresponding to the limits of the Study Area and any structures belonging to these individuals have been summarized in Table 3 below.

Table 3: 1861 Property Owners, Waterloo and North Dumfries Townships (Tremaine 1861)

Property	Owner	Structures
Southeast quarter, Lot 1, BBF Concession	H. Brower	No structures depicted
West half, Lot 1, Concession BBL	Jacob Bergey	House depicted to the northeast of the Great Western Railway line, within study area limits
West half, Lot 2, Concession BBL	T. C. Kerr	No structures depicted
Northwest half, Lot 3 EGR, Concession 12	George Clemens Jr.	House depicted to the northeast of the Great Western Railway line, outside study area limits
Southeast half, Lot 3 EGR, Concession 12, and Lot 2 EGR, Concession 12	Andrew Oliver	No structures depicted

Aside from T. C. Kerr, all of the individuals listed in Tables 2 and 3 above were identified in Ezra Eby's *A Biographical History of Waterloo Township* written in 1895 and, as such, likely represent significant figures in the early history of Waterloo Township.

Unfortunately, as a result of poor atlas subscribership, the Waterloo and North Dumfries Township maps contained in the *Illustrated Historical Atlas of Waterloo County* (Parsell & Co. 1881) do not depict any owners for, or structures located on, any of the lots located within the limits of the Study Area (Maps 4 and 5); thus, it is not possible at the

present time to determine if any of the property owners listed in Tables 2 or 3 above were still residing within the Study Area during the late 19th century.

1.3.4 Heritage Properties

Inspection of the *City of Cambridge Heritage Properties Register* (2015) indicates that six municipally listed properties with cultural heritage value or interest occur within the limits of the Study Area (Table 4).

Table 4: Heritage Properties in the Study Area

Former Township	Lot and Concession	Civic Address	Status	Comments
Waterloo	Lot 1, Concession 1, BLB	435 Blue Heron Ridge	Listed	Stucco cottage; built 1917
Waterloo	Lot 1, Concession 1, BLB	160 Blue Heron Ridge	Listed	Stone residence; built 1924
Waterloo	Lot 1 (now Lot 4), BBF Concession	140 Blue Heron Ridge	Listed	Ontario Gothic stucco residence, Landmark Series; unknown date of construction
Waterloo	Lot 1 (now Lot 4), BBF Concession	110 Blue Heron Ridge	Listed	Stucco residence; built 1931
North Dumfries	Lot 3, Concession 12, EGR	2156-2162 Coronation Blvd.	Listed	Clemens farmhouse, stone; built by George Clemens Jr. in 1873
Waterloo	Lot 2, Concession 1, BLB	535 Dunbar Rd.	Listed	Red brick residence; built 1910

1.4 Archaeological Context

1.4.1 Study Area Overview and Physical Setting

The Study Area that is the subject of the present assessment is located within a mixed residential, commercial, and industrial area in the west-central portion of the City of Cambridge, to the northeast of the Grand River and southwest of the former Town of Preston. Irregular in shape, the Study Area extends from just north of Brower Street at its northwestern limit to just southeast of the intersection between Brooklyne Road and Norfolk Avenue at its southwestern limit, running roughly parallel to the west side of Coronation Boulevard and the east side of the CN railway line. It is bounded by residential subdivisions to the northwest, northeast, and southeast, a golf course and the Grand River to the southwest, and the Dumfries Conservation Area to the northeast. The Study Area itself, which measures approximately 116 hectares in size, is comprised of a combination of residential, commercial, and industrial buildings, transportation routes, including Coronation Boulevard, Hespeler Road, secondary residential roads, and the CN railway, manicured lawns, wooded/brush areas, and watercourses; each of these areas is described in more detail in Section 2.0, below. The proposed pump station site is comprised of a sparsely wooded, grassy area located to southwest of the CN railway line.

The Study Area is situated within the southern end of the Guelph Drumlin Field physiographic region (Chapman and Putnam 1984:137):

> *The drumlins of this field are not so closely grouped as those of some other areas and there is more intervening low ground, which is largely occupied by fluvial materials. The till in these drumlins is loamy and calcareous, and was derived mostly from dolostone of the Amabel Formation so strategically exposed along the Niagara Cuesta…The till throughout is rather stony, with large surface boulders being more numerous in some localities than others…The ice which moulded this drumlin field advanced from the southeast and the front of the melting receding glacier was at right angles to this, that is, down slope of the plain. The drainage of the ice front was consequently able to find progressively lower and lower outlets, so that the drumlin field is furrowed by more or less parallel valleys running almost at right angles to the trend of the drumlins themselves. There are also numerous interconnecting cross valleys which occupy deeper depressions between drumlins. Along the sides of these valleys there are broad sand and gravel terraces, while the bottoms are often swampy…Incidental to this pattern are the several gravel ridges or eskers which cross the plain in the same general direction as the drumlins.*
>
> Chapman and Putnam 1984:137-138

The localized topography of the Study Area is gently sloping from the northeast towards the banks of the Grand River to the southwest, with elevations ranging from 275 to 300 metres above sea level. Although the *Waterloo County Ontario Soil Survey* map (Presant and Wicklund 1971) depicts the vast majority of the Study Area as unmapped urban land, it appears that the soils occurring along the western edge of the Study Area, beyond the urban areas, are comprised of the well-drained loam and loamy sand of the Grand-Kirkland soil series. It is likely that the native soils existing within the remainder of the Study Area are comprised of the well-drained gravelly loam and loamy sand of the Burford-Fox soil series, which is the dominant soil series throughout the surrounding area. Bedrock deposits in the vicinity date from the Middle to Lower Silurian Periods and consist of the buff-coloured, fine-grained dolomite of the Guelph Formation (Hewitt 1972).

The Study Area lies within the Mixed-wood Plains ecozone of Ontario (The Canadian Atlas Online 2016). Although largely altered by recent human activity, this ecozone once supported a wide variety of deciduous trees, such as various species of ash, birch, chestnut, hickory, oak, and walnut, as well as a variety of birds and small to large land mammals, such as raccoon, red fox, white tailed deer, and black bear. The 1880 *Ontario Agriculture Commission Report* confirms that the timber present in Waterloo County during the 19th century included pine, oak, beech, maple, cedar, ash, elm, and hemlock.

The Study Area lies within the Grand River watershed, which covers an area of approximately 6,800 square kilometres in south-central Ontario (LESPR 2008). The length of the Grand River itself is 300 kilometres, with an average watershed width of 36 kilometres. The closest potable water source is an unnamed tributary of the Grand River, which flows in a roughly southern direction through the centre of the Study Area, entering the Grand River approximately 120 metres southwest.

1.4.2 Previous Archaeological Research

A search of the Ontario Archaeological Sites Database indicated that there are 19 pre-contact Aboriginal, two historical Euro-Canadian, and six unknown registered archaeological sites located within a one kilometre radius of the Study Area (MTCS 2016) (Table 5); nine of these sites are located within 300 metres of the Study Area.

Table 5: Sites Recorded within One Kilometre Radius of Study Area

Borden	Site Name	Site Type	Time Period	Site within 300 m?
AiHb-9	Golf Course	Other: camp/campsite; Other: camp/campsite	Archaic; Woodland, Late	Yes
AiHb-36	Riverwalk 1	N/A	N/A	
AiHb-37	Riverwalk 2	N/A	N/A	
AiHb-38	Norrich West	N/A	N/A	
AiHb-42	Riverwalk 3	N/A	N/A	
AiHb-43	Riverwalk 4	N/A	N/A	Yes
AiHc-5	Upstream	Unknown	Woodland	
AiHc-70	Grandview Hills	homestead	Post-Contact	
AiHc-160	Cruickston 19	Other: tool manufacturing	Pre-Contact	
AiHc-161	Cruickston 20	Other: tool manufacturing	Pre-Contact	Yes
AiHc-165	Bernhardt Brewery	Other: building; brewery	Post-Contact	Yes
AiHc-304	Easter	Unknown	Woodland, Middle	
AiHc-305	Priest	Unknown	Pre-Contact	Yes
AiHc-306	Rain Point	findspot	Pre-Contact	
AiHc-307	Bipolar	Unknown	Pre-Contact	
AiHc-308	Reid	findspot	Pre-Contact	
AiHc-309	Cedar Copse	Unknown	Pre-Contact	
AiHc-310	Tin Can Alley	Unknown	Pre-Contact	
AiHc-311	Flat Rock II	Unknown	Pre-Contact	
AiHc-312	Mothers Day	findspot	Pre-Contact	Yes
AiHc-313	Peel	findspot	Pre-Contact	Yes
AiHc-319	Reflector	findspot	Pre-Contact	
AiHc-326	Random	Unknown	Pre-Contact	Yes
AiHc-327	Siege	findspot	Pre-Contact	
AiHc-328	Unlucky	findspot	Pre-Contact	
AiHc-338	Commando	findspot	Pre-Contact	
AiHc-445	N/A	N/A	N/A	Yes

Based on a search of Golder's corporate library and the Ontario Public Register of Archaeological Reports (MTCS 2016), it appears that no previous archaeological assessments have occurred within the limits of the present Study Area, or within a 50 metre radius.

Information concerning specific site locations is protected by provincial policy, and is not fully subject to the Freedom of Information Act. The release of such information in the past has led to looting or various forms of

illegally conducted site destruction. Confidentiality extends to all media capable of conveying location, including maps, drawings, or textual descriptions of a site location. For this reason maps and data that provide information on archaeological site locations are provided as supplementary documentation and do not form part of this public report.

The Ministry of Tourism, Culture and Sport (MTCS) will provide information concerning site location to the party or an agent of the party holding title to a property, or to a licensed archaeologist with relevant cultural resource management interests.

1.4.3 Assessing Archaeological Potential

Archaeological potential is established by determining the likelihood that archaeological resources may be present within a property. In accordance with the MTCS's 2011 *Standards and Guidelines for Consultant Archaeologists* the following are features or characteristics that indicate archaeological potential:

- Previously identified archaeological sites;
- Water sources:
  - Primary water sources (lakes, rivers, streams, creeks);
  - Secondary water sources (intermittent streams and creeks; springs; marshes; swamps);
  - Features indicating past water sources (e.g., glacial lake shorelines indicated by the presence of raised gravel, sand, or beach ridges; relic river or stream channels indicated by clear dip or swale in the topography; shorelines of drained lakes or marshes; and cobble beaches);
  - Accessible or inaccessible shoreline (e.g., high bluffs, swamps or marsh fields by the edge of a lake; sandbars stretching into marsh);
- Elevated topography (eskers, drumlins, large knolls, plateaux);
- Pockets of well drained sandy soil, especially near areas of heavy soil or rocky ground; distinctive land formations that might have been special or spiritual places, such as waterfalls, rock outcrops, caverns, mounds, and promontories and their bases (there may be physical indicators of their use, such as burials, structures, offerings, rock paintings or carvings);
- Resource areas including:
  - Food or medicinal plants;
  - Scarce raw minerals (e.g., quartz, copper, ochre or outcrops of chert);
  - Early Euro-Canadian industry (fur trade, mining, logging);
- Areas of Euro-Canadian settlement; and
- Early historical transportation routes.

In recommending a Stage 2 property survey based on determining archaeological potential for a study area, the MTCS stipulates the following:

- No areas within 300 metres of a previously identified site; water sources; areas of early Euro-Canadian Settlement; or locations identified through local knowledge or informants can be recommended for exemption from further assessment;
- No areas within 100 metres of early transportation routes can be recommended for exemption from further assessment; and
- No areas within the property containing an elevated topography; pockets of well-drained sandy soil; distinctive land formations; or resource areas can be recommended for exemption from further assessment.

Based on the criteria outlined above, portions of the Study Area for the proposed new Cambridge Pressure Zone 1 West were determined to have archaeological potential. This determination is based on: the identification of nine previously registered archaeological sites within 300 metres of the Study Area; the location of the unnamed tributary of the Grand River that flows through the Study Area and the Grand River itself, which abuts the Study Area; the presence of well-drained soils at the western edge of the Study Area, and in the surrounding area; and, the fact that the Study Area overlies three historical transportation routes (Coronation Boulevard, Hespeler Road, CN Railway line) in Waterloo and North Dumfries Townships with a history of Euro-Canadian occupation beginning in the early 19th century. In addition, historical research has suggested that the five historical lots on which the Study Area is located were continuously occupied from at least the early to late 19th century. This is consistent with the information contained in a section of the Regional Municipality of Waterloo's *Archaeological Facilities Master Plan* (Regional Municipality of Waterloo 1989) provided by Ms. Kate Hagerman of the Region of Waterloo, which indicated that several portions of the Study Area exhibit archaeological potential.

As stated in Section 1.3.2 of the *Standards and Guidelines for Consultant Archaeologists* (Government of Ontario 2011:18), archaeological potential can be determined to be removed either entirely or in part when background research and property inspection confirm extensive and deep land alterations that have severely damaged the integrity of any archaeological resources that may be present. Types of disturbance that remove archaeological potential may include: quarrying; major landscaping involving grading below topsoil; building footprints; and sewage and infrastructure development. Within the present Study Area, disturbance associated with the construction of the provincial and secondary residential roads, including their paved surfaces, shoulder areas, and drainage ditches, in addition to modern residential subdivisions and institutional buildings, commercial/industrial developments, and the CN railway line are considered to have been sufficiently deep and extensive to have removed any archaeological potential associated with these portions of the Study Area. This disturbance was confirmed during an inspection of the Study Corridor, as described in Section 2.1 below.

2.0 METHODOLOGY

2.1 Stage 1 Property Inspection

A Stage 1 property survey of the Study Corridor was conducted by Golder under archaeological consulting license P457, issued to Lafe Meicenheimer of Golder by the Ministry of Tourism, Culture and Sport (P457-0029-2016). The objective of the survey was to confirm and document the presence or absence of archaeological potential, and to determine what survey strategies would be appropriate for a Stage 2 assessment, should it be required.

The entire Study Area was inspected on August 24, 2016, while a more detailed inspection of the recommended trunk watermain alignment and pump station site was performed on April 26, 2017.

The weather during the inspection was variable; the conditions are presented in Table 6. At no time were conditions detrimental to the observation and recognition of features of archaeological potential. Field notes and photographs of the Study Area were taken during the inspection. The photograph locations and directions have been illustrated on Map 6.

Table 6: Summary of Weather Conditions

Date	Weather
August 24, 2016	Hot (27°C), clear
April 26, 2017	Warm (13-16°C), partly cloudy

The northwesterly rectangular half of the Study Area lying to the north of Isherwood Avenue consisted primarily of individual residential properties with manicured lawns to the southwest of the CN railway line and to the north of Dunbar Road (Image 1 to Image 3), with wooded/brush areas (Image 4) and an unnamed tributary of the Grand River (Image 5) associated with the Dumfries Conservation Area to the northeast of the CN railway line.

The southeasterly irregularly shaped half of the Study Area lying to the south of Isherwood Avenue is comprised of a combination of individual residential properties with manicured lawns (Image 6 and Image 7), several industrial/institutional/commercial use properties (Image 8 to Image 12), a modern residential subdivision immediately south of Isherwood Avenue and west of Hespeler Road (Image 13), St. Patrick's cemetery to the northeast of the intersection between Avenue Road and Hespeler Road (Image 14), a wooded/brush area to the northeast of the CN railway line (Image 15), a portion of the Galt Country Club golf course to the southwest of Coronation Boulevard (Image 16), and a steeply sloped area along the banks of the Grand River at the southwestern edge of the Study Area (Image 17).

Additionally, several transportation routes traverse the entire Study Area, including the CN railway line and Coronation Boulevard (Highway 8) (Image 18 to Image 23), which run roughly parallel to one another in a northwest-southeast direction through the centre of the Study Area, Hespeler Road (Highway 24) (Image 24), which runs in a north-south direction through the eastern portion of the Study Area, and numerous secondary residential roads.

The property survey confirmed that the steeply sloped areas and the previously disturbed paved surfaces, shoulders, and drainage ditches of the provincial and secondary residential roads, including the section of Coronation Boulevard where the proposed trunk watermain is recommended to be placed, as well as the modern residential subdivisions and institutional buildings, the commercial/industrial developments, and the CN railway line all exhibit no or low archaeological potential. Although it is likely that the construction and/or installation of individual residential buildings and utilities would have also resulted in extensive land disturbance, the full extent of this disturbance is not known at the present time and, as such, it is possible that these portions of the Study Area may retain areas of archaeological potential.

The remainder of the Study Area was confirmed to exhibit archaeological potential. The proposed activities associated with the creation of the Cambridge Pressure Zone 1 West are not planned to impact any areas with

archaeological potential within the Study Area with the exception of the proposed pump station site (Map 7). The proposed pump station site did not appear to have been impacted by previous disturbance and, as a result, was subjected to Stage 2 Archaeological Assessment.

2.2 Stage 2 Archaeological Assessment

The Stage 2 Archaeological Assessment of the proposed pump station was conducted by Golder on April 26, 2017, under archaeological consulting license P457, issued to Lafe Meicenheimer of Golder by the Ministry of Tourism, Culture and Sport (P457-0046-2017). The weather during the assessment was partly cloudy with temperatures between 13 and 16 degrees Celsius. Visibility was excellent. At no time were conditions detrimental to the recovery of archaeological material.

As described in Section 1.4.1 above, the 0.1 ha proposed pump station site consisted entirely of a sparsely wooded, grassy area; therefore, this area was assessed by the standard shovel test pit method at a five metre interval, as per Standard 1, Section 2.1.2 of the *Standards and Guidelines for Consultant Archaeologists* (Government of Ontario 2011). Each test pit was at least 30 centimetres in diameter and was dug a minimum of five centimetres into subsoil with all soil screened through six millimetre hardware cloth to facilitate the recovery of any cultural material present. Each test pit was examined for stratigraphy, cultural features and fill. The soil stratigraphy consisted of dark silty loam topsoil overlying yellow brown silty loam subsoil. Test pits were excavated to within one metre of built structures or until test pits showed evidence of recent ground disturbance or poor drainage. Each test pit was back filled upon completion. Had artifacts been encountered, a one-by-one metre test unit would have been excavated over the initial positive test pit along with eight additional test pits dug at a maximum of 2.5 metre intervals within a radius of five metres around the positive pit. Map 7 illustrates the methods and results of the Stage 2 archaeological field assessment. Had any cultural materials been identified, then GPS co-ordinates would have been taken from a Garmin eTrex 10 handheld GPS unit using the North American Datum (NAD) 83, with a minimal accuracy of three metres.

3.0 RECORD OF FINDS

The Stage 1 property survey and Stage 2 Archaeological Assessment were conducted employing the methods described in Section 2.0. Maps 6 and 7 illustrate the areas assessed and the technique employed, while Images 1 to 30 illustrate the Stage 1 and 2 survey conditions. No archaeological material or sites were identified during the Stage 2 Archaeological Assessment of the proposed pump station site. Table 4 provides an inventory of the documentary record generated in the field.

Table 7: Inventory of Documentary Record.

Document Type	Current Location of Document	Additional Comments
Field Notes	Golder Office in London	Total of 2 pages from original field book. Hard copies stored in project folder and digitally in project file.
Hand Drawn Maps	Golder Office in London	Three in total from original field book. Hard copies stored in project folder and digitally in project file.
Maps provided by Client	Golder Office in London	3 maps in total stored in project folder and stored digitally in project file.

Document Type	Current Location of Document	Additional Comments
Digital Photographs	Golder Office in London	A total of 69 photos stored in project folder and stored digitally in project file.

4.0 ANALYSIS AND CONCLUSIONS

The Stage 1 Archaeological Assessment determined that there was potential for both pre-contact Aboriginal and historical Euro-Canadian archaeological sites within the undisturbed portions of the Study Area due to: the identification of nine previously registered archaeological sites within 300 metres of the Study Area; the location of an unnamed tributary of the Grand River that flows through the Study Area and the Grand River itself, which abuts the Study Area; the presence of well-drained soils at the western edge of the Study Area, and in the surrounding area; and, the fact that the Study Area overlies three historical transportation routes (Coronation Boulevard, Hespeler Road, CN Railway line) in Waterloo and North Dumfries Townships with a history of Euro-Canadian occupation beginning in the early 19th century. As a result of these findings, it was determined that a Stage 2 field assessment should be conducted for the undisturbed portions of the Study Area. Steeply sloped areas and previously disturbed areas within the Study Area (i.e., the existing road surfaces, shoulders, drainage ditches, modern residential subdivisions, institutional buildings, commercial/industrial developments, and CN rail line) were determined to no longer retain archaeological potential.

The only potentially undisturbed portion of the Study Area that will be impacted by the project is the proposed pump station site. As a result, the proposed pump station site was subjected to a Stage 2 field assessment. No archaeological material or sites were identified during the Stage 2 archaeological assessment of the proposed pump station site; as such no analysis of artifacts or sites was conducted.

5.0 RECOMMENDATIONS

A Stage 1 archaeological assessment determined that there was potential for the presence of archaeological resources within the undisturbed portions of the Study Area. The only potentially undisturbed portion of the Study Area that will be impacted by the project is the proposed pump station site on part of Lot 3 EGR, Concession 12. As a result, the proposed pump station site was subjected to a Stage 2 field assessment.

The Stage 2 Archaeological Assessment of the proposed pump station site did not result in the identification of any archaeological sites and no further archaeological assessment is recommended for this area. Stage 2 Archaeological Assessments were not performed for any other potentially undisturbed portions of the Study Area.

Given that there are undisturbed areas within the Study Area that still retain archaeological potential, they should be subject to Stage 2 field assessment prior to any proposed ground disturbance. Areas of archaeological potential within the Study Area will not require Stage 2 field assessment if they will not be impacted by any proposed ground disturbance (i.e., construction). As the areas with archaeological potential within the Study Area cannot be ploughed, the Stage 2 assessment, if required, should consist of shovel test pitting at five metre intervals by a licensed archaeologist.

The Ontario Ministry of Tourism, Culture and Sport is asked to review the results and recommendations presented herein, accept this report into the Provincial Register of archaeological reports and issue a standard letter of compliance with the Ministry's 2011 *Standards and Guidelines for Consultant Archaeologists* and the terms and conditions for archaeological licencing.

6.0 ADVICE ON COMPLIANCE WITH LEGISLATION

This report is submitted to the Minister of Tourism, Culture, and Sport as a condition of licensing in accordance with Part VI of the *Ontario Heritage Act*, R.S.O. 1990, c 0.18 (Government of Ontario 1990b). The report is reviewed to ensure that it complies with the standards and guidelines that are issued by the Minister, and that the archaeological fieldwork and report recommendations ensure the conservation, protection and preservation of the cultural heritage of Ontario. When all matters relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the MTCS, a letter will be issued by the ministry stating that there are no further concerns with regards to alterations to archaeological sites by the proposed development.

It is an offence under Section 48 and 69 of the *Ontario Heritage Act* for any party other than a licensed archaeologist to make any alterations to a known archaeological site or to remove any artifact or other physical evidence of past human use or activity from the site, until such time as a licensed archaeologist has completed archaeological fieldwork on the site, submitted a report to the Minister stating that the site has no further cultural heritage value or interest, and the report has been filed in the Ontario Public Register of Archaeological reports referred to in Section 65.1 of the *Ontario Heritage Act* (Government of Ontario 1990b).

Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48(1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with Section 48(1) of the *Ontario Heritage Act* (Government of Ontario 1990).

The Funeral, Burial and Cremation Services Act, 2002, S.O. 2002, c.33, requires that any person discovering or having knowledge of a burial site shall immediately notify the police or coroner. It is recommended that the Registrar of Cemeteries at the Ministry of Consumer Services is also immediately notified.

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8.0 IMAGES

8.1 Stage 1 Property Inspection



Image 1: Stage 1 property inspection, representative example of residential neighbourhood with single detached homes, manicured lawns, and utilities, facing southwest.



Image 2: Stage 1 property inspection, representative example of residential neighbourhood with single detached homes, manicured lawns, and utilities, facing south.



Image 3: Stage 1 property inspection, representative example of residential neighbourhood with single detached homes, manicured lawns, a church, and utilities, facing northeast.



Image 4: Stage 1 property inspection, overview of Dumfries Conservation Area, illustrating brush and wooded areas, facing south.



Image 5: Stage 1 property inspection, representative example of unnamed tributary of Grand River surrounded by brush/wooded area, facing north.



Image 6: Stage 1 property inspection, representative example of residential neighbourhood with single detached homes, manicured lawns, and utilities, facing southwest.



Image 7: Stage 1 property inspection, representative example of residential neighbourhood with single detached homes, manicured lawns, and utilities, facing northwest.



Image 8: Stage 1 property inspection, representative example of industrial-use property, facing east.



Image 9: Stage 1 property inspection, representative example of industrial-use property, facing west.



Image 10: Stage 1 property inspection, representative example of Cambridge Memorial Hospital property, illustrating recent construction, facing southeast.



Image 11: Stage 1 property inspection, representative example of modern Police Station, illustrating surface grading, facing northwest.



Image 12: Stage 1 property inspection, representative example of modern commercial-use complex, facing southeast.



Image 13: Stage 1 property inspection, representative example of modern subdivision, facing southeast.



Image 14: Stage 1 property inspection, illustrating St. Patrick's Cemetery, facing northeast.



Image 15: Stage 1 property inspection, illustrating brush/wooded area (background) to the northeast of the CN railway line, facing northwest.



Image 16: Stage 1 property inspection, illustrating a brush/wooded area of the Galt County Club golf course, facing southeast.



Image 17: Stage 1 property inspection, illustrating steep slope along banks of the Grand River, facing southeast.



Image 18: Stage 1 property inspection, representative example of CN railway line, facing southeast.



Image 19: Stage 1 property inspection, illustrating previous disturbance within ROW of Coronation Blvd., facing southeast.



Image 20: Stage 1 property inspection, illustrating previous disturbance within ROW of Coronation Blvd., facing northwest.



Image 21: Stage 1 property inspection, illustrating previous disturbance within ROW of Coronation Blvd., facing northwest.



Image 22: Stage 1 property inspection, illustrating previous disturbance within ROW of Coronation Blvd., facing northwest.



Image 23: Stage 1 property inspection, illustrating previous disturbance within ROW of Coronation Blvd., facing northwest.



Image 24: Stage 1 property inspection, overview of Hespeler Road, facing south.

8.2 Stage 2 Archaeological Assessment



Image 25: Stage 2 Archaeological Assessment, overview of proposed pump station site, facing northwest.



Image 26: Stage 2 Archaeological Assessment, overview of proposed pump station site, facing east.



Image 27: Stage 2 Archaeological Assessment, test pit survey in progress, facing northwest.



Image 28: Stage 2 Archaeological Assessment, test pit survey in progress, facing southeast.



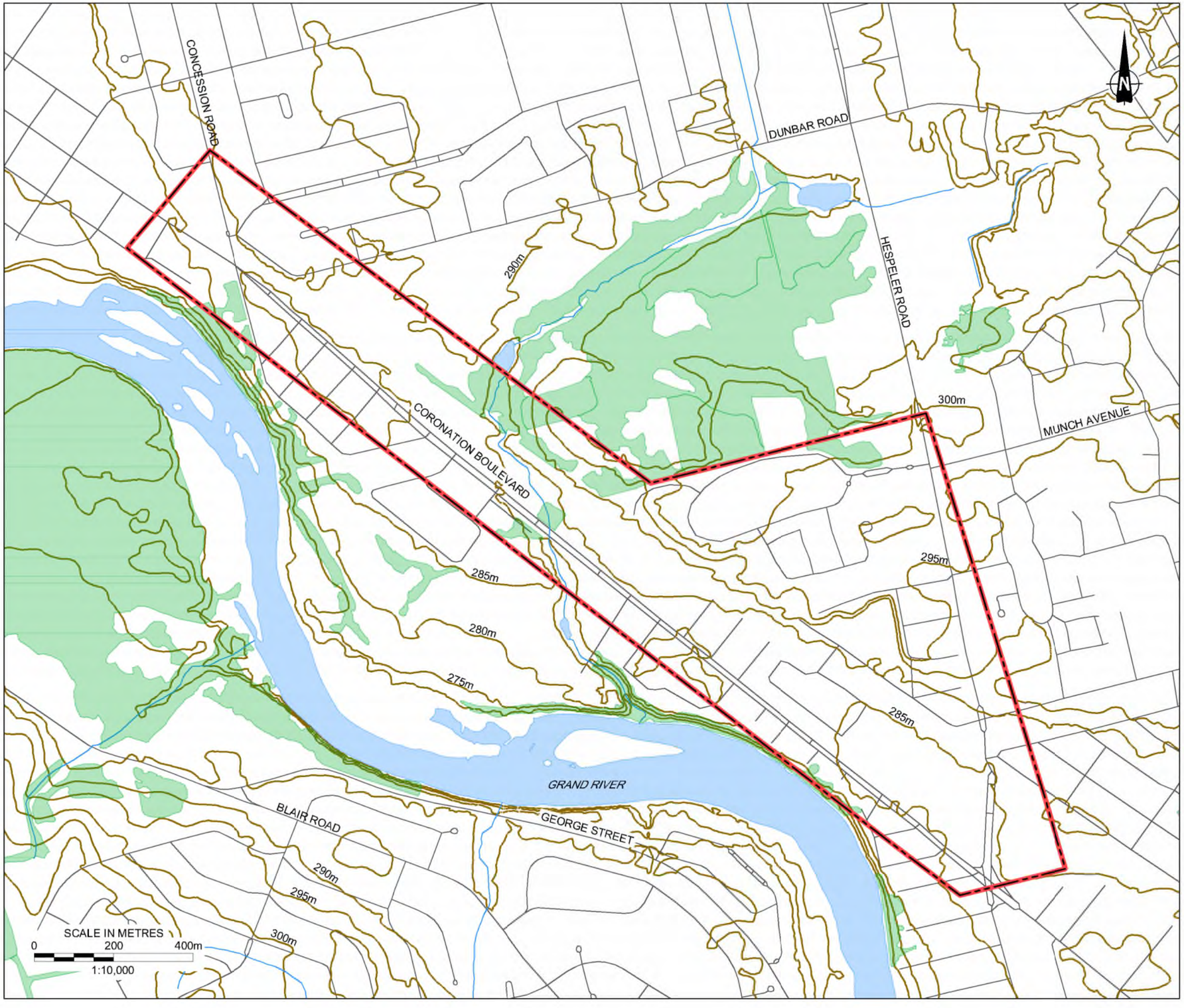
Image 29: Stage 2 Archaeological Assessment, soil stratigraphy in completed test pit, facing down.

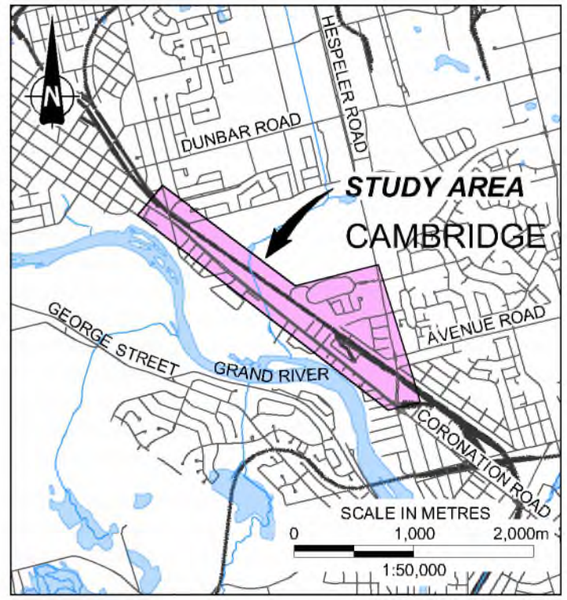


Image 30: Stage 2 Archaeological Assessment, soil stratigraphy in completed test pit, facing down.

9.0 MAPS

All maps follow on the succeeding pages.





REGIONAL MAP

LEGEND

STUDY AREA

REFERENCE

DRAWING BASED ON MNR LIO, OBTAINED 2009 PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2012; AND CANMAP STREETFILES V2008.4.

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

ALL LOCATIONS ARE APPROXIMATE.

PROJECT

STAGE 1-2 ARCHAEOLOGICAL ASSESSMENT, CAMBRIDGE PRESSURE ZONE 1W MUNICIPAL CLASS EA, CITY OF CAMBRIDGE, REGIONAL MUNICIPALITY OF WATERLOO, ONTARIO

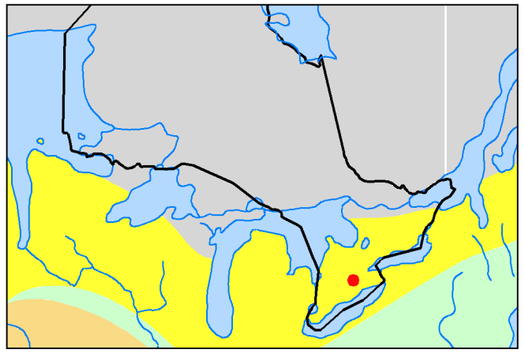
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LOCATION OF STUDY AREA

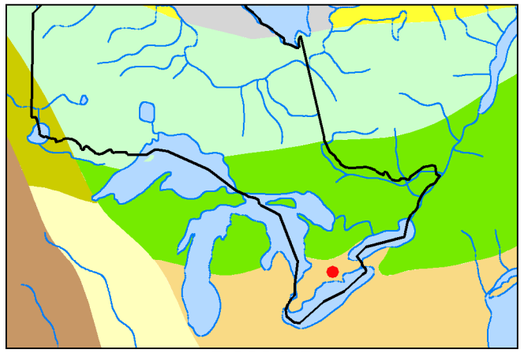
Golder Associates

PROJECT No.			1653341	FILE No. 1653341-1000-R01001
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CADD	ZJB	May 11/17		
CHECK				MAP 1

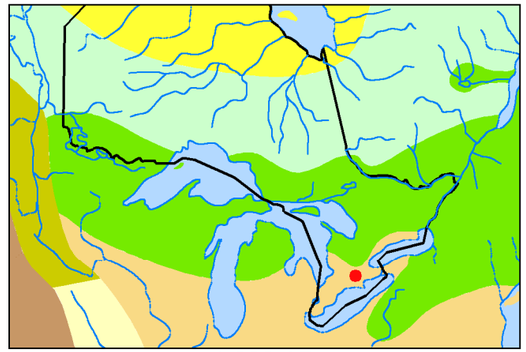
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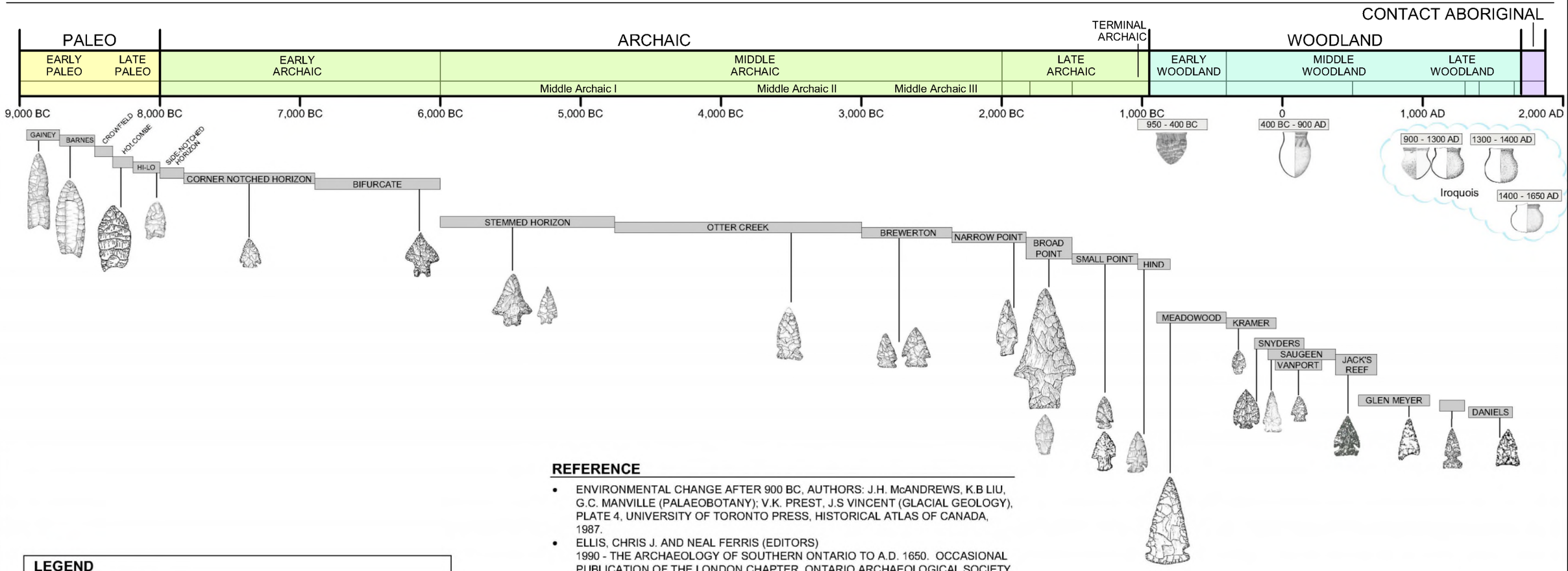
9,000 BC



5,000 BC



1,000 AD



LEGEND

- PROJECT AREA

VEGETATION COVERAGE:

- Tundra
- Boreal Forest
- Great Lakes-St. Lawrence Forest
- Decidous Forest
- Decidous Woodlands
- Grassland
- Litchen Woodland
- Parkland

REFERENCE

- ENVIRONMENTAL CHANGE AFTER 900 BC, AUTHORS: J.H. McANDREWS, K.B LIU, G.C. MANVILLE (PALAEOBOTANY); V.K. PREST, J.S VINCENT (GLACIAL GEOLOGY), PLATE 4, UNIVERSITY OF TORONTO PRESS, HISTORICAL ATLAS OF CANADA, 1987.
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- FOX, W.A. - 1982 GLEN MEYER TANGED-TRIANGULAR. KEWA 82-1.
- FOX, W.A. - 1981 NANTICOKE NOTCHED POINTS. KEWA 81-3.
- FOX, W.A. - 1981 DANIELS TRIANGULAR POINTS. KEWA 81-1.

PROJECT

STAGE 1-2 ARCHAEOLOGICAL ASSESSMENT,
CAMBRIDGE PRESSURE ZONE 1W
MUNICIPAL CLASS EA, CITY OF CAMBRIDGE,
REGIONAL MUNICIPALITY OF WATERLOO, ONTARIO

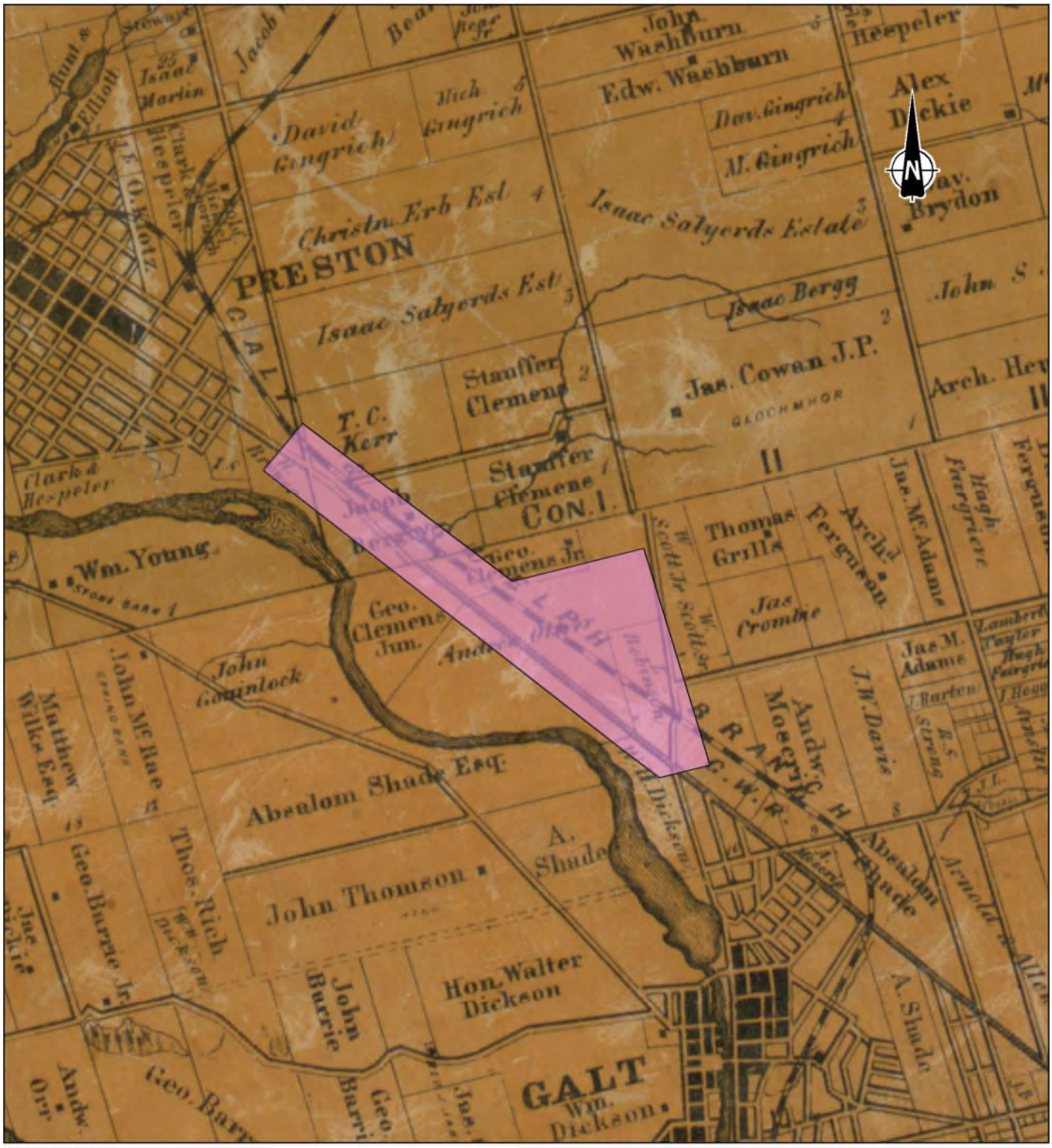
TITLE

SOUTHWESTERN ONTARIO PRE-CONTACT ABORIGINAL CULTURE HISTORY

Golder Associates

PROJECT No.			1653341	FILE No. 1653341-1000-R01002
				SCALE AS SHOWN REV.
CADD	LMK/ZJB	May 15/17		
CHECK				MAP 2

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LEGEND

APPROXIMATE STUDY AREA

REFERENCE

TREMAINE, GEORGE R. 1861, TREMAINE'S MAP OF THE COUNTY OF WATERLOO. GEORGE C. TREMAINE., TORONTO, ONTARIO

NOTES

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ALL LOCATIONS ARE APPROXIMATE.

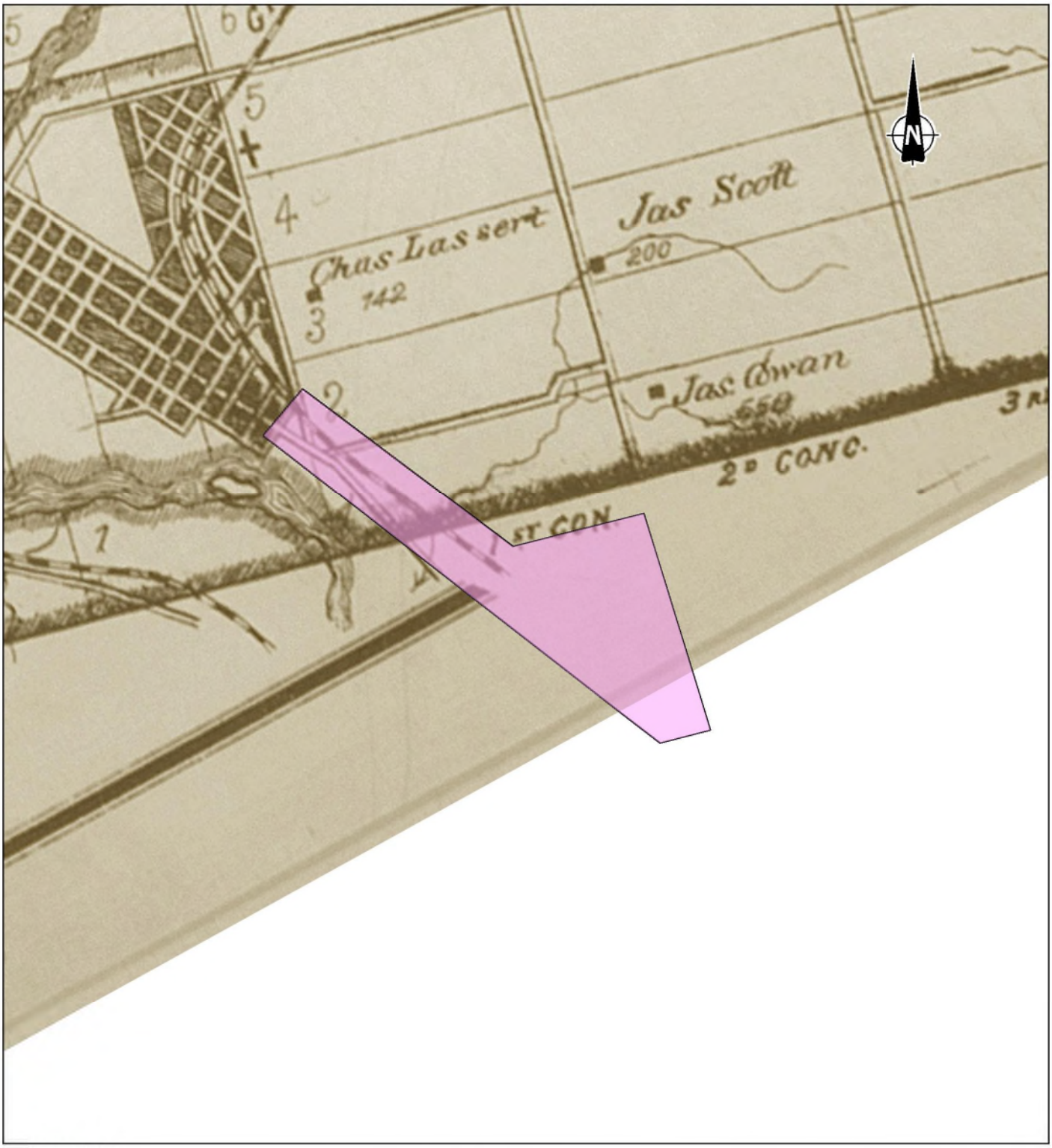
PROJECT: STAGE 1-2 ARCHAEOLOGICAL ASSESSMENT, CAMBRIDGE PRESSURE ZONE 1W MUNICIPAL CLASS EA, CITY OF CAMBRIDGE, REGIONAL MUNICIPALITY OF WATERLOO, ONTARIO

TITLE: **A PORTION OF TREMAINE'S 1861 MAP OF WATERLOO COUNTY**

Golder Associates

PROJECT No.		1653341	FILE No. 1653341-1000-R01003	
			SCALE N.T.S.	REV.
CADD	ZJB	May 11/17		
CHECK	JM		**MAP 3**	

Drawing file: 1653341-1000-R01003.dwg May 15, 2017 - 11:28am



LEGEND

APPROXIMATE STUDY AREA

REFERENCE

PARSELL, H. & CO. 1881, ILLUSTRATED HISTORICAL ATLAS OF WATERLOO COUNTY, TORONTO. REPRINT 1972. ROSS CUMMING, PORT ELGIN, ONTARIO

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

ALL LOCATIONS ARE APPROXIMATE.

PROJECT: STAGE 1-2 ARCHAEOLOGICAL ASSESSMENT, CAMBRIDGE PRESSURE ZONE 1W MUNICIPAL CLASS EA, CITY OF CAMBRIDGE, REGIONAL MUNICIPALITY OF WATERLOO, ONTARIO

TITLE: **A PORTION OF THE 1881 HISTORICAL ATLAS MAP OF WATERLOO TOWNSHIP**

Golder Associates

PROJECT No.			1653341
CADD	ZJB	May 11/17	
CHECK			

FILE No. 1653341-1000-R01003 | SCALE N.T.S. | REV.

MAP 4

Drawing file: 1653341-1000-R01003.dwg May 15, 2017 - 11:28am



LEGEND

APPROXIMATE STUDY AREA

REFERENCE

PARSELL, H. & CO. 1881, ILLUSTRATED HISTORICAL ATLAS OF WATERLOO COUNTY, TORONTO. REPRINT 1972. ROSS CUMMING, PORT ELGIN, ONTARIO

NOTES

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ALL LOCATIONS ARE APPROXIMATE.

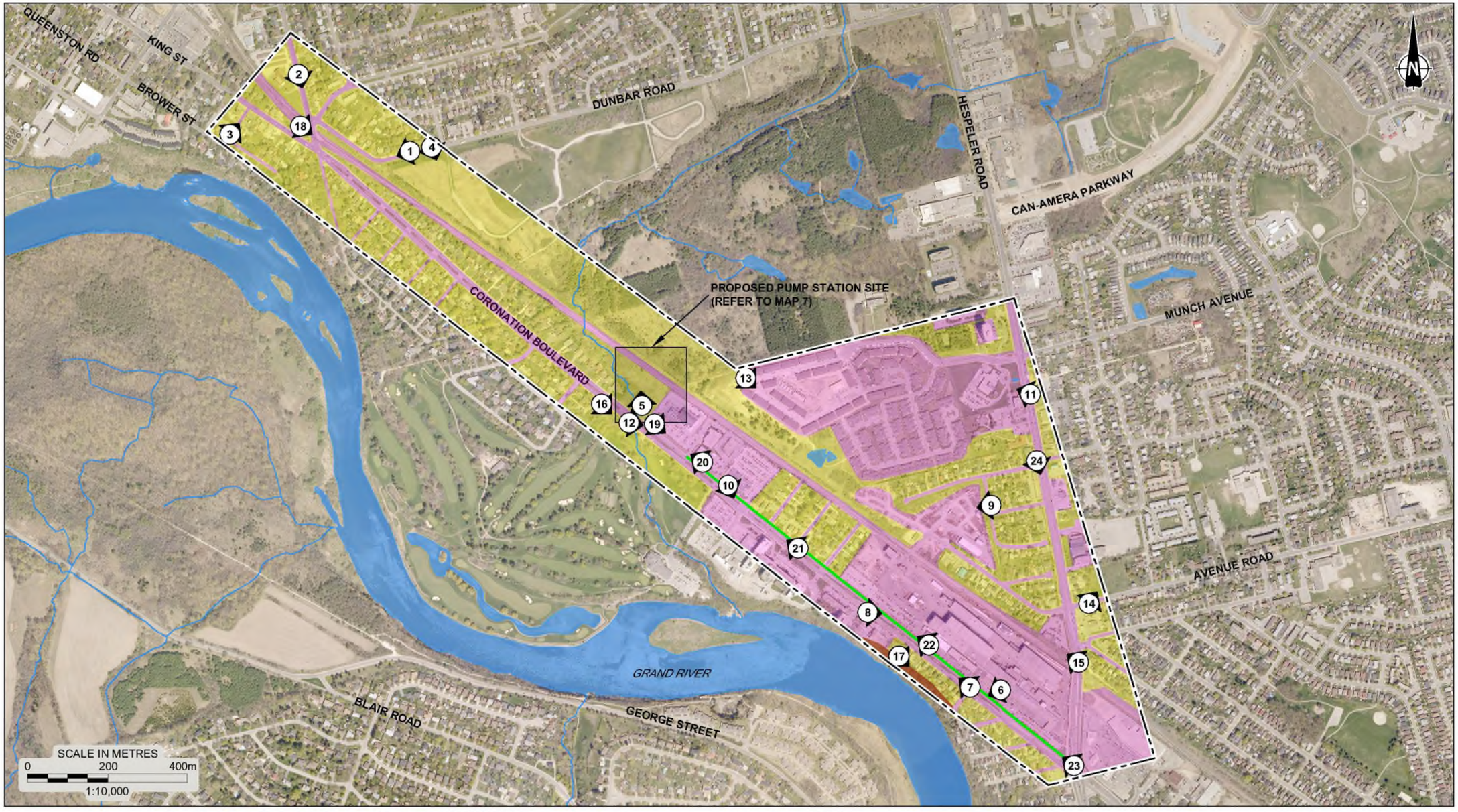
PROJECT: STAGE 1-2 ARCHAEOLOGICAL ASSESSMENT, CAMBRIDGE PRESSURE ZONE 1W MUNICIPAL CLASS EA, CITY OF CAMBRIDGE, REGIONAL MUNICIPALITY OF WATERLOO, ONTARIO

TITLE: **A PORTION OF THE 1881 HISTORICAL ATLAS MAP OF NORTH DUMFRIES TOWNSHIP**

Golder Associates

PROJECT No.		1653341	FILE No. 1653341-1000-R01003	
			SCALE AS SHOWN	REV.
CADD	ZJB	May 11/17	MAP 5	
CHECK				

Drawing file: 1653341-1000-R01003.dwg May 15, 2017 - 11:28am



LEGEND

- PHOTOGRAPH LOCATION, VIEWING DIRECTION, AND PLATE NUMBER
- APPROXIMATE STUDY AREA
- APPROXIMATE LOCATION OF RECOMMENDED TRUNK WATERMAIN ALIGNMENT
- PREVIOUSLY DISTURBED (RECENTLY DEVELOPED) STAGE 2 ARCHAEOLOGICAL ASSESSMENT NOT RECOMMENDED
- STEEPLY SLOPED AREA (>20°) STAGE 2 ARCHAEOLOGICAL ASSESSMENT NOT RECOMMENDED
- AREA RECOMMENDED FOR STAGE 2 ARCHAEOLOGICAL ASSESSMENT

REFERENCE

DRAWING BASED ON 2006 IMAGERY FROM THE GRAND RIVER CONSERVATION AUTHORITY;
AND CANMAP STREETFILES V.2008.

NOTES

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ALL LOCATIONS ARE APPROXIMATE.

PROJECT: STAGE 1-2 ARCHAEOLOGICAL ASSESSMENT, CAMBRIDGE PRESSURE ZONE 1W MUNICIPAL CLASS EA, CITY OF CAMBRIDGE, REGIONAL MUNICIPALITY OF WATERLOO, ONTARIO

TITLE: **RESULTS OF THE STAGE 1 PROPERTY INSPECTION**

Golder Associates

PROJECT No.			1653341	FILE No. 1653341-1000-R01006
				SCALE AS SHOWN REV.
CADD	ZJB	May 11/17		MAP 6
CHECK	JLO			

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LEGEND

- TEST PIT SURVEY AT 5m INTERVALS
- 28 — PHOTOGRAPH LOCATION, VIEWING DIRECTION, AND PLATE NUMBER
- 30 — PHOTOGRAPH LOCATION, AND PLATE NUMBER, LOOKING DOWN

REFERENCE

DRAWING BASED ON 2006 IMAGERY FROM THE GRAND RIVER CONSERVATION AUTHORITY

NOTES

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ALL LOCATIONS ARE APPROXIMATE.

PROJECT: STAGE 1-2 ARCHAEOLOGICAL ASSESSMENT, CAMBRIDGE PRESSURE ZONE 1W MUNICIPAL CLASS EA, CITY OF CAMBRIDGE, REGIONAL MUNICIPALITY OF WATERLOO, ONTARIO

TITLE

RESULTS OF THE STAGE 2 ARCHAEOLOGICAL ASSESSMENT OF THE PROPOSED PUMP STATION SITE

Golder Associates

PROJECT No.		1653341	FILE No. 1653341-1000-R01006	
			SCALE AS SHOWN	REV.
CADD	ZJB	May 11/17	MAP 7	
CHECK				

Drawing file: 1653341-1000-R01006.dwg May 15, 2017 - 11:29am

10.0 IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

Golder has prepared this report in a manner consistent with the level of care and skill ordinary exercised by members of the archaeological profession currently practicing under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

This report has been prepared for the specific site, design objective, developments and purpose described to Golder by Mr. Chris Campbell of GM BluePlan (the client). The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without Golder's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the client, Golder may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process. Any other use of this report by others is prohibited and is without responsibility to Golder. The report, all plans, data, drawings and other documents as well as electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof to any other party without the express written permission of Golder. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client cannot rely upon the electronic media versions of Golder's report or other work products.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project.

Special risks occur whenever archaeological investigations are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain archaeological resources. The sampling strategies incorporated in this study comply with those identified in the Ministry of Tourism and Culture's *Standards and Guidelines for Consultants Archaeologists* (Government of Ontario 2011).

Report Signature Page

GOLDER ASSOCIATES LTD.

Michael Teal, M.A.
Project Archaeologist

Carla Parslow, Ph.D.
Associate, Senior Archaeologist

SS/MT/CAP/ly/mp

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Golder Associates

Appendix E - Cultural Heritage Assessment

TECHNICAL MEMORANDUM

DATE May 17, 2017 **PROJECT No.** 1653341

TO Chris Campbell, MTP, MCIP, RPP, MRTPI
GM BluePlan Engineering Limited

CC Carla Parslow, PhD, Golder Associates Ltd, Richard Booth, PhD, Golder Associates Ltd.

FROM Benjamin Holthof, MMA, MPl, CAHP, Cultural Heritage Specialist **EMAIL** Benjamin_Holthof@golder.com

CULTURAL HERITAGE SCREENING REPORT - CAMBRIDGE PRESSURE ZONE 1 WEST MUNICIPAL CLASS (SCHEDULE B) ENVIRONMENTAL ASSESSMENT, CITY OF CAMBRIDGE, ONTARIO

Executive Summary

A desktop cultural heritage screening report for the Cambridge Pressure Zone 1 West Municipal Class Environmental Assessment (EA) determined that the Study Area contains known and potential cultural heritage resources. However, the preferred alignment for work is in the Coronation Boulevard right-of-way and cultural heritage resources will not be directly impacted. Golder therefore recommends that:

Site plan control and communication: The properties identified in this technical memo should be clearly marked on project mapping and communicated to all project personnel for avoidance during construction. No further cultural heritage studies are required.

Background Summary

In 2016, GM BluePlan Engineering Limited (GM BluePlan) retained Golder Associates Ltd. (Golder), on behalf of the Regional Municipality of Waterloo (the Region), to conduct a Cultural Heritage Screening Report (CHSR) as part of the required Municipal Class (Schedule B) EA study for the proposed creation of the new pressure zone, Cambridge Pressure Zone 1 West, in the City of Cambridge. The EA study is being performed to determine the necessary infrastructure requirements and system modifications in order to create the Cambridge Pressure Zone 1 West.

The purpose of this technical memo is to provide a summary of existing conditions in the Study Area and determine if the project will require subsequent cultural heritage evaluation reports (CHERs) or heritage impact assessments (HIAs). The guidelines for Cultural Heritage Resource Screening reports are provided in the Ministry of Tourism, Culture and Sport (MTCS) *Ontario Heritage Tool Kit* series and *Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes* (2015).

Study Area

The Study Area for the EA is irregular in shape, and includes a corridor approximately 300 m wide along the length of Coronation Blvd. The north boundary of the Study Area is parallel to Brower Street at King Street East. The south boundary of the Study Area is parallel to Wright Ave at Coronation Boulevard and includes the properties south of the Dumfries Conservation Area between Coronation Boulevard and Hespeler Road (Figure 1). The preferred alignment for work is within the Coronation Boulevard right-of-way with a pumping station on a parcel with the civic address 765 Coronation Boulevard.

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Method

The desktop survey for cultural heritage resources in the Study Area involved the following tasks:

Task 1: Background research

Federal, provincial, and municipal heritage registers, inventories, and databases were reviewed to identify known cultural heritage resources in the Study Area. This included review of the:

- *Canadian Register of Historic Places* (www.historicplaces.ca);
- Historic Sites and Monuments Board of Canada *Directory of Federal Heritage Designations* (http://www.pc.gc.ca/apps/dfhd/search-recherche_eng.aspx) and *Directory of Heritage Railway Stations* (http://www.pc.gc.ca/eng/clmhc-hsmbc/pat-her/gar-sta.aspx);
- Ontario Heritage Foundation *Online Plaque Guide* (http://www.heritagetrust.on.ca/Resources-and-Learning/Online-Plaque-Guide.aspx) and *Ontario Places of Worship Inventory* (http://www.heritagetrust.on.ca/Ontario-s-Places-of-Worship/Inventory);
- Ontario Ministry of Government and Consumer Services (OMGCS) *Database of Registered Cemeteries* (Accessed at: https://www.consumerbeware.mgs.gov.on.ca/esearch/start.do);
- The City of Cambridge Heritage Properties Register (http://www.cambridge.ca/planning_and_development/policy_planning/municipal_heritage_advisory_committee_m_h_a_c_the_heritage_properties_inventory); and,
- The City of Cambridge map page (http://maps.cambridge.ca/maps).

Other sources consulted included:

- Ontarioplaques.com (data correlated with the Ontario Heritage Foundation *Online Plaque Guide*);
- the Cambridge Heritage Master Plan (2008);
- the Region of Waterloo *Scenic Roads and Special Character Streets Resource Document* (2011);
- For the Grand River, Canadian Heritage River documents including the:
  - *Canadian Heritage Rivers System Grand River Nomination Document* (1990);
  - first 10 year monitoring report: *A Decade in the Canadian Heritage River System a Review of the Grand Strategy 1994-2004* (2004);
  - second 10 year monitoring report: *Canadian Heritage Rivers System Ten Year Monitoring Report 2004-2014* (2014); and,
  - *Heritage River Inventory – Grand River Watershed* (2013).

Task 2: Stakeholder Consultation

Golder contacted the City of Cambridge Heritage Planner in August 2016 about the potential for cultural resources in the Study Area, to identify further sources of information on cultural heritage in the municipality, and confirm that the data in the City of Cambridge Heritage Properties Inventory was current and valid. At the time of writing a response had not been received.

Task 3: MTCS Check Sheet

Based on the information compiled during Tasks 1 & 2, the MTCS *Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes* (2015) checklist was completed for the Study Area (Appendix A).

Results

The MTCS *Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes* (2015) checklist results, examination of City of Cambridge and Region of Waterloo planning documents, and research into the history of the Study Area, found nine known cultural heritage resources and as many as 300 properties with buildings or structures over 40 years old that could be potential cultural heritage resources.

The known and potential cultural heritage resources in the Study Area are illustrated on Figure 1 and include:

- Six properties listed on the *City of Cambridge Heritage Properties Register* and protected under Section 27 of the *Ontario Heritage Act*:
  - 535 Dunbar Road;
  - 110 Blue Heron Ridge;
  - 140 Blue Heron Ridge;
  - 160 Blue Heron Ridge;
  - 435 Blue Heron Ridge; and,
  - 2156-2162 Coronation Blvd.
- part of the St. Patrick Catholic Cemetery, established in 1864;
- the Grand River, a Canadian Heritage River;
- the Canadian Pacific Railway corridor, a historic corridor that carried the Galt and Guelph Railway (1857) and the Galt Preston and Hespeler Railway (1905);
- as many as 300 buildings and structures over 40 years old; and,
- a tree planted in 1973 by the Preston Horticultural Society with a bronze plaque commemorating the visit of Queen Elizabeth II to Cambridge.

Summary

This cultural heritage screening determined that the Study Area:

- ***Contains known and potential cultural heritage resources.***
  - In addition to the known cultural heritage resources, there is a high number of properties with potential cultural heritage value or interest throughout the entire Study Area.

However,

- ***No identified cultural heritage resources will be directly impacted by this project.***

Recommendations

To ensure that cultural heritage resources in the Study Area will not be adversely impacted by the proposed development, Golder recommends that:

- **Site plan control and communication**: The properties identified in this technical memo should be clearly marked on project mapping and communicated to all project personnel for avoidance during construction

Based on project mapping and descriptions provided to Golder, no cultural heritage resources will be directly impacted by this project, therefore no further cultural heritage studies are required.

If the project Study Area or Project components change, CHERs or HIAs may be required.

Closure

We trust that this report meets your current needs. If you have any questions, or if we may be of further assistance, please contact the undersigned at Benjamin_Holthof@golder.com, 1(613)328-5598.

GOLDER ASSOCIATES LTD.

Benjamin Holthof, MMA, MPl, CAHP
Cultural Heritage Specialist

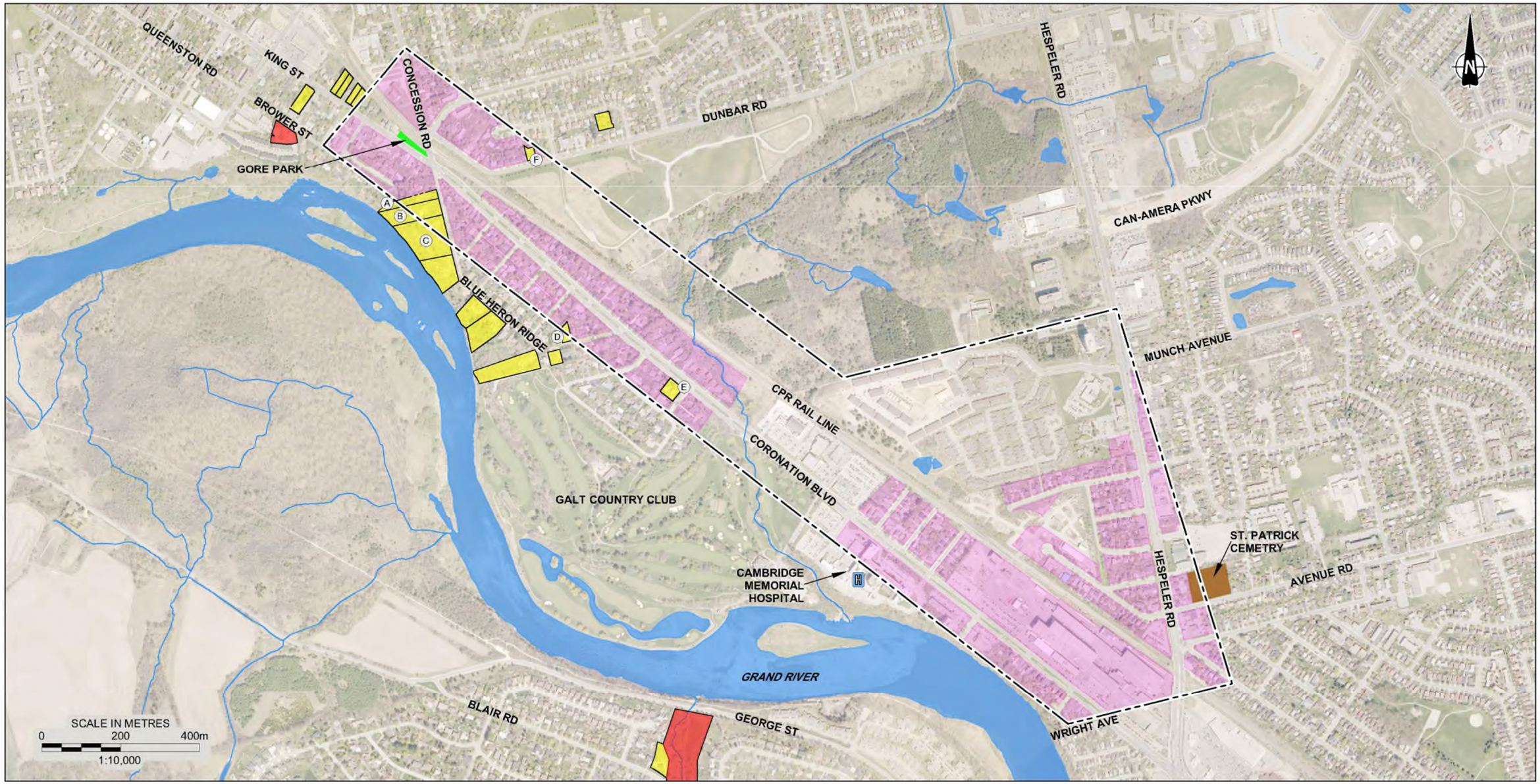
Hugh Daechsel, MA.
Principal, Archaeologist

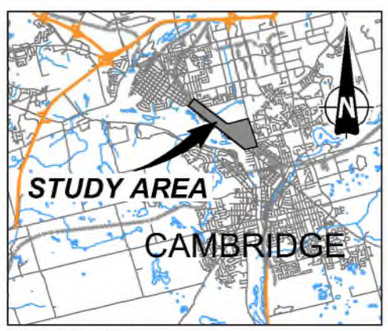
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Attachments: Map *1, Cultural Heritage Constraints*

Appendix A: MTCS Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes: A Checklist for the Non-Specialist (2015)





KEY PLAN

LEGEND

- APPROXIMATE STUDY AREA
- LISTED HERITAGE PROPERTY
- DESIGNATED HERITAGE PROPERTY
- POTENTIAL CULTURAL HERITAGE VALUE OR INTEREST PROPERTY
- ST. PATRICK CATHOLIC CEMETERY
- GORE PARK (OAK TREE AND PLAQUE COMMEMORATING THE VISIT OF QUEEN ELIZABETH II, 1973)

LISTED HERITAGE PROPERTIES:

BLUE HERON RIDGE
- (A) MN 110
- (B) MN 140
- (C) MN 160
- (D) MN 435

CORONATION BOULEVARD
- (E) MN 2156-2162

DUNBAR ROAD
- (F) MN 535

REFERENCE

DRAWING BASED ON 2006 IMAGERY BY THE GRAND RIVER CONSERVATION AUTHORITY;
PROPERTY DATA SETS PROVIDED BY G.M. BLUEPLAN ENGINEERING LTD; AND
CANMAP STREETFILES V.2008.

NOTES

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ALL LOCATIONS ARE APPROXIMATE.

PROJECT
CULTURAL HERITAGE ASSESSMENT FOR MUNICIPAL CLASS (SCHEDULE B) ENVIRONMENTAL ASSESSMENT FOR THE CAMBRIDGE PRESSURE ZONE 1W

TITLE
CULTURAL HERITAGE CONSTRAINTS

Golder Associates

PROJECT No.			1653341	FILE No. 1653341-2000-M01001
				SCALE AS SHOWN REV.
CADD	DCH	Sept 1/16		
CHECK				MAP 1

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Project or Property Name

Cultural Heritage Resource Screen Municipal Class (Schedule B) EA, Cambridge Pressure Zone 1 West

Project or Property Location (upper and lower or single tier municipality)

Cambridge Ontario

Proponent Name

G.M. Blueplan Engineering Ltd.

Proponent Contact Information

Chris Campbell

Screening Questions

	Yes	No
1. Is there a pre-approved screening checklist, methodology or process in place?	☐	☑

If Yes, please follow the pre-approved screening checklist, methodology or process.

If No, continue to Question 2.

Part A: Screening for known (or recognized) Cultural Heritage Value

	Yes	No
2. Has the property (or project area) been evaluated before and found **not** to be of cultural heritage value?	☐	☑

If Yes, do not complete the rest of the checklist.

The proponent, property owner and/or approval authority will:

- summarize the previous evaluation and
- add this checklist to the project file, with the appropriate documents that demonstrate a cultural heritage evaluation was undertaken

The summary and appropriate documentation may be:

- submitted as part of a report requirement
- maintained by the property owner, proponent or approval authority

If No, continue to Question 3.

	Yes	No
3. Is the property (or project area):		
a. identified, designated or otherwise protected under the *Ontario Heritage Act* as being of cultural heritage value?	☑	☐
b. a National Historic Site (or part of)?	☐	☑
c. designated under the *Heritage Railway Stations Protection Act*?	☐	☑
d. designated under the *Heritage Lighthouse Protection Act*?	☐	☑
e. identified as a Federal Heritage Building by the Federal Heritage Buildings Review Office (FHBRO)?	☐	☑
f. located within a United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Site?	☐	☑

If Yes to any of the above questions, you need to hire a qualified person(s) to undertake:

- a Cultural Heritage Evaluation Report, if a Statement of Cultural Heritage Value has not previously been prepared or the statement needs to be updated

If a Statement of Cultural Heritage Value has been prepared previously and if alterations or development are proposed, you need to hire a qualified person(s) to undertake:

- a Heritage Impact Assessment (HIA) – the report will assess and avoid, eliminate or mitigate impacts

If No, continue to Question 4.

Part B: Screening for Potential Cultural Heritage Value

	Yes	No
4. Does the property (or project area) contain a parcel of land that:		
a. is the subject of a municipal, provincial or federal commemorative or interpretive plaque?	☐	☑
b. has or is adjacent to a known burial site and/or cemetery?	☑	☐
c. is in a Canadian Heritage River watershed?	☑	☐
d. contains buildings or structures that are 40 or more years old?	☑	☐

Part C: Other Considerations

	Yes	No
5. Is there local or Aboriginal knowledge or accessible documentation suggesting that the property (or project area):		
a. is considered a landmark in the local community or contains any structures or sites that are important in defining the character of the area?	☐	☑
b. has a special association with a community, person or historical event?	☐	☑
c. contains or is part of a cultural heritage landscape?	☐	☑

If Yes to one or more of the above questions (Part B and C), there is potential for cultural heritage resources on the property or within the project area.

You need to hire a qualified person(s) to undertake:

- a Cultural Heritage Evaluation Report (CHER)

If the property is determined to be of cultural heritage value and alterations or development is proposed, you need to hire a qualified person(s) to undertake:

- a Heritage Impact Assessment (HIA) – the report will assess and avoid, eliminate or mitigate impacts

If No to all of the above questions, there is low potential for built heritage or cultural heritage landscape on the property.

The proponent, property owner and/or approval authority will:

- summarize the conclusion
- add this checklist with the appropriate documentation to the project file

The summary and appropriate documentation may be:

- submitted as part of a report requirement e.g. under the *Environmental Assessment Act, Planning Act* processes
- maintained by the property owner, proponent or approval authority

Appendix F - Technical Memorandum No. 2

Creation of Cambridge Pressure Zone 1W Environmental Assessment

Technical Memorandum #2

The Planning Framework to Evaluate Alternatives

Prepared by GM BluePlan for:

Region of Waterloo

Project No. 716015

December 2016

Region of Waterloo

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ROYAL CENTRE, 3300 HIGHWAY NO. 7, SUITE 402, VAUGHAN, ON L4K 4M3
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2 Overview of the Municipal Class Environmental Assessment Process 5

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Alternate formats of this document are available upon request.

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1 Introduction

The Region of Waterloo retained GM BluePlan Engineering Limited to complete a Schedule 'B' Municipal Class Environmental Assessment (EA) for the Creation of the Cam 1W Pressure Zone.

The goal of the Class EA is to confirm the necessary infrastructure requirements and system modifications needed to create a new pressure zone Cambridge Zone 1 West (Cam 1W) in the City of Cambridge. This includes:

- Confirmation of the new pressure zone operational configuration,
- Identification and sizing of new infrastructure, system modification, and operational changes,
- Identifying the infrastructure and locations required at each zone boundary, including the new booster pumping station and chlorination facility, trunk watermain alignment, and Pressure Reducing Valves (PRVs), and
- Preparing the environmental screening report and project file.

Upon completion of the Schedule 'B' Class EA, GM BluePlan will complete a conceptual design of the proposed system upgrades, which will provide the Region with a clear vision of the infrastructure requirements and facilitate the next steps of detailed design and construction. Key conceptual design elements will include:

- Pump station site layout and conceptual layout, including related structural, mechanical and electrical work,
- Preliminary plan and profile drawings for the watermain alignments,
- PRV chamber layouts and site layouts, and
- Design brief that comprises all key technical details and project considerations, including capital and operating cost estimates.

The Municipal Class Environmental Assessment (EA) process is a decision-making and planning process that ensures that potential effects of a project are identified, documented and managed prior to implementation. As such, the creation of a Cambridge 1W Pressure Zone is being studied under this standardized planning process.

1.1 Project Study Area

Within the context of the Class EA, there are two project study areas within the new Cam 1W Pressure Zone consisting of the existing Kress Hill PS site in the north of the Cam 1W zone, and the Coronation-Hespeler corridor area in the south Cam 1W Zone (See **Figure 1**).



Freeport Elevated Tank

Cambridge Zone 2 (W)

KIT 2 (E)

Kress Hill Pressure Reducing Valve

City of Kitchener
City of Cambridge

Cambridge Zone 2 (E)

H3

Dundee PRV

City of Cambridge
Township of North Dumfries

Coronation - Hespeler Corridor

Turnbull

G4 Well

Cambridge Zone 3

Cambridge Zone 1

Shades Mill

0 0.25 0.5 1 Kilometers

First Base Solutions (2016)

N

Region of Waterloo

Creation of Cambridge Pressure Zone 1W Class EA

Figure 1

Focus Area

- Existing Facilities
- Railway
- Focus Area
- Existing Pressure Zone
- Municipal Boundary

Environmental Features

- Creeks
- Rivers
- Grand River Conservation Authority Limits
- Dumfries Conservation Area
- Regulatory Floodplain

BluePlan Engineering

716015-8-W-Focus Area
March 2017
Data Source: Region of Waterloo
Scale: 1:30,769 | NAD 1983 UTM Zone 17N

1.1.1 Existing Kress Hill Pumping Station Site

The existing Kress Hill Pumping Station site is located along Fountain Street North in Cambridge. It was built to supply Cam 2W from Cam 1; however, it became redundant once the Freeport ET went into service and is no longer needed. The Kress Hill Pumping Station is currently under consideration to be decommissioned and torn down in order to reduce the amount of property owned and managed by the Region. Given the amount of yard piping that will continue to remain in service, it is not practical to sell off all or part of the existing site for private use, even though the existing facility occupies more land than is necessary to accommodate the new Kress Hill PRV. However, the new PRV would benefit from a heated building to house the monitoring and communications equipment, and a dry chamber space to house and maintain the zone boundary valves. There is a potential cost savings opportunity to adapt and re-use the existing site infrastructure, including the existing surplus pump station building which already has these dry, heated spaces to support the New Kress Hill PRV, as it may be less expensive to keep the larger building in service instead of tearing it down and replacing it with a smaller building in the same place.

1.1.2 Coronation-Hespeler Corridor

Figure 1 also illustrates the Coronation-Hespeler corridor, which is the project focus area roughly bound by Hespeler Road to the east, the Grand River to the south, Bishop Street to the west, and the existing rail corridor and Isherwood Avenue to the North. The new Cam 1W infrastructure will most likely be constructed within the Coronation-Hespeler corridor, including:

- Cam 1W Booster Pumping Station and Chloramination Station;
- New Trunk Watermain; and,
- New Cam 2E to Cam 1 PRV.

1.2 Technical Memo #2

In support of the Final Class EA submission, the technical work related to the **Creation of New Cam 1 West Pressure Zone EA** will be structured into interim Technical Memorandums (TMs). Each TM will summarize: the work completed to date, key assumptions and results, and key recommendations and outcomes moving forward.

This memo provides an overview of the Municipal Class EA process and its relevance to the creation of the Cambridge 1W Pressure Zone. In so doing, it:

- Broadly describes the Municipal Class EA process and the “Schedule” or classification in which the Cambridge study falls under;

- Defines the two phases of the Municipal Class EA process that the Cambridge 1W Pressure Zone must adhere to; and,
- Describes the methodology used to evaluate the key elements of Cambridge 1W Pressure Zone including a new watermain, the location of a new booster pumping and chloramination station, modifications to the existing Kress Hill Pumping Station, Pressure Reducing Valve (PRV) site, and other operational strategies.

A general overview of the Municipal Class EA process is provided in Section 2.

2 Overview of the Municipal Class Environmental Assessment Process

The Municipal Class EA is an approved environmental assessment per the Environmental Assessment Act (EA Act) which addresses the construction of municipal projects including water, wastewater and stormwater management projects as well as collector and arterial roads.

Projects by municipalities and other public bodies are subject to the EA Act unless specifically exempted by regulation. Municipalities and, in some cases private sector developers, must comply with the Municipal Class EA for specific projects listed in the Class EA.

The Municipal Class EA provides specific environmental planning processes for projects, including roads, stormwater management, water and wastewater servicing. Reflecting the varying environmental impacts of municipal projects, the Municipal Class EA classifies projects into three main schedules (A/A+, B, and C).

Schedule A/A+ projects have minimal adverse environmental effects; while Schedule C projects have the highest potential for adverse environmental effects. The Municipal Class EA consists of a five phase process that provides a logical planning study process including provisions for consultation with the public, stakeholders and agencies.

The proponent of a project subject to the Municipal Class EA (in this case, the Region of Waterloo) may satisfy the requirements of the Class EA by completing the study process, set out in the Class EA. For example, projects under Schedule A are only required to complete Phase 1. Schedule 'B' projects require at a minimum, the preparation of a study documenting the environmental planning process in a report known as a Project File, two mandatory points of public consultation with affected public, stakeholders and agencies (typically including one public meeting) and an opportunity for the public to object to the Minister of the Environment and Climate Change (Part II Order request). A Schedule 'C' project requires all of these same steps and requires an additional public meeting and a supplementary, more detailed study documenting the environmental planning process in an Environmental Study Report.

Appendix 1 of the Municipal Class EA (October 2000, as amended in 2011 and 2015) lists specific types of projects that fall within the various schedules (A/A+, B, and C). "Municipal Water and Wastewater Projects" include:

- Schedule 'A' or 'A+' projects that include normal or emergency operational activities that typically result in minimal impacts;

- Schedule ‘B’ projects whose water and wastewater activities require the need to assess their impacts, such as establishing or enlarging a water distribution system and all works to connect the system to an existing system or water source; and,
- Schedule ‘C’ projects which would include such large undertakings as constructing a new water system comprising a new well and water distribution system.

This Cambridge Pressure Zone 1W Class EA will follow a Schedule ‘B’ process to satisfy Phase 1 (Problem / Opportunity Statement) and Phase 2 (Alternative Solutions) of the planning process.

3 Phase 1 of the Class EA Process – Development of a Problem / Opportunity Statement

The initial phase of the Municipal Class EA process is the development of a Problem / Opportunity Statement that documents the factors which lead to the conclusion that an improvement or change is needed. In other words, Phase 1 helps answer the question:

What is the justification for "X" to be undertaken?

For this Municipal Class EA study, the need for a new Cambridge 1 West Pressure Zone arose from the need to support the *Cambridge Water System Upgrade Strategy* and its water system upgrade improvements. The *Strategy*, itself, was developed to support the recommendations made in the Region's 2013 *Water Supply and Distribution Operations Master Plan* and *Water Supply Master Plan* of its Integrated Urban Water System.

The new Cambridge 1W Pressure Zone will be generally bound by Hespeler Road to the east, Highway 401 to the north, and the Grand River to the west, and consists of the existing Cambridge 1 zone within the Preston community. Based on the findings from the *Cambridge Water System Upgrade Strategy,* as well as the *Background Review & Design Parameters Summary* for the Cambridge Pressure Zone 1W Class EA study, the following water distribution opportunities and challenges exist within the study area:

Preston generally experiences low water pressure;

- Improved fire flow capacity is needed to ensure water pressure levels are not affected throughout the study area;
- The current security of water supply does not meet the system's needs as an unplanned event for additional water will result in the residual mixing of both chlorine and chloramine to occur in the system; and,
- Enabling the lowering of the Cambridge 1 hydraulic grade line (HGL) will enhance the operation and efficiencies of the Turnbull Reservoir.

Recognizing these issues, the following statement was developed to capture the key water distribution challenges and opportunities in the study area:

> "Optimize the existing water system to improve existing customer level of service while increasing overall security of supply and flexibility of system operations"

The Problem / Opportunity Statement is typically vetted through dialogue with residents and stakeholders to confirm that the need for the project is understood.

4 Phase 2 of the Class EA Process – Identification and Evaluation of Alternative Solutions

The second phase of the Municipal Class EA process involves the identification and evaluation of all feasible solutions to the problem. As both improvements to the study area's trunk watermain and pumping station are required to create a new Cambridge Zone 1W Pressure Zone, two separate – but integrated - evaluations will be undertaken to address the potential advantages and disadvantages of each infrastructure improvement. As the location of a new pumping station is dependent on the route of the watermain, the evaluation of the latter is required to be undertaken first.

4.1 Potential Trunk Watermain Alignments

Supporting the creation of a new Cambridge Zone 1W Pressure Zone is the construction of a new watermain to provide security of supply to the Cambridge 1W pumping and chloramination station and Cambridge Memorial Hospital. The new trunk watermain will need to be sized to provide peak flows to the Cambridge 1W pumping station; and, follow a sufficiently different alignment that minimizes the potential for simultaneous watermain failure of the existing Coronation Boulevard watermain and proposed trunk watermain.

4.1.1 Stage I Evaluation for Long List of Alignment Alternatives

The evaluation of the watermain alignments will be undertaken in two stages: Stage I will "screen" a long list of watermain alignment alternatives down to a smaller group, which will be evaluated more rigorously in Stage II. The long list of alignment alternatives will be evaluated on the following three screening criteria:

- **Problem Statement:**
    - Is the alignment alternative able to address the problem / opportunity?
- **Technical Viability:**
    - Is the alignment alternative able to meet service requirements
    - Is the site available?
- **Reasonable:**
    - Will the alignment alternative avoid unnecessary impacts to existing and future land uses?
    - Will the alignment alternative maximize the use of existing infrastructure capacity, while minimizing capital upgrades where possible?

Those alignment alternatives that meet all three screening criteria will be carried forward into Stage II. Those alternatives that receive one “no” response will be eliminated from further consideration.

4.1.2 Stage II Evaluation for Short List of Alignment Alternatives

A shorter list of alternative alignments will be assessed in greater detail during the Stage II evaluation. The alternatives will be evaluated on five key factors:

- Technical feasibility;
- Financial viability (costs);
- Legal / jurisdictional (coordination and compliance);
- Environmental impacts; and,
- Socio/cultural impacts.

Each factor comprises a number of specific criteria, and a rating system will be used to evaluate each alternative based on those criteria. The rating system will apply a “Low”, “Medium” or “High” ranking enabling a comparative review of each alternative. The ratings represent the following:

- “High” refers to mostly positive elements with few (if any) negative impacts
- “Medium” refers to a mix of positive and negative elements with some impacts
- “Low” refers to mostly negative elements with several impacts

Having ranked each alternative accordingly, the evaluation and selection of a technically preferred solution will be guided by the *Reasoned Argument Approach* which will provide a clear and thorough rationale of the tradeoffs between the various evaluation factors and criteria and identify the reasons why one option best meets the servicing needs of the new Cambridge Zone 1W Pressure Zone.

4.2 Potential Pumping and Chloramination Station Locations

Another element of the new Cambridge Zone 1W Pressure Zone is the construction of a booster pumping and chloramination station. The new Cambridge 1W booster pumping station will be the primary source of water to the Cambridge 1W Zone system, a closed pressure zone. As such, pump selection will focus on having adequate overlap between pumps and will be configured with Variable Frequency Drive and pump controls in order to maintain a constant Zone HGL under all demand conditions.

4.2.1 Stage I Evaluation for Long List of Pumping and Chloramination Station Locations

Similar to the process of assessing the watermain alignment options, the evaluation of booster pumping and chloramination station locations will occur in two stages: Stage I will "screen" a long list of pumping station sites down to a smaller group, which will be evaluated in more detail in Stage II. The long list of alignment alternatives will be evaluated on the following four screening criteria:

- **Problem Statement:**
    - Is the alternative able to address the problem / opportunity?
- **Technical Viability:**
    - Is the alternative able to meet service requirements?
    - Is the site available?
- **Reasonable:**
    - Will the location of the alternative avoid unnecessary impacts to existing and future land uses?
    - Will the location of the alternative maximize the use of existing infrastructure capacity, while minimizing capital upgrades where possible?

Those locations that meet all four screening criteria will be carried forward into Stage II. Those alternatives that receive one "no" response will be eliminated from further consideration.

4.2.2 Stage II Evaluation for Short List of Pumping and Chloramination Station Locations

A shorter list of pumping station locations will be assessed in greater detail during the Stage II evaluation. The alternatives will be similarly evaluated on five key factors:

- Technical feasibility;
- Financial viability (costs);
- Legal / jurisdictional (coordination and compliance);
- Environmental impacts; and,
- Socio/cultural impacts.

The evaluation of the pumping and chloramination station locations will employ a similar methodology as used to assess the watermain alignments. Once again, the evaluation and selection of a technically preferred solution will be guided by the *Reasoned Argument Approach* which will provide a clear rationale of why the location of the pumping and chloramination station best meets the servicing needs of the new Cambridge Zone 1W Pressure Zone.

The criteria developed to evaluate both the alternative alignments and pumping station locations are provided in **Table 1**.

Table 1 - Factors and Criteria Used to Evaluate Watermain Alignment and Pumping Station Location Options

Factors	Evaluation Criteria	Factors	Evaluation Criteria
Technical	Compatibility with existing / future infrastructure	**Environmental Impacts**	Environmentally sensitive features
	Capacity for future growth		Species at Risk
	System security[1]		Crossings
	System overflow[2]		Soil / Land Contamination
	Overall project delivery risk		Water features and resources
	Technical viability		Air quality
	Traffic management		
	Existing utilities	**Socio / Cultural Impacts**	Community Impacts (residents, businesses)
	Operations and maintenance		Road infrastructure
Financial	Capital cost		Noise, vibration, dust
	Operation and maintenance cost		Odour impacts
	Life cycle cost		Heritage / cultural impacts
			Archaeological impacts
Legal / Jurisdictional	Compliance with applicable planning policies		Traffic impacts
	Property acquisition		

1 Technical criterion only used to evaluate alignment alternatives
2 Technical criterion only used to evaluate pumping station locations

4.3 Kress Hill Pressure Reducing Valve (PRV) Modifications

The Cambridge 1W Zone supply will be further enhanced by the Kress Hill PRV and recently refurbished Dundee PRV, which in combination will provide full peak flows to provide an additional layer of security. A new Kress Hill PRV will replace the existing Kress Hill Pumping Station and PRV which are no longer in operation. The new PRV is expected to be constructed within the existing property. The new Kress Hill PRV will be sized to support peak flows to Cam 1W while maintaining adequate zone pressures.

Because modifications to the Kress Hill PRV are limited in scale, the project is classified as a Schedule 'A' undertaking under the Municipal Class EA process. As a result, the project is pre-approved and can proceed to implementation.

4.4 Hespeler Road PRV Location

As part of the larger Cambridge upgrade strategy, several new PRVs are proposed to provide emergency support to the Cambridge 1 Zone. This includes a new Cambridge 2E to Cambridge 1 PRV along the Hespeler Road trunk, roughly between Spiers Crescent and Paisley Heights as per the new proposed zone boundary.

Similar to the Kress Hill PRV modifications, the Hespeler Road PRV changes are limited in scale and will be undertaken under the pre-approved Schedule 'A' Municipal Class EA process.

4.5 Zone Operational Strategy

Through the system review process, the option to leverage the Kress Hill PRV and Dundee PRV to simplify operations of the new Cambridge 1W Pumping Station was identified as a potential control strategy for the new Cambridge 1W Zone. The more active use of the PRVs could enable a more streamlined pumping station design and reduced land use requirements, while resulting in a more efficient system operation.

While the evaluation of operational strategies will not be required to adhere to the Class EA planning process, consideration of different zone control strategies and their impacts of infrastructure and site requirements will be reviewed when completing the infrastructure alternatives development and evaluation.

The criteria developed to evaluate Zone Operation Strategy is provided in **Table 2**

Table 2 - Factors and Criteria Used to Evaluate Zone Operational Strategy

Factors	Evaluation Criteria	Factors	Evaluation Criteria
System Level of Service	Meets Zone Performance Objectives	**System Operations**	Impacts on System Energy Efficiency
	Impacts on System Water Quality		Impacts on Integrated Urban System Supply Strategy
	System Operational Redundancy		Impacts on System Operational Flexibility
Cost Impacts	Impacts on Facility Capital Costs		Impacts on Facility Capacity and Component Requirements
	Impacts on Land Acquisition Requirements		

5 Final Steps in the Municipal Class EA Process

The results of both evaluations, including their preliminary recommendations, will be made available to the public at a future Public Consultation Centre (PCC). It is critical that the evaluation process and identification of the technically preferred solution be documented clearly and logically in a way that residents and key stakeholders will easily understand. This will invite meaningful input.

For Municipal Class EA Schedule 'B' projects, the Project File is essentially the final report which captures all of the key information relevant to the study. The Project File will include:

- The Problem / Opportunity Statement and supportive data;
- Details of the planning process followed;
- An overview of the consultation carried out;
- Existing baseline conditions (environmental, socio-economic, etc.);
- Alternative solutions and the evaluation of their potential effects;
- Identification of the (technically) preferred solution and its effects on the environment / community;
- Potential mitigation measures to be implemented to avoid or minimize the effects;
- Commitments made during the planning process; and
- An Implementation Plan

It is recognized that the planning process is one which allows for concerns to be identified and resolved through the course of the projects planning. In some circumstances, it is possible that issues may arise during public review of a project that cannot be easily accommodated. In cases where concerns are raised, it is the proponent's obligation to use all reasonable means available to address these concerns. In circumstances where interested person, Aboriginal communities, or government agencies feel that the proposed undertaking should be made to a more rigorous planning procedure, a Part II Order request or appeal can be made to the Minister. Section A.2.8 of the Municipal Class Environmental Assessment (October 2000, as amended in 2007, 2011 and 2015) details the Part II Order process.

Appendix G -Technical Memorandum No. 3

Creation of Cambridge Pressure Zone 1W Environmental Assessment

Technical Memorandum #3

Alternatives Evaluation

Prepared by GM BluePlan for:

Region of Waterloo

Project No. 716015

December 2016

Region of Waterloo

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Appendix A Evaluation of Short-listed Watermain Alignment Alternatives

Appendix B Estimated Costs

Appendix C Evaluation of Short-listed Pump Station Site Alternatives

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1 Introduction

The Region of Waterloo retained GM BluePlan Engineering Limited to complete a Schedule 'B' Municipal Class Environmental Assessment (EA) for the Creation of the Cam 1W Pressure Zone.

The aim of the Class EA is to confirm the necessary infrastructure requirements and system modifications needed to create a new pressure zone – Cambridge Zone 1 West (Cam 1W) in the City of Cambridge. This includes:

- Confirmation of the new pressure zone operational configuration;
- Identification and sizing of new infrastructure, system modification, and operational changes;
- Identifying the infrastructure and locations required at each zone boundary, including the new booster pumping station and chlorination facility, trunk watermain alignment, and Pressure Reducing Valves (PRVs); and,
- Preparing the environmental screening report and project file.

The new Cam 1W Pressure Zone is generally bound by Hespeler Road to the east, Highway 401 to the north, and the Grand River to the west, and consists of the existing Cambridge 1 zone within the Preston community. Based on the findings from the *Cambridge Water System Upgrade Strategy,* as well as the *Background Review & Design Parameters Summary* for the Cambridge Pressure Zone 1W Class EA study, the following water distribution opportunities and challenges exist within the study area:

- Certain areas in Preston experience low water pressure;
- Emergency high water demand incident may result in the mixing of chlorine and chloramine – which is undesirable;
- Improved flow capacity is needed to support improvements in water pressure levels and fire flow capacity throughout the study area;
- Enabling the lowering of the Cambridge 1 hydraulic grade line (HGL) will enhance the operation and efficiencies of the Turnbull Reservoir; and,
- Changing of the pressure zone secondary disinfection residual will enable operational flexibility and improve overall security of water supply to the Preston area.

Recognizing these issues, the following statement was developed during the initial phase of the Municipal Class EA to capture the key water distribution challenges and opportunities in the study area:

"Optimize the existing water system to improve existing customer level of service while increasing overall security of supply and flexibility of system operations"

Upon completion of the Schedule 'B' Class EA, GM BluePlan will complete a conceptual design of the proposed system upgrades, which will provide the Region with a clear vision of the infrastructure requirements and facilitate the next steps of detailed design and construction. Key conceptual design elements will include:

- Pump station site layout and conceptual layout, including related structural, mechanical and electrical work;
- Preliminary plan and profile drawings for the watermain alignments;
- PRV chamber layouts and site layouts; and,
- Design brief that comprises all key technical details and project considerations, including capital and operating cost estimates

The Municipal Class EA process is a decision-making and planning process that ensures that potential effects of a project are identified, documented and managed prior to implementation. As such, the creation of a Cambridge 1W Pressure Zone has been studied under this standardized planning process.

1.1 Technical Memo #3

In support of the Final Class EA submission, the technical work related to the **Creation of New Cam 1 West Pressure Zone EA** will be structured into interim Technical Memorandums (TMs). Each TM will summarize: the work completed to date, key assumptions and results, and key recommendations and outcomes moving forward.

This memo provides an overview of the recommended elements and strategies that would comprise the new Cam 1 Pressure Zone. These recommendations include:

- Constructing a new trunk watermain within Coronation Boulevard;
- Constructing a new pumping station located within vacant land near Groff Mill Creek and adjacent to Coronation Boulevard;
- Re-purposing the existing Kress Hill Pump Station to accommodate PRVs; and,
- Construction of a new Cam 2E to Cam 1 PRV at Spiers Crescent.

An overview of the evaluation processes used to assess the Cam 1 Pressure Zone strategies and elements can be found in Section 2 and Section 3.

2 Cam 1W Zone Operational Strategy

2.1 Cam 1W Operational Overview

As identified in TM #1, The **Creation of New Cam 1 West Pressure Zone** consists of the following new Regional transmission Infrastructure components:

- New Cam 1W to supply the new zone HGL booster pumping and chloramination station (BPCS);
- New Kress Hill PRV, used as an additional supply to Cam 1W Zone;
- New trunk watermain along Coronation Boulevard to provide security of supply to the new pumping station; and,
- New Cam 2E to Cam 1 PRV on Hespeler Road to support security of supply to Cam 1

Figure 1 depicts a simplified system schematic of the New Cam 1W Zone, with new infrastructure highlighted in red.

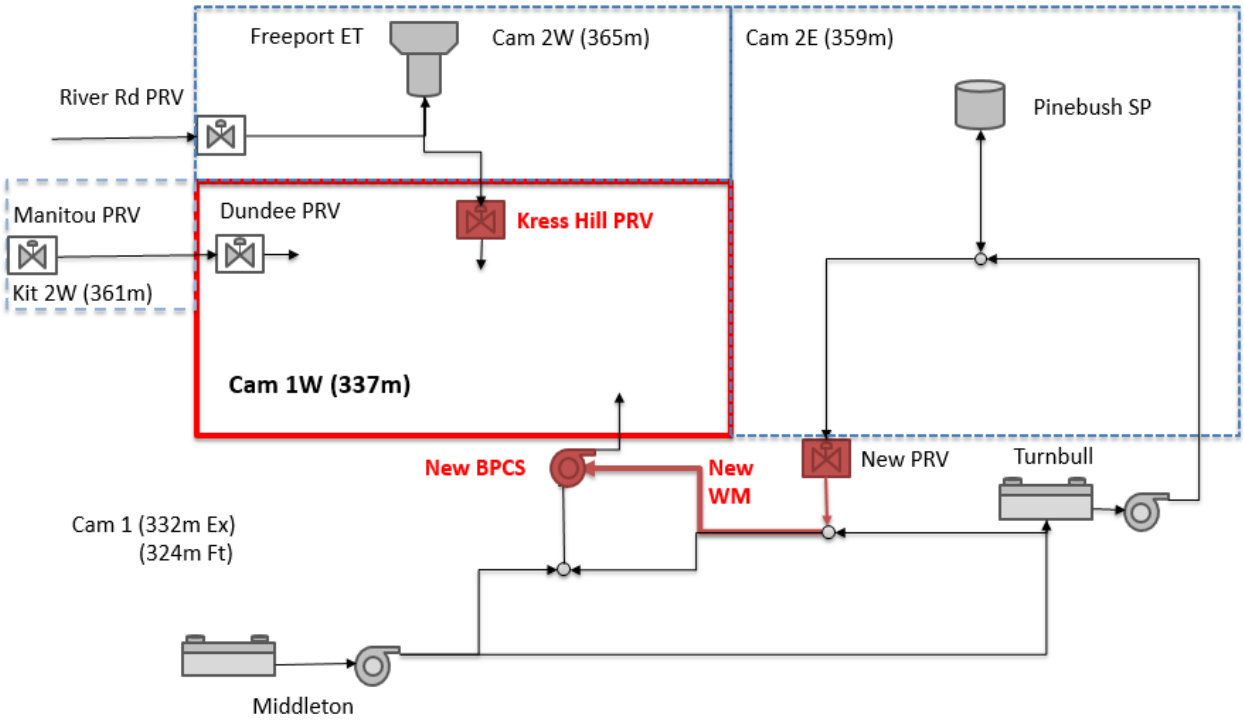


Figure 1. Schematic for New Cam 1W Pressure Zone

The operational changes needed to implement the new Cam 1W Zone involves:

- Increasing the existing HGL within the new Cam 1W Zone from 332 metres to 337 metres;
- Reducing the existing HGL within the remaining Cam 1 Zone from 332 metres to between 324 metres and 326 metres, which will occur after the implementation of the Cam 1W HGL increase; and,
- Changing the disinfection residual type in the Cam 1W Zone from free chlorine to chloramine.

2.2 Cam 1W Technical Objectives

This creation of the new Cam 1 West Pressure Zone has the following system objectives:

- Addresses existing low pressure issues within the Preston area;
- Allows for the disinfection residual change from free chlorine to chloramine in the new Cam 1W Zone by:
    - Flow-paced addition of ammonium sulfate at the proposed pumping station
    - Providing for the zone supply supplementation from Cam 2W and Kit 2E without mixing residuals and potential breakpoint chlorination in the distribution system, as all sources to Zone 1W will be chloraminated
    - Addressing potential and reported treatment residual mixing occurrences in the current system;
- Provides security of supply to the Cam 1W Zone with the new Kress Hill PRV;
- Provides security of supply to Cam 1W and to the Cambridge Memorial Hospital (CMH) through the:
    - New Cam 1 trunk watermain
    - New Cam 2E to Cam 1 PRV
- Allows for the lowering of the Cam 1 HGL, which addresses existing Cam 1 storage issues by allowing better operation of the Turnbull Reservoir; and,
- Potential to reducing the frequency and magnitude of bi-directional flow within existing Cam 1W watermains, which may provide localized water quality improvements.

2.3 Cam 1W Pressure Zone Operational Strategy Evaluation

The operational strategy for the new zones generally consists of:

- New Cam 1W BPCS acting as the primary supply to the new Zone;

- Existing New Dundee PRV and Kress Hill PRV to act as secondary feeds to the new pressure zone; and,
- Sizing of New Dundee PRV and Kress Hill PRV to have sufficient capacity to supply the Cam 1W zone independently of the new pumping station.

Through the system review process, the option to leverage the Kress Hill PRV and New Dundee PRV to simplify operations of the new Cam 1W BPCS are identified as a potential control strategy for the new Cam 1W Zone. This includes utilization of the Kress Hill PRV to support minimum nighttime flows, thereby reducing the normal operating range of the pumping station and eliminating the need for a low flow pumps

The more active utilization of the PRVs could allow for a more streamlined pumping station design and reduced land use requirements, while resulting in a more efficient system operation.

2.3.1 Cam 1W Pressure Zone Operational Strategy Options

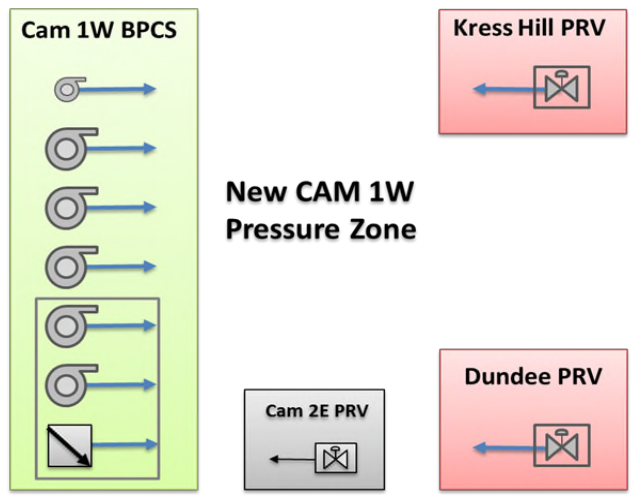
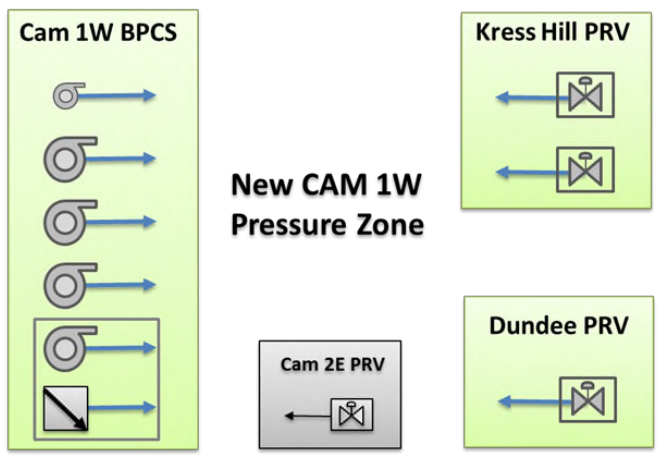
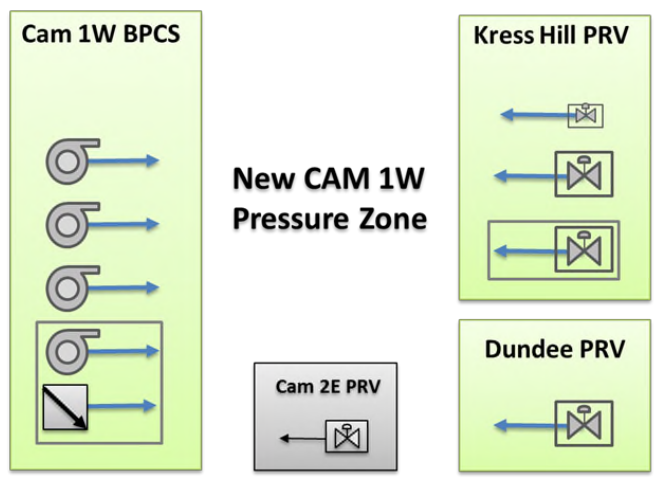
In consultation with Regional staff, three potential Cam 1W operational strategies were developed, highlighted in **Table 1**.

2.3.2 Cam 1W Pressure Zone Operational Strategy Evaluation Criteria

Each of the three (3) potential operational strategies was evaluated against the criteria listed below using the reasoned argument approach highlighted in TM#2:

- System Level of Service
    - Capacity to meet zone hydraulic performance objectives;
    - Impacts on system water quality; and,
    - System operational redundancy
- System Operations
    - Impacts on system energy efficiency;
    - Impacts on Integrated Urban System (IUS) supply strategy;
    - Impacts on system operational flexibility; and,
    - Impacts on facility capacity and component requirements
- Cost Impacts
    - Impacts on facility capital costs
    - Impacts on land acquisition requirements

Table 1 Cam 1W Zone Operational Strategy

Operational Strategy 1: Single Source - Booster Pump and Chloramination Station	
• BPCS is sized and configured to provide the full range of potential flow rates, including: ○ Jockey pump for low flows ○ Duty pumps for normal flows ○ Fire pumps for fire flows • Kress Hill and New Dundee PRVs only operated under emergency conditions, designed as single valve stations. • Zone Firm Capacity calculation based on single source strategy: ○ BPCS firm capacity calculated with the two largest pumps out of service**.** ○ Kress Hill and Dundee PRVs are not included in the Zones Supply Firm Capacity Calculation.	
Operational Strategy 2: Multiple Source –Booster Pump Station and PRV	
• BPCS is sized and configured to provide the full range of potential flow rates, including: ○ Jockey pump for low flows ○ Duty pumps for normal flows ○ Fire pumps for fire flows • Kress Hill and New Dundee PRVs can operate under normal conditions • Zone Firm Capacity calculation based on multi-source strategy: ○ Zone BPCS firm capacity calculated with one largest pump out of service ○ Kress Hill PRV firm capacity with largest PRV out of service	
Operational Strategy 3: Low Flow PRV – High Flow Multi Source	
• BPCS is sized and configured to provide average day to peak flow rate. ○ All pumps are the same size, in combination they meet average and peak flows • Kress Hill and New Dundee PRVs can operate under normal conditions. • Kress Hill PRVs are optimized for ○ Pilot PRV for low flows ○ Large PRV for normal and peak flows • Zone Firm Capacity calculation based on multi-source strategy: ○ Zone BPCS firm capacity calculated with one largest pump out of service • Kress Hill PRV firm capacity with largest PRV out of service	

2.3.3 Cam 1W Zone Operational Strategy Evaluation

Table 2 summarizes the detailed evaluation of the three (3) potential operational strategies. The key findings are summarized below:

- All three (3) operational strategies are adequate to service the Cam 1W, achieving all the identified level of service objectives;
- Increasing the operational flexibility of the Kress Hill PRV provides significant additional benefit to the Cam 1W and IUS operations, including:
    - Increased flexibility in system operations;
    - Improved security of supply to the Cam 1W zone;
    - Improved water quality within the Cam 2W and Kit 2E zones are due to regular flow through the Dundee and Kress Hill PRVs;
    - Simplification of the Cam 1W BPCS operations and configuration; and,
- Increasing operational flexibility of the Kress Hill PRV increases the cost and complexity of the Kress Hill PRV; however, these additional costs are offset by the reduction in the Cam 1W BPCS cost and the potential re-utilization of the existing Kress Hill pump station as a PRV station.

2.3.4 Recommended Cam 1W Zone Operational Strategy

Based on a review of the different options, **Operational Strategy 3: Low Flow PRV – High Flow Multi Source** is recommended as the preferred operational strategy, as this option provides additional system flexibility while strengthening the Cam 1W security of operations without increasing overall capital and operating costs of the Cam 1W Zone.

3 Cam 1W Trunk Watermain Alignment

3.1 Evaluation Process

As both improvements to the study area's trunk watermain and pumping station are required to create a new Cambridge Zone 1W Pressure Zone, two separate– but integrated -evaluations were undertaken to address the potential advantages and disadvantages of each infrastructure improvement. As the location of a new pumping station was dependent on the route of the watermain, the evaluation of the latter was required to be undertaken first.

3.2 Stage I Evaluation for Long List of Potential Watermain Alignments

A new trunk watermain is required to provide security of supply to a future Cam 1W Pumping and Chloramination Station and Cambridge Memorial Hospital. It will need to be sized to provide peak flows to the pumping station, and follow a sufficiently different alignment that minimizes the potential for simultaneous watermain failure of the existing Coronation Boulevard watermain and proposed trunk watermain.

Recognizing these requirements, an initial list of eight watermain alignment options (and sub-options) was developed through site visits and a desktop review. The options, illustrated in **Figure 2**, included:

- **Option 1**: Coronation Boulevard (second watermain)
- **Option 2a**: CN/CP Railway / Oliver Avenue / Coronation Boulevard
- **Option 2b**: CN/CP Railway / Babcock and Wilcox Lands / Coronation Boulevard
- **Option 3a**: Jaffray Street / Oliver Avenue / Coronation Boulevard
- **Option 3b**: Jaffray Street / Babcock and Wilcox Lands / Coronation Boulevard
- **Option 4a**: Spiers Crescent / Pitt Street / Wauchope Avenue / Oliver Avenue / Coronation Boulevard
- **Option 4b**: Spiers Crescent / Pitt Street / Wauchope Avenue / Babcock and Wilcox Lands / Coronation Boulevard
- **Option 5**: Spiers Crescent / Pitt Street / Wauchope Avenue / Babcock and Wilcox Lands / Isherwood Avenue Subdivision Streets

The evaluation of the watermain alignments was undertaken in two stages: Stage I "screened" a long list of watermain alignment alternatives down to a smaller group, which would be evaluated more rigorously in Stage II. The long list of alignment alternatives was evaluated on the following three screening criteria:

Table 2. Evaluation of Potential Operational Strategies

Mostly Positive / Few Impacts
Positive and Negative / Some Impacts
Mostly Negative / Several Impacts

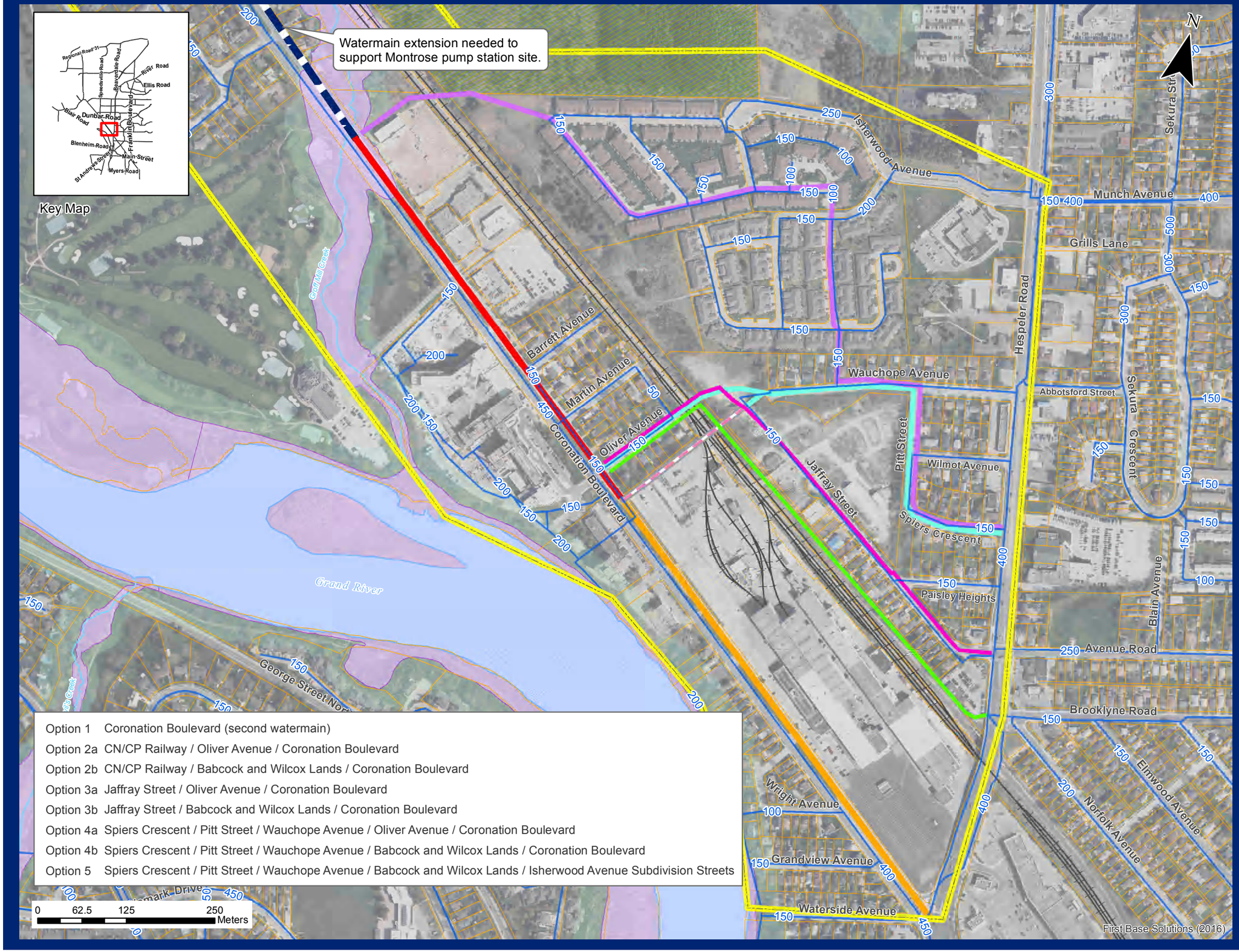
Factor	Evaluation Criteria	Rationale & Indicators	Operational Strategy 1: Single Source - Booster Pump Station	Operational Strategy 2: Multiple Source –Booster Pump Station and PRV	Operational Strategy 3: Low Flow PRV – High Flow Multi Source
System Level of Service	Meets Zone Performance Objectives	• Capacity to service system flows	**High:** - BPCS will be sized to provide full range of required flow rates.	**High:** - BPCS and PRVs will be sized to independently provide full range of required flow rates.	**High:** - BPCS and PRVs will be sized to independently provide full range of required flow rates.
	Impacts on system Water Quality	• Impacts Cam 1W water quality • Impact on IUS water quality	**Medium:** • Source water chloraminated at BPCS • Single source maintains consistent watermain flow direction • Poor water quality upstream of Dundee and Kress Hill PRVs. Need for periodic flushing into Cam 1W zone	**Medium:** • Source water chloraminated at BPCS • Single source maintains consistent watermain flow direction • Poor water quality upstream of Dundee and Kress Hill PRVs. Need for periodic flushing into Cam 1W zone	**High:** • Primary Source water chloraminated at BPCS • Regular used of Dundee and Kress Hill PRVs, maintains good water quality upstream of PRVs. • Multiple source creating changes in watermain flow direction. Impacts mitigated due to flow direction change occurring during low flow periods
	System Operational Redundancy	• Cam 1W peak flow redundancy • Typical system operations	**Medium:** • BPCCS firm capacity calculated with 2 largest pumps out of service • BPS operations and configuration complicated due to need to provide full range of flows.	**Medium:** • BPCS firm capacity calculated with largest pump out of service • BPCS operations and configuration complicated due to need to provide full range of flows.	**High:** • Kress Hill PRV configuration flows for greater flexibility in operation and capacity to service all flow conditions • BPCS firm capacity calculated with largest pump out of service • Kress Hill PRV configuration, simplifies BPCS operation and configuration

Table 2. Evaluation of Potential Operational Strategies

Factor	Evaluation Criteria	Rationale & Indicators	Operational Strategy 1: Single Source - Booster Pump Station	Operational Strategy 2: Multiple Source –Booster Pump Station and PRV	Operational Strategy 3: Low Flow PRV – High Flow Multi Source
System Operations	Impacts on system energy efficiency	• Facility energy usage • Total IUS energy impacts	**High:** All options have equivalent total energy and cost impacts. BPCS supply has lower total system energy cost but water source (Middleton) has a higher production cost then PRV source (Mannheim)	**High:** All options have equivalent total energy and cost impacts. BPCS supply has lower total system energy cost but water source (Middleton) has a higher production cost then PRV source (Mannheim)	**High:** All options have equivalent total energy and cost impacts. BPCS supply has lower total system energy cost but water source (Middleton) has a higher production cost then PRV source (Mannheim)
	Impacts on Integrated Urban System supply strategy	• Cambridge supply self-sufficient • Source water quality and supply cost	**High:** Very supportive of Cambridge supply self-sufficiency.	**High:** Very supportive of Cambridge supply self-sufficiency	**High:** Reliant on Mannheim source water during low flow periods. However, allows for Cambridge supply self-sufficiency during high demand period (when supply self-sufficiency is needed to support IUS supply strategy)
	Impacts on System Operational Flexibility	• Cam 1W Supply Redundancy • Standby Power Impacts	**Medium:** • PRVs provide peak flow redundancy • Kress Hill PRV sizing may complicate Cam 1W operation during flow periods • Increases potential need for standby-power capabilities at the Cam 1W BPCS	**High:** • PRVs provide peak flow redundancy. Kress Hill PRV equipped with redundant PRV with peak flow capacity • Kress Hill PRV sizing may complicate Cam 1W operation during flow periods • Reduces potential need for standby-power capabilities at the Cam 1W BPCS	**High:** • PRVs provide peak flow redundancy. Kress Hill PRV equipped with redundant PRV with peak flow capacity • Kress Hill PRV configuration flows for greater flexibility in operation and capacity to service all flow conditions • Reduces potential need for standby-power capabilities at the Cam 1W BPCS
	Impacts on facility capacity and component requirements	• Cam 1W BPCS configuration • Kress Hill PRV configuration	**Medium:** • 6 pump BPCS is required (Jockey, Normal, Fire Flow) • 1 high flow PRV at Kress Hill	**Medium:** • 5 pump BPCS is required (Jockey, Normal, Fire Flow) • 2 high flow PRV at Kress Hill	**High:** • 4 pump BPCS is required (3 duty & 1 Standby) • 2 high flow & 1 low flow PRV at Kress Hill

Table 2. Evaluation of Potential Operational Strategies

Factor	Evaluation Criteria	Rationale & Indicators	Operational Strategy 1: Single Source - Booster Pump Station	Operational Strategy 2: Multiple Source –Booster Pump Station and PRV	Operational Strategy 3: Low Flow PRV – High Flow Multi Source
Cost Impacts	Impacts on facility capital costs	• BPCS capital & O&M cost implications • Kress Hill PRV capital & O&M cost implications	**Medium:** • Greatest BPCS site cost • Smallest Kress Hill PRV costs • Potential to utilize existing Kress Hill Pump Station Building to minimize Kress Hill PRV costs	**High:** • Mid-range BPCS site cost • Mid-Range Kress Hill PRV costs • Potential to utilize existing Kress Hill Pump Station Building to minimize Kress Hill PRV costs	**High:** • Lowest BPCS site cost • Highest Kress Hill PRV costs • Potential to utilize existing Kress Hill Pump Station Building to minimize Kress Hill PRV costs
	Impacts on land acquisition requirements	• BPCS Land Requirements	**Medium:** • Largest BPCS building footprint • Need for standby-generator pad on site	**Medium:** • Mid-range BPCS building footprint • Need for standby-generator pad on site	**High:** • Smallest BPCS building footprint • Potential to eliminate for standby-generator pad on site



Option 1	Coronation Boulevard (second watermain)
Option 2a	CN/CP Railway / Oliver Avenue / Coronation Boulevard
Option 2b	CN/CP Railway / Babcock and Wilcox Lands / Coronation Boulevard
Option 3a	Jaffray Street / Oliver Avenue / Coronation Boulevard
Option 3b	Jaffray Street / Babcock and Wilcox Lands / Coronation Boulevard
Option 4a	Spiers Crescent / Pitt Street / Wauchope Avenue / Oliver Avenue / Coronation Boulevard
Option 4b	Spiers Crescent / Pitt Street / Wauchope Avenue / Babcock and Wilcox Lands / Coronation Boulevard
Option 5	Spiers Crescent / Pitt Street / Wauchope Avenue / Babcock and Wilcox Lands / Isherwood Avenue Subdivision Streets

Region of Waterloo

Creation of Cambridge Pressure Zone 1W Class EA

Figure 2

Watermain Alignment Alternatives - Long List

- Watermain
- Railway
- Focus Area
- Parcels

Alignment Options

- Option 1
- Option 2a
- Option 2b
- Option 3a
- Option 3b
- Option 4a
- Option 4b
- Option 5

Environmental Features

- Creeks
- Rivers
- Grand River Conservation Authority Limits
- Regulatory Floodplain
- Dumfries Conservation Area

BluePlan ENGINEERING

716015-15-W-Watermain Alignment Long List Alternatives v2
March 2017
Data Source: Region of Waterloo
Scale: 1:5,091 | NAD 1983 UTM Zone 17N

- **Does the Alignment Support the Problem / Opportunity Statement?**
    - Is the alignment alternative able to address the issues identified in the problem / opportunity?
- **Is the Alignment Technically Viable?**
    - Is the alignment alternative able to meet service requirements (based on the hydraulic grade line)?
    - Is the site available?
- **Is the Alignment Reasonable?**
    - Will the alignment alternative avoid unnecessary impacts to existing and future land uses?
    - Will the alignment alternative maximize the use of existing infrastructure capacity, while minimizing capital upgrades where possible?

Those alternatives that received one "no" (*x*) response would be screened out from further consideration. Conversely, those alignment alternatives that met all three screening criteria (√) would be carried forward into the more rigorous Stage II evaluation. **Table 3** summarizes the Screen I Evaluation of alignment alternatives.

3.3 Stage II Evaluation for Short List of Potential Watermain Alignments

The short list of watermain alignment alternatives was assessed in greater detail during the Stage II evaluation. The remaining five alternatives were evaluated on five key factors:

- Technical feasibility;
- Financial viability (costs);
- Legal / jurisdictional (coordination and compliance);
- Environmental impacts; and,
- Socio/cultural impacts.

Each factor comprised a number of specific criteria, and a rating system was used to evaluate each alternative based on those criteria. The rating system applied a "Low", "Medium" or "High" ranking enabling a comparative review of each alternative. The ratings represent the following:

- "High" refers to mostly positive elements with few (if any) negative impacts
- "Medium" refers to a mix of positive and negative elements with some impact

Table 3. Screen I Evaluation of Watermain Alignment Alternatives

Watermain Alignment Options	Addresses the Problem Statement?	Is Technically Viable?	Is Reasonable?	Recommended for Further Study?
Option 1: Coronation Boulevard	√	√	√	**Yes**
Option 2a: CN/CP Railway / Oliver Avenue / Coronation Boulevard	√	x	x	**No**
Option 2b: CN/CP Railway / Babcock and Wilcox Lands / Coronation Boulevard	√	x	x	**No**
Option 3a: Jaffray Street / Oliver Avenue / Coronation Boulevard	√	√	√	**Yes**
Option 3b: Jaffray Street / Babcock and Wilcox Lands / Coronation Boulevard	√	√	√	**Yes**
Option 4a: Spiers Crescent / Pitt Street / Wauchope Avenue / Oliver Avenue / Coronation Boulevard	√	√	√	**Yes**
Option 4b: Spiers Crescent / Pitt Street / Wauchope Avenue / Babcock and Wilcox Lands / Coronation Boulevard	√	√	√	**Yes**
Option 5: Spiers Crescent / Pitt Street / Wauchope Avenue / Babcock and Wilcox Lands / Isherwood Avenue Subdivision Streets	√	√	x	**No**

- "Low" refers to mostly negative elements with several impacts

The criteria developed to evaluate both the alternative alignments and pumping station locations are provided in Technical Memorandum #2 (*The Planning Framework to Evaluate Alternatives*) and are applied to the Stage II evaluation in **Appendix A**. A summary of the Stage II Evaluation is provided in **Table 4** below. A breakdown of the watermain alignment cost estimates is included in **Appendix B.**

3.4 Recommended Watermain Alignment

Having ranked each alternative accordingly, the evaluation and selection of a technically preferred solution was guided by the *Reasoned Argument Approach* which provided a clear and thorough rationale of the tradeoffs between the various evaluation factors and criteria and identified the reasons why one option best meets the servicing needs of the new Cambridge Zone 1W Pressure Zone. **Table 5** presents an overview of the recommended watermain alignment.

Table 4. Stage II Evaluation of Watermain Alignment Alternatives

Mostly Positive / Few Impacts

Positive and Negative / Some Impacts

Mostly Negative / Several Impacts

Servicing Strategy Options	Evaluation Factors				
	Technical	**Financial**	**Legal / Jurisdictional**	**Environmental**	**Socio / Cultural**
Key Differentiators	• Option 1 is most compatible with existing and future infrastructure, would result in the least amount of scheduling and financial risk and would still be able to accommodate traffic during construction. Options 3a, 3b, 4a and 4b may be constrained by smaller rights-of-way, CN and CP rail crossings and its ability to maintain access to the Cambridge Memorial Hospital and St. John's ambulance station	• Option 1 will result in the smallest capital costs ($2.2 million) while Options 3a, 3b, 4a and 4b will experience higher capital costs for both the watermain alignment and acquisition of property and/or easements	• Option 1 is not anticipated to require any additional property, while Options 3a, 3b, 4a and 4b will most likely require additional property and significant coordination with CN and CP Rail for tunneling under their tracks	• None of the options are anticipated to significantly impact the natural environment	• All of the options will result in some impacts to residences and local commuters (which will be mitigated); but for each option, it is imperative to coordinate with Cambridge Memorial Hospital to ensure access and mobility issues are addressed as needed • Option 1 will avoid construction along residential streets
Option 1: Coronation Boulevard	• Is compatible with existing and future infrastructure as it maintains two independent supplies to pumping station and hospital, avoids crossing the rail line, encompasses large right-of way for improvements, and has the opportunity to coordinate with future road improvements on Coronation Boulevard • Minimal project delivery risk as improvements would only occur within the Regional right-of-way, would avoid conflicts with major utilities, would require limited coordination with other jurisdictions and would avoid trench less technology • Because of its wide right-of-way, traffic on Coronation Boulevard would be maintained as two lanes could stay opened	• Open cut method of construction will result in $2.2 million in capital costs • No land acquisition or easements required	• No property acquisition anticipated • Complies with applicable local and Regional planning policies	• No significant environmental impacts anticipated • Small potential for contaminated soil to impact the project	• A limited number of residences and businesses along Coronation Boulevard will be impacted by the construction • Coordination with Cambridge Memorial Hospital is required to ensure access and mobility issues are addressed as needed • Modest impact to traffic on four-lane Coronation Boulevard as wide right-of-way will enable two lanes to be open during construction • Potential noise, vibration and dust impacts along Coronation Boulevard anticipated during open cut construction
Option 3a: Jaffray Street / Oliver Avenue / Coronation Boulevard	• Modest construction and financial risk as a result of increased jurisdictional issues, easement and property requirements and coordination with CN and CP railways (crossings)	• Open cut and tunneling construction will results in $3.0 million in capital costs, • Additional costs associated with land	• Acquisition of property or easements likely; coordination and the need for permits with CN or CP railways also likely	• No significant environmental impacts anticipated • Potential brownfield site and contaminated soil will result in the	• A limited number of residences and businesses along Jaffray Street, Oliver Avenue and Coronation Boulevard will be impacted by the construction • Coordination with Cambridge Memorial Hospital is required to ensure access and mobility issues are addressed as needed

Table 4. Stage II Evaluation of Watermain Alignment Alternatives

Servicing Strategy Options	Evaluation Factors				
	Technical	Financial	Legal / Jurisdictional	Environmental	Socio / Cultural
	• Narrow rights-of-way could hinder access to hospital and to St. John's ambulance station	acquisition and easements	• Complies with applicable local and Regional planning policies	need for contamination review / investigation / remediation	• Access to St. John's ambulance station on Jaffray Street (single entry) needs to be maintained • Potential noise, vibration and dust impacts anticipated during open cut and tunneling construction
Option 3b: Jaffray Street / Boiler Lands / Coronation Boulevard	• Modest construction and financial risk as a result of increased jurisdictional issues, easement and property requirements and coordination with CN and CP railways (crossings) • Narrow rights-of-way could hinder access to hospital and to St. John's ambulance station	• Open cut and tunneling construction will result in additional $2.5 million in capital costs • Additional costs associated with land acquisition and easements	• Acquisition of property or easements likely; coordination and the need for permits with CN or CP railways also likely • Complies with applicable local and Regional planning policies	• No significant environmental impacts anticipated • Potential brownfield site and contaminated soil will result in the need for contamination review / investigation / remediation	• A limited number of residences and businesses along Jaffray Street, Oliver Avenue (east side) and Coronation Boulevard will be impacted by construction • Coordination with Cambridge Memorial Hospital is required to ensure access and mobility issues are addressed as needed • Access to St. John's ambulance station on Jaffray Street (single entry) needs to be maintained • Potential noise, vibration and dust impacts anticipated during open cut and tunneling construction
Option 4a: Spiers Crescent / Pitt Street / Wauchope Avenue / Oliver Avenue / Coronation Boulevard	• Modest construction and financial risk as a result of increased jurisdictional issues, easement and property requirements and coordination with CN and CP railways (crossings) • Narrow rights-of-way could hinder access to hospital and to St. John's ambulance station • Steep embankment on Wauchope Avenue would increase the potential for trenchless length	• Open cut and tunneling construction will result in additional $3.2 million in capital costs • Additional costs associated with land acquisition and easements	• Acquisition of property or easements likely; coordination and the need for permits with CN or CP railways also likely • Complies with applicable local and Regional planning policies	• No significant environmental impacts anticipated • Potential brownfield site and contaminated soil will result in the need for contamination review / investigation / remediation	• Several residences along Spiers Crescent, Pitt Street, Wauchope Avenue, Oliver Avenue and Coronation Boulevard will be impacted by the construction • Coordination with Cambridge Memorial Hospital is required to ensure access and mobility issues are addressed as needed • Potential noise, vibration and dust impacts anticipated during open cut and tunneling construction
Option 4b: Spiers Crescent / Pitt Street / Wauchope Avenue / Boiler Lands / Coronation Boulevard	• Modest construction and financial risk as a result of increased jurisdictional issues, easement and property requirements and coordination with CN and CP railways (crossings) • Narrow rights-of-way could hinder access to hospital and to St. John's ambulance station • Steep embankment on Wauchope Avenue would increase the potential for trenchless length	• Open cut and tunneling construction will result in additional $2.8 million in capital costs • Additional costs associated with land acquisition and easements	• Acquisition of property or easements likely; coordination and the need for permits with CN or CP railways also likely • Complies with applicable local and Regional planning policies	• No significant environmental impacts anticipated • Potential brownfield site and contaminated soil will result in the need for contamination review / investigation / remediation	• Several residences along Spiers Crescent, Pitt Street, Wauchope Avenue and Coronation Boulevard will be impacted by the construction • Coordination with Cambridge Memorial Hospital is required to ensure access and mobility issues are addressed as needed • Potential noise, vibration and dust impacts anticipated during open cut and tunneling construction

Table 5. Stage II Evaluation: Results and Recommendations

Watermain Alignment Option	Recommendation
Option 1: Coronation Boulevard	**Recommended** **Justification:** Option 1 is recommended as the most technically feasible alignment alternative because: • It is the most compatible with existing and future infrastructure. • It will cost the least to construct of the five alignment alternatives ($2.2 million). • Unlike the other options, Option 1 is not anticipated to require any additional property/easement acquisition. • It will result in the least amount of scheduling and financial risk and would be able to accommodate traffic during construction. While there are some impacts associated with Option 1, they are minor in nature and can be mitigated. As is the case with all of the options, it is imperative to coordinate with Cambridge Memorial Hospital to ensure access and mobility issues are addressed as needed.
Option 3a: Jaffray Street / Oliver Avenue / Coronation Boulevard	**Not Recommended** **Justification:** Option 3a involves several challenges: • It will be constrained by smaller rights-of-way to accommodate the new watermain. • It will experience higher capital costs ($3.0 million) plus additional costs related to property acquisition. • It will require significant coordination with CN and CP rail over rail crossings. • It could hinder access to Cambridge Memorial Hospital and St. John's ambulance station.

Watermain Alignment Option	Recommendation
Option 3b: Jaffray Street / Babcock and Wilcox Lands / Coronation Boulevard	**Not Recommended** **Justification:** Option 3b involves several challenges: • It will experience higher capital costs ($2.5 million) plus additional costs related to property acquisition. • It will require significant coordination with CN and CP rail over rail crossings. • It could hinder access to Cambridge Memorial Hospital and St. John's ambulance station.
Option 4a: Spiers Crescent / Pitt Street / Wauchope Avenue / Oliver Avenue / Coronation Boulevard	**Not Recommended** **Justification:** Option 4a involves several challenges: • Construction impacts could be significant for the many residents who live along the corridor. • It will experience higher capital costs ($3.2 million) plus additional costs related to property acquisition. • It will require significant coordination with CN and CP rail over rail crossings. • It could hinder access to Cambridge Memorial Hospital and St. John's ambulance station. • A steep embankment on Wauchope Avenue would increase the potential for a trenchless length.
Option 4b: Spiers Crescent / Pitt Street / Wauchope Avenue / Babcock and Wilcox Lands / Coronation Boulevard	**Not Recommended** **Justification:** Option 4b involves several challenges: • Construction impacts could be significant for the many residents who live along the corridor. • It will experience higher capital costs ($2.8 million) plus additional costs related to property acquisition. • It will require significant coordination with CN and CP rail over rail crossings. • It could hinder access to Cambridge Memorial Hospital and St. John's ambulance station. • A steep embankment on Wauchope Avenue would increase the potential for a trenchless length.

4 Cam 1W Booster Pump Station Site

4.1 Evaluation Process

The new Cam 1W Pumping Station will be the primary source of water to the Cam 1W zone, a closed pressure zone. As such, identifying a suitable location for a pumping station focused on having adequate overlap between pumps that would configure with Variable Frequency Drive (VFD) and pump controls in order to maintain a constant Zone HGL under all demand conditions. In addition, the pumping station would be required to be fully integrated into the Region's existing SCADA system to allow for:

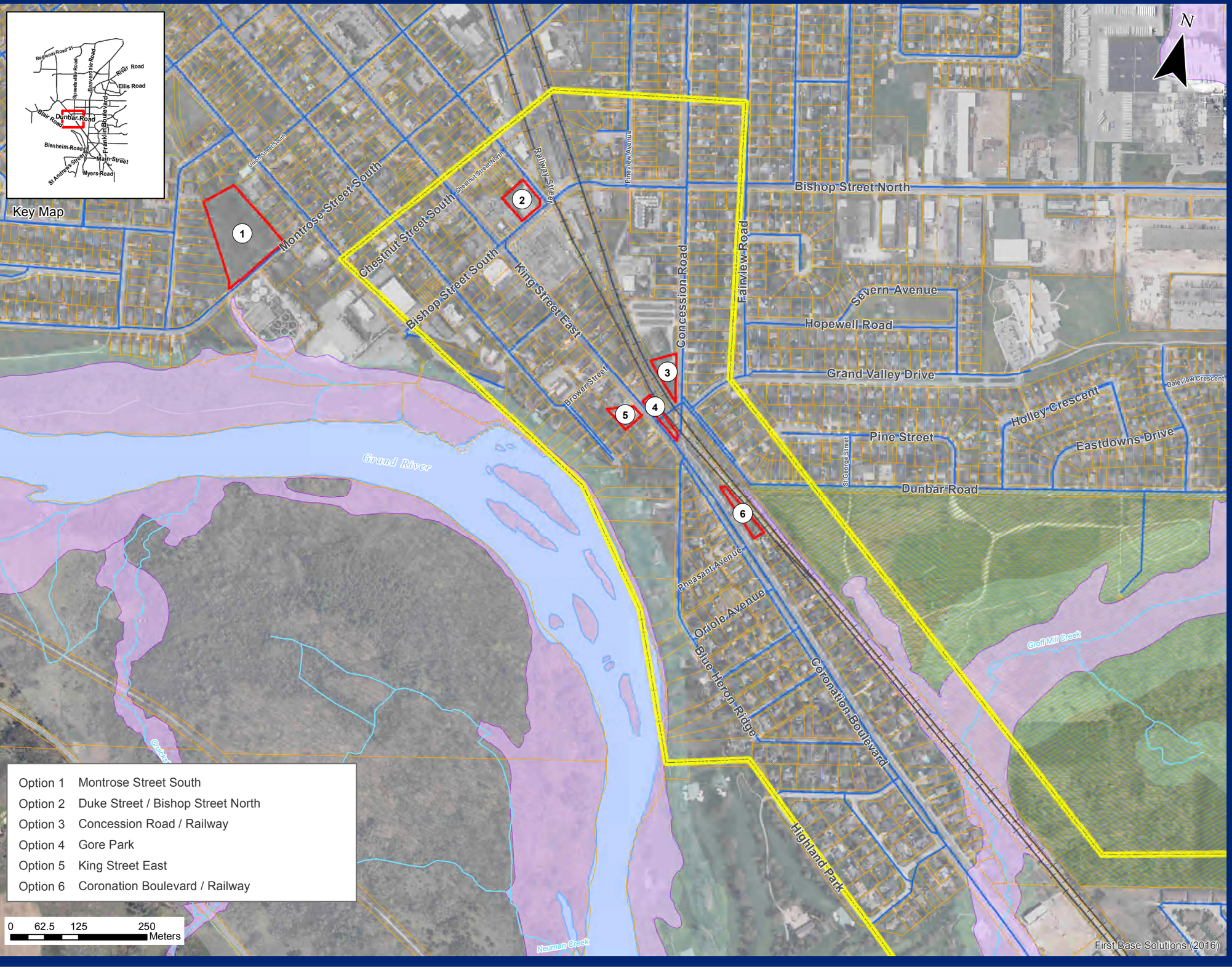
- Pumping station controls to be managed by local discharge pressures and may be informed by system pressures at either the Kress Hill PRV and/or New Dundee PRV or other pressure monitoring points as required
- Coordination of operations of the Middleton Pumping Station, Turnbull and other Zone 1 sources during peak flow periods
- Automated monitoring of upstream and downstream secondary disinfection residual levels.

4.2 Long List of Potential Pump Station Sites

Recognizing the important functions of a new pumping station within the Cam 1W Zone, and the need to be integrated with the recommended Coronation Boulevard watermain alignment (Option 1) described above, an initial list of 12 pumping station sites within the study area was identified through site visits and a desktop review. To facilitate this evaluation, the pumping station sites were grouped into a "north" study area and a "south" study area as illustrated in **Figure 3** and **Figure 4** as described below:

Potential Pumping Station Sites – North Study Area

- Option 1: Montrose Street South
- Option 2: Duke Street / Bishop Street North
- Option 3: Concession Road / Railway
- Option 4: Gore Park
- Option 5: King Street East
- Option 6: Coronation Boulevard / Railway



Region of Waterloo

Creation of Cambridge Pressure Zone 1W Class EA

Figure 3

Pumping Station Site Alternatives - Long List (Northern Sections)

- Watermain
- Railway
- Long List of Property Sites
- Focus Area
- Parcels

Pump Station Foot Print Limits

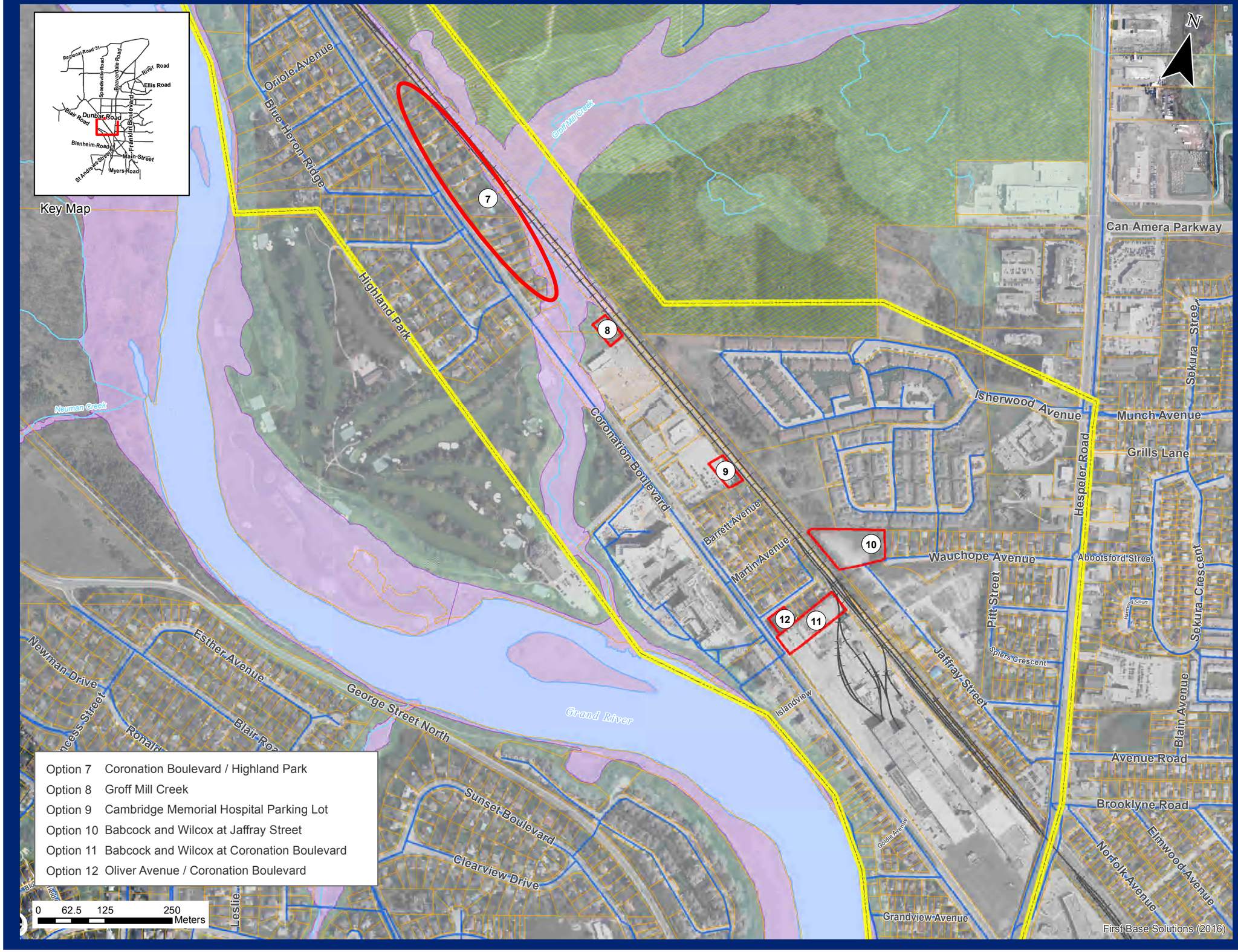
- 30 m X 20 m
- 30 m X 60 m

Environmental Features

- Creeks
- Rivers
- Grand River Conservation Authority Limits
- Regulatory Floodplain
- Dumfries Conservation Area

BluePlan ENGINEERING

716015-17A-W-PS Long List (North)
March 2017
Data Source: Region of Waterloo
Scale: 1:6,750 | NAD 1983 UTM Zone 17N



Region of Waterloo

Creation of Cambridge Pressure Zone 1W Class EA

Figure 4

Pumping Station Site Alternatives - Long List (Southern Sections)

- Watermain
- Railway
- Long List of Property Sites
- Focus Area
- Parcels

Pump Station Foot Print Limits

- 30 m X 20 m
- 30 m X 60 m

Environmental Features

- Creeks
- Rivers
- Grand River Conservation Authority Limits
- Regulatory Floodplain
- Dumfries Conservation Area

BluePlan ENGINEERING

716015-17B-W-PS Long List (South)
March 2017
Data Source: Region of Waterloo
Scale: 1:6,750 | NAD 1983 UTM Zone 17N

Potential Pumping Station Sites – South Study Area

- Option 7: Coronation Boulevard / Highland Park
- Option 8: Groff Mill Creek
- Option 9: Cambridge Memorial Hospital Parking Lot
- Option 10: Babcock and Wilcox at Jaffray Street
- Option 11: Babcock and Wilcox at Coronation Boulevard
- Option 12: Oliver Avenue / Coronation Boulevard

The evaluation of the pumping station sites was also undertaken in two stages: Stage I "screened" a long list of pumping station sites down to a smaller group, which would be evaluated more rigorously in Stage II. Similar to the screening of alignment alternatives, the long list of pumping station sites was evaluated on the following three screening criteria:

- **Does the Pumping Station Site Support the Problem / Opportunity Statement?**
    - Is the pumping station site able to address the issues identified in the problem / opportunity?
- **Is the Pumping Station Site Technically Viable?**
    - Is the site available and large enough to accommodate a pumping station?
    - Will the site support the community's infrastructure needs?
- **Is the Pumping Station Site Reasonable?**
    - Will the site avoid unnecessary impacts to existing and future land uses?
    - Will the site maximize the use of existing infrastructure capacity, while minimizing capital upgrades where possible?

Those alternatives that received one "no" (*x*) response were screened out from further consideration. Conversely, those pumping station sites that met all three screening criteria (√) were carried forward into the more rigorous Stage II evaluation. **Table 6** and **Table 7** summarize the Screen I Evaluation of the pumping station sites for the northern and southern sections of the study area.

Table 6. Screen I Evaluation of Pumping Stations- Northern Sites

Pumping Station Site Options (North)	Addresses the Problem Statement?	Is Technically Viable?	Is Reasonable?	Recommended for Further Study?
Option 1: ***Montrose Street South***	√	√	√	**Yes**
Option 2: ***Duke Street / Bishop Street North***	√	x	√	**No**
Option 3: ***Concession Road / Railway***	√	√	x	**No**
Option 4: ***Gore Park***	√	x	√	**No**
Option 5: ***King Street East***	√	x	√	**No**
Option 6: ***Coronation Boulevard / Railway***	√	x	√	**No**

Table 7. Screen I Evaluation of Pumping Stations- Southern Sites

Pumping Station Site Options (South)	Addresses the Problem Statement?	Is Technically Viable?	Is Reasonable?	Recommended for Further Study?
Option 7: ***Coronation Boulevard / Highland Park***	√	√	x	No
Option 8: ***Groff Mill Creek***	√	√	√	Yes
Option 9: ***Cambridge Memorial Hospital Lot***	√	√	√	Yes
Option 10: ***Babcock and Wilcox at Jaffray Street***	√	x	√	No
Option 11: ***Babcock and Wilcox at Coronation Boulevard***	√	√	√	Yes
Option 12: ***Oliver Avenue / Coronation Boulevard***	√	√	√	Yes

4.3 Short List of Potential Pump Station Sites

Five pumping station sites advanced into the Stage II evaluation – one located in the northern section of the study area and four sites positioned in the south. The remaining five alternatives were evaluated on the same key factors as applied to the evaluation of alignment alternatives:

- Technical feasibility;
- Financial viability (costs);
- Legal / jurisdictional (coordination and compliance);
- Environmental impacts; and,
- Socio/cultural impacts.

The evaluation process used to assess the pumping station locations mirrored the one previously used for the watermain alignment options (see **Section 3.3**). The complete results of the Stage II Evaluation of the pumping station sites is provided in **Appendix C**. A summary of the Stage II Evaluation is provided in **Table 8.**

4.4 Recommended Pump Station Site

Having ranked each alternative accordingly, the evaluation and selection of a technically preferred solution was again guided by the *Reasoned Argument Approach* which provided a clear and thorough rationale of the tradeoffs between the various evaluation factors and criteria and identified the reasons why one pumping station site best meets the servicing needs of the new Cambridge Zone 1W Pressure Zone. **Table 9** presents an overview of the recommended pump station site.

Table 8. Stage II Evaluation of Pumping Station Site Alternatives

Mostly Positive / Few Impacts

Positive and Negative / Some Impacts

Mostly Negative / Several Impacts

Servicing Strategy Options	Evaluation Factors				
	Technical	**Financial**	**Legal / Jurisdictional**	**Environmental**	**Socio / Cultural**
Key Differentiators	• **Options 1 and 2 comprise lands that are owned partially or fully by a municipality, while Options 3,4, and 5 require the purchase of privately owned parcels** • **Risks to delivering the project are highest for those options where contamination is likely, access to the site is limited, and transferring property rights is challenging (Options 3, 4, and 5)**	• **Option 2 is the lowest cost among the six alternatives; Option 1 requires significant additional cost for watermain extension while Options 3, 4, and 5 necessitate the purchase of private property.**	• **Options 1 and 2 comply best with existing planning policies and require limited or no property acquisition**	• **None of the options comprise significant environmental impacts, although additional assessments and engagement should be undertaken for Option 1 (Groff Mill Creek crossing) and Option 2 (floodplain)**	• **With the exception of Option 2, all of the alternatives would be constructed within existing neighbourhoods (or in the case of Option 3, which would eliminate existing parking utilized by the Cambridge Memorial Hospital parking), requiring significant consultation with residents and adjacent land owners and the need for mitigation measures to minimize the impacts.**
Option 1: Montrose Street South	• Regional-owned site is located adjacent to the existing wastewater treatment plant but would require the watermain to be significantly extended beyond Coronation Boulevard • Provides sufficient capacity to meet future servicing needs • Low project delivery risk given the fact that the site is owned by the Region • Minimal traffic management issues in accessing site	• Relatively high costs associated with the pumping station and the significant extension of the watermain from Coronation Boulevard (an additional $4.1 for the extension)	• No land acquisition is required • The Region owns the site at 370 Montrose Street South	• Parcel is heavily vegetated but formal assessment indicates that little vegetation needs to be preserved • Crossing of Groff Mill Creek anticipated	• A residential community surrounds the proposed property, which will require consultation with residents and the local ratepayer group as needed
Option 8: Groff Mill Creek	• Located on land partially owned by the City of Cambridge; constitutes large parcel adjacent to proposed Coronation Boulevard watermain • Provides sufficient capacity to meet future servicing needs with opportunity for natural overflow • Parcel located within a floodplain increases overall delivery risk • Requires acquisition of property or easement for access	• Relatively modest costs associated with the pumping station and watermain extension ($0.6 million) as a portion of the facility would be constructed on City of Cambridge-owned land	• Property is partially owned by the City of Cambridge but access is regulated as a floodplain • Requires acquisition of property or easement for access • Current land is vacant and should not conflict with any adjacent uses	• Site partially located within GRCA regulated area requiring special permitting, but initial discussions with GRCA suggested no major issues with locating pumping station on this parcel • Species at Risk identified north of site at Dumfries Conservation area, but not at specific location where pumping station would be constructed	• Few properties surround the proposed site so (real or perceived) community impacts would be limited

Table 8. Stage II Evaluation of Pumping Station Site Alternatives

Servicing Strategy Options	Evaluation Factors				
	Technical	Financial	Legal / Jurisdictional	Environmental	Socio / Cultural
Option 9: Cambridge Memorial Hospital Parking Lot	• Privately-owned land is located adjacent to proposed Coronation Boulevard watermain • Provides sufficient capacity to meet future servicing needs, but parcel may be limited due to existing use (hospital parking lot) • Hospital ownership of the parcel suggests significant delays in coordination, transferring the property and constructing the facility • Significant traffic issues during construction and maintenance as site is located within hospital parking lot	• Relatively modest costs associated with the pumping station and watermain extension ($0.2 million), although additional costs will result from property acquisition	• Existing parking lot utilized which is primarily utilized by Cambridge Memorial Hospital staff and visitors	• No significant environmental impacts, but potentially contaminated soil will result in the need for contamination review / investigation / remediation	• Potential community resistance would revolve around the location's potential impact on the hospital, emergency access, and parking availability • Significant traffic impacts may occur during construction in heavily used hospital parking lot
Option 11: Babcock and Wilcox at Coronation Boulevard	• Privately-owned land is located adjacent to proposed Coronation Boulevard watermain • Large parcel provides sufficient capacity to meet future servicing needs, but requires stormwater overflow • Parcel likely comprises significant contamination suggests delays in coordination, transferring the property and constructing the facility • No traffic impacts	• Relatively modest costs associated with the pumping station, although additional costs will result from property acquisition	• Property will need to be acquired through private land owner • May not conform with existing policies or uses	• No significant environmental impacts, but potentially contaminated soil will result in the need for contamination review / investigation / remediation	• A residential community on the west is adjacent to the proposed property, which will require consultation with residents
Option 12: Oliver Avenue and Coronation Boulevard	• Privately-owned land is located adjacent to proposed Coronation Boulevard watermain • Parcel provides sufficient capacity to meet future servicing needs, but is somewhat constrained by size and requires stormwater overflow • Parcel likely comprises significant contamination suggests delays in coordination, transferring the property and constructing the facility • Significant access issues as a result of its limited size and surrounding land uses	• Relatively modest costs associated with the pumping station, although additional costs will result from property acquisition	• Property will need to be acquired through private land owner • May not conform with existing policies or uses	• No significant environmental impacts, but potentially contaminated soil will result in the need for contamination review / investigation / remediation	• The proposed site is imbedded into a local neighbourhood which will require consultation with residents • Traffic impacts during construction may occur as a result of limited space and access into the site

Table 9. Stage II Evaluation: Results and Recommendations

Watermain Alignment Option	Recommendation
Option 1: Montrose Street South	**Not Recommended** **Justification:** Option 1 involves several challenges: • The site requires excessive costs for both the pumping station and watermain extension (Additional $4.1 million cost to extend the watermain). • The site necessitates watermain crossing Groff Mill Creek as part of the watermain extension along Coronation Boulevard, which would require permits and additional mitigation measures. • Construction impacts could be significant for many residents along Montrose Street South and those that back onto the site.
Option 8: Groff Mill Creek	**Recommended** **Justification:** Option 8 is recommended as the most technically feasible alternative because: • The site is located on a large parcel partially owned by the City of Cambridge and adjacent to proposed Coronation Boulevard watermain. • The property requires modest additional costs associated with extending the watermain to the site (+$0.6 million). • Few properties surround the proposed site so community impacts will be minimal. While part of the property is owned by the City of Cambridge, construction of the pumping station will require acquisition of property or easement for access to the site. In addition, the site is partially located within a floodplain requiring special permitting, but initial discussions with GRCA suggested no major issues with locating pumping station on this parcel.

Watermain Alignment Option	Recommendation
Option 9: Cambridge Memorial Hospital Parking Lot	**Not Recommended** **Justification:** Option 9 involves several challenges: • The parcel is located on land currently owned by Cambridge Memorial Hospital. • Potential community resistance would revolve around the location's potential impact on the hospital, emergency access, and parking availability. • Significant traffic impacts may occur during construction in heavily used hospital parking lot.
Option 11: Babcock and Wilcox at Coronation Boulevard	**Not Recommended** **Justification:** Option 11 involves several challenges: • The property will need to be acquired through a private land owner, further increasing the costs of the pumping station. • Construction impacts could be significant for many residents who around the site. • The parcel likely comprises significant contamination, suggesting delays in coordination, transferring the property and constructing the facility.
Option 12: Oliver Avenue and Coronation Boulevard	**Not Recommended** **Justification:** Option 12 involves several challenges: • The property will need to be acquired through a private land owner, further increasing the costs of the pumping station. • The parcel likely comprises significant contamination, suggesting delays in coordination, transferring the property and constructing the facility. • The site comprises significant access issues as a result of its limited size and surrounding land uses.

5 Kress Hill Cam 2W to Cam 1W PRV

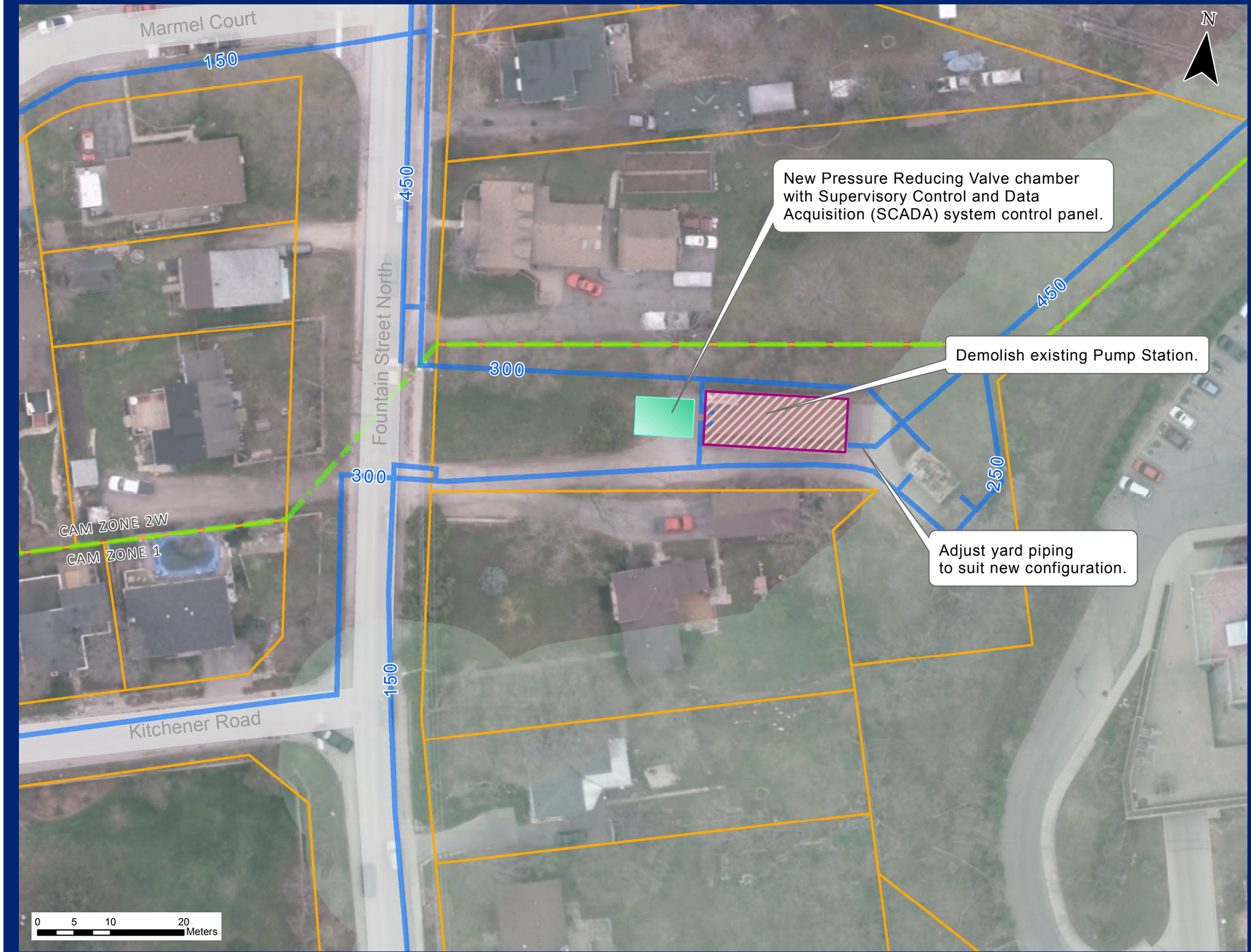
Based on the recommended Cam 1W operational strategy, a total of three PRVs are recommended at the Kress Hill PRV. The new PRV station will be located within the existing Kress Hill Pump Station site. The Kress Hill Pump Station has been offline for several years and was planned to be decommissioned as part of the Kress Hill PRV works. A subsequent site visit to the Kress Hill Pump Station site and building, confirmed that the existing pump station building appears to be in relatively good condition.

In consultation with the Region's operations staff, a total of three (3) potential site options were considered:

- Construct a new PRV chamber and decommission (demolish) the existing Kress Hill Pump Station building and/or convert the building into a local storage facility.
- Partially demolish the existing Kress Hill Pump Station building, and install the PRVs within the existing pump station basement.
- Re-purpose the existing pump station as a PRV station, by replacing the three (3) existing pumps with PRVs, along with general process pipe replacement.

Figure 5, Figure 6, and Figure 7 present the three concepts. **Table 10** summarizes the projected capital cost of the three (3) options. Under all three (3) options, the following assumptions were made:

- No significant yard piping works will be needed to accommodate the new PRVs;
- The PRVs will consist of:
    - 1 – 100 mm low flow PRV
    - 2 – 350 mm high flow PRV, each sized to convey ~500 L/s; and,
- New electrical and SCADA controls are required.



Region of Waterloo

Creation of Cambridge Pressure Zone 1W Class EA

Figure 5

Kress Hill PRV Option 1

New Pressure Reducing Valve (PRV) Chamber

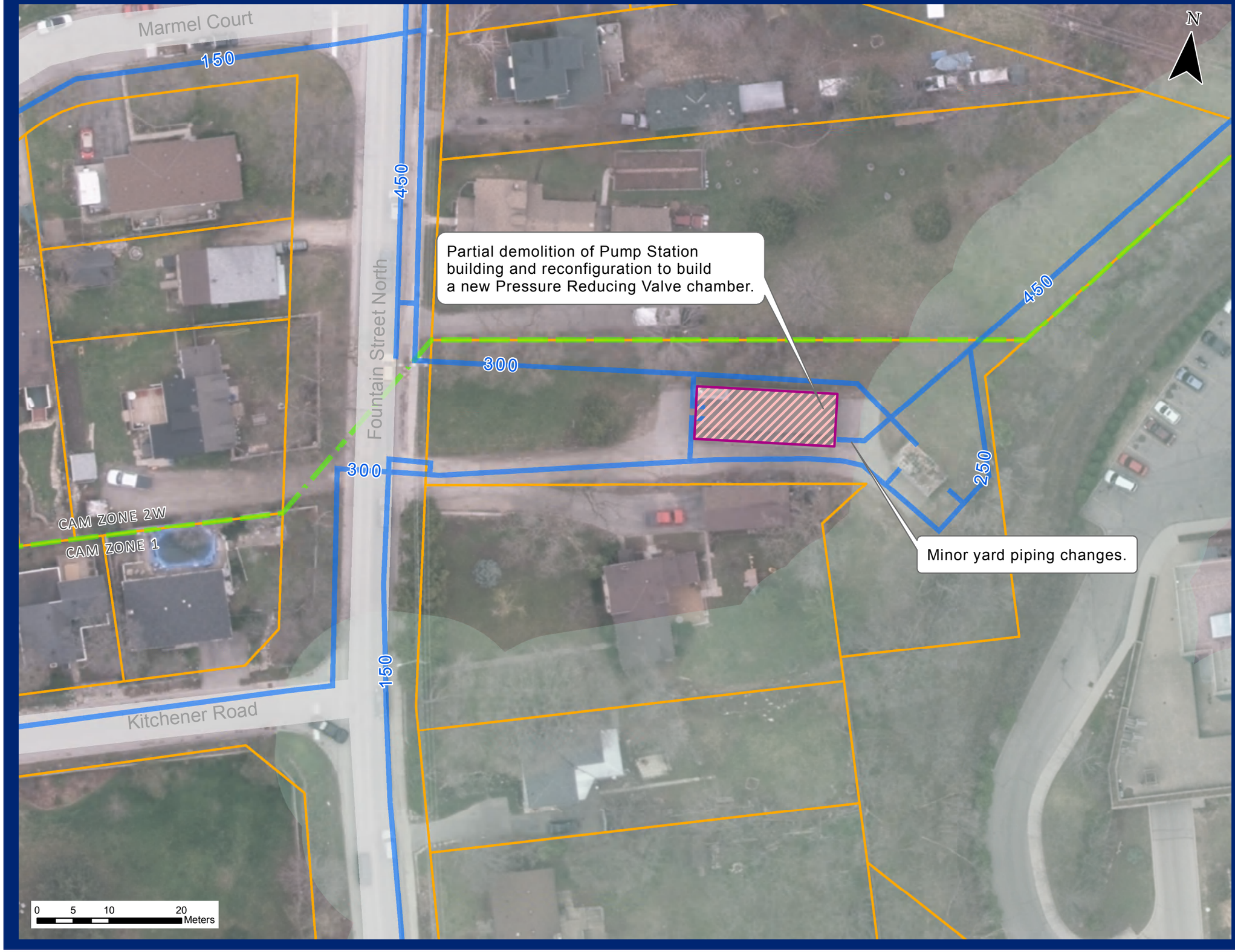
- Watermain
- Existing Pressure Zone
- Parcels
- Exisitng Pump Station Site

Environmental Features

- Creeks
- Rivers
- Grand River Conservation Authority Limits
- Regulatory Floodplain
- Dumfries Conservation Area

BluePlan ENGINEERING

716015-22A-W-KressHill Option 1
March 2017
Data Source: Region of Waterloo
Scale: 1:500 | NAD 1983 UTM Zone 17N



Region of Waterloo

Creation of Cambridge Pressure Zone 1W Class EA

Figure 6

Kress Hill PRV Option 2

Partial use of existing Pump Station building

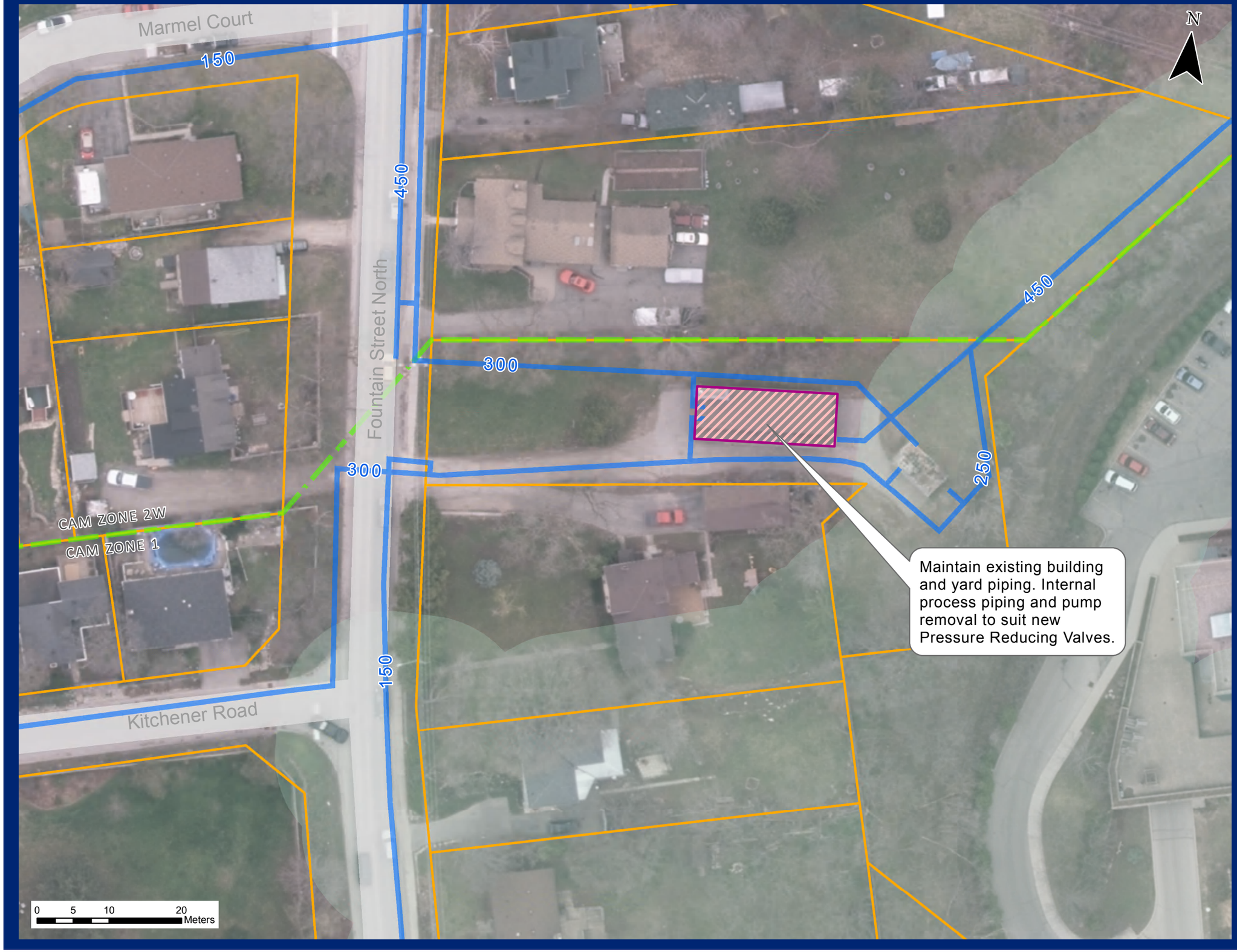
- Watermain
- Existing Pressure Zone
- Parcels
- Exisitng Pump Station Site

Environmental Features

- Creeks
- Rivers
- Grand River Conservation Authority Limits
- Regulatory Floodplain
- Dumfries Conservation Area

BluePlan ENGINEERING

716015-22B-W-KressHill Option 2
March 2017
Data Source: Region of Waterloo
Scale: 1:500 | NAD 1983 UTM Zone 17N



Region of Waterloo

Creation of Cambridge Pressure Zone 1W Class EA

Figure 7

Kress Hill PRV Option 3

Convert Pump Station to Pressure Reducing Valve (PRV) Station

- Watermain
- Existing Pressure Zone
- Parcels
- Exisitng Pump Station Site

Environmental Features

- Creeks
- Rivers
- Grand River Conservation Authority Limits
- Regulatory Floodplain
- Dumfries Conservation Area

BluePlan ENGINEERING

716015-22C-W-KressHill Option 3
March 2017
Data Source: Region of Waterloo
Scale: 1:500 | NAD 1983 UTM Zone 17N

Table 10. Kress Hill PRV Cost Estimates

	Option 1 Construct a new PRV chamber	Option 2 Partially demolish the existing Kress Pump Station Building	Option 3 Re-purpose the existing Pump Station as a PRV station
Pump Station Building Demolition and/or Modifications	$350K	$300K	$100K
PRV & Equipment	$500K	$400K	$400K
Total Cost	**$850K**	**$700K**	**$500K**

Based on a review of the options, it is recommended that Option 3, **Re-purposing the existing pump station as a PRV station,** be implemented as it**:**

- Has the lowest capital cost, by a significant margin;
- Utilizes an existing facility that would otherwise be demolished; and,
- Provides operations with additional space, allowing for ease of future inspection and maintenance.

6 Hespeler Road Cam 2E to Cam 1 PRV

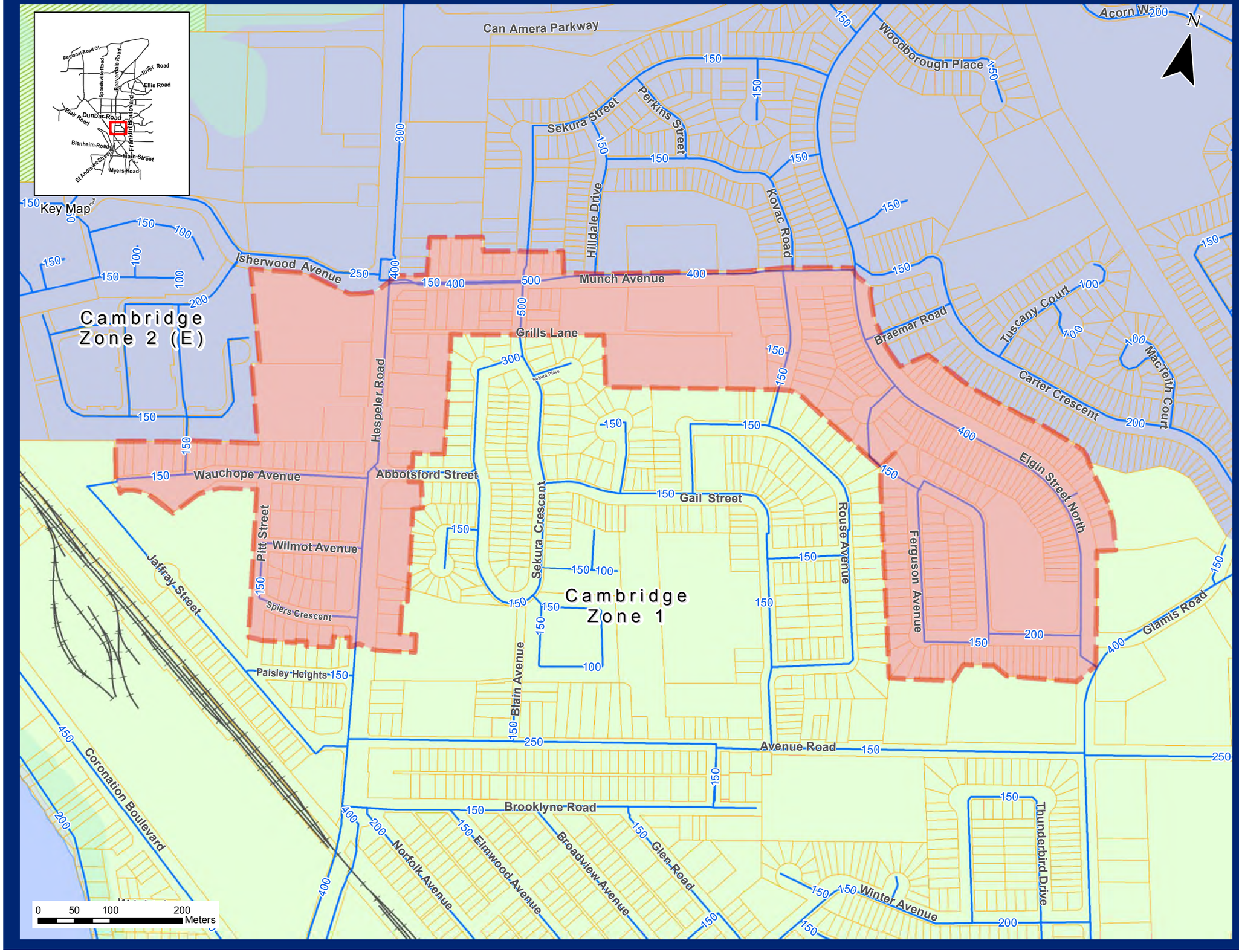
As part of the Cam 1 zone boundary re-alignment and HGL change, the boundary between Cam 2E and Cam 1 along Munch Avenue and Elgin Street will be adjusted south. **Figure 8** highlights this proposed boundary change.

As part of the zone boundary change and overall strategy to strengthen security of supply within the Cambridge water system, a new Cam 2E to Cam 1 PRV is proposed at the new zone boundary along the existing Hespeler trunk watermain. As identified in the Cambridge Implementation Plan, this new PRV will be normally closed, and would open only under emergency conditions - such as a long-term Middleton Pump Station failure or local fire flow.

Based on the proposed zone boundary change, the PRV is required to be located between Spiers Crescent and Paisley Heights. In consultation with Region operations staff, the new PRV chamber must be located within the existing roadway cul-de-sacs of either Spiers Crescent or Paisley Heights.

Figure 9 and **Figure 10** present the two potential PRV chamber locations and inter-connecting watermain. Based on a review of the two sites and the required watermain works, it is recommended that the PRV be located at Spiers Crescent due to the increased installation complexity at the Paisley Heights site resulting from:

- Significant elevation grading within the Hespeler Road boulevard at Paisley Heights; and,
- The need for an additional watermain to integrate the existing Paisley Heights watermain into the Cam 1 Zone.



Region of Waterloo

Creation of Cambridge Pressure Zone 1W Class EA

Figure 8

Hespeler Road
Overview of Pressure Zone Boundary Change

- Watermain
- Parcels

Pressure Zone Changes

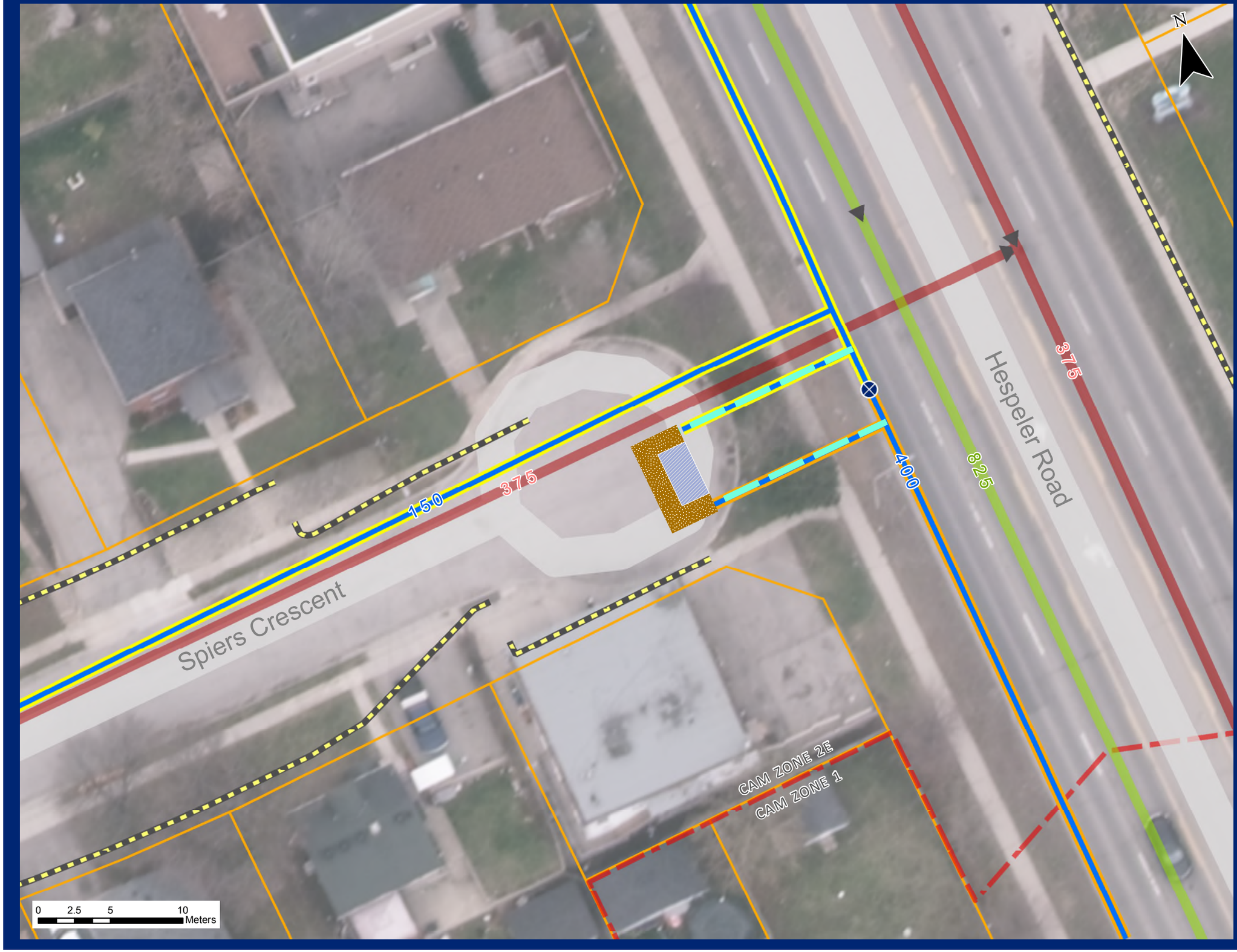
- Cam 2E Expansion
- Existing Cam 1 Pressure Zone
- Existing Cam 2E Pressure Zone

Environmental Features

- Creeks
- Rivers
- Grand River Conservation Authority Limits
- Regulatory Floodplain
- Dumfries Conservation Area

BluePlan Engineering

716015-20-W-Overview Water Pressure Zone Change
March 2017
Data Source: Region of Waterloo
Scale: 1:5,012 | NAD 1983 UTM Zone 17N



Region of Waterloo

Creation of Cambridge Pressure Zone 1W Class EA

Figure 9

Option 1

Spiers Crescent Hespeler Road Pressure Reducing Valve

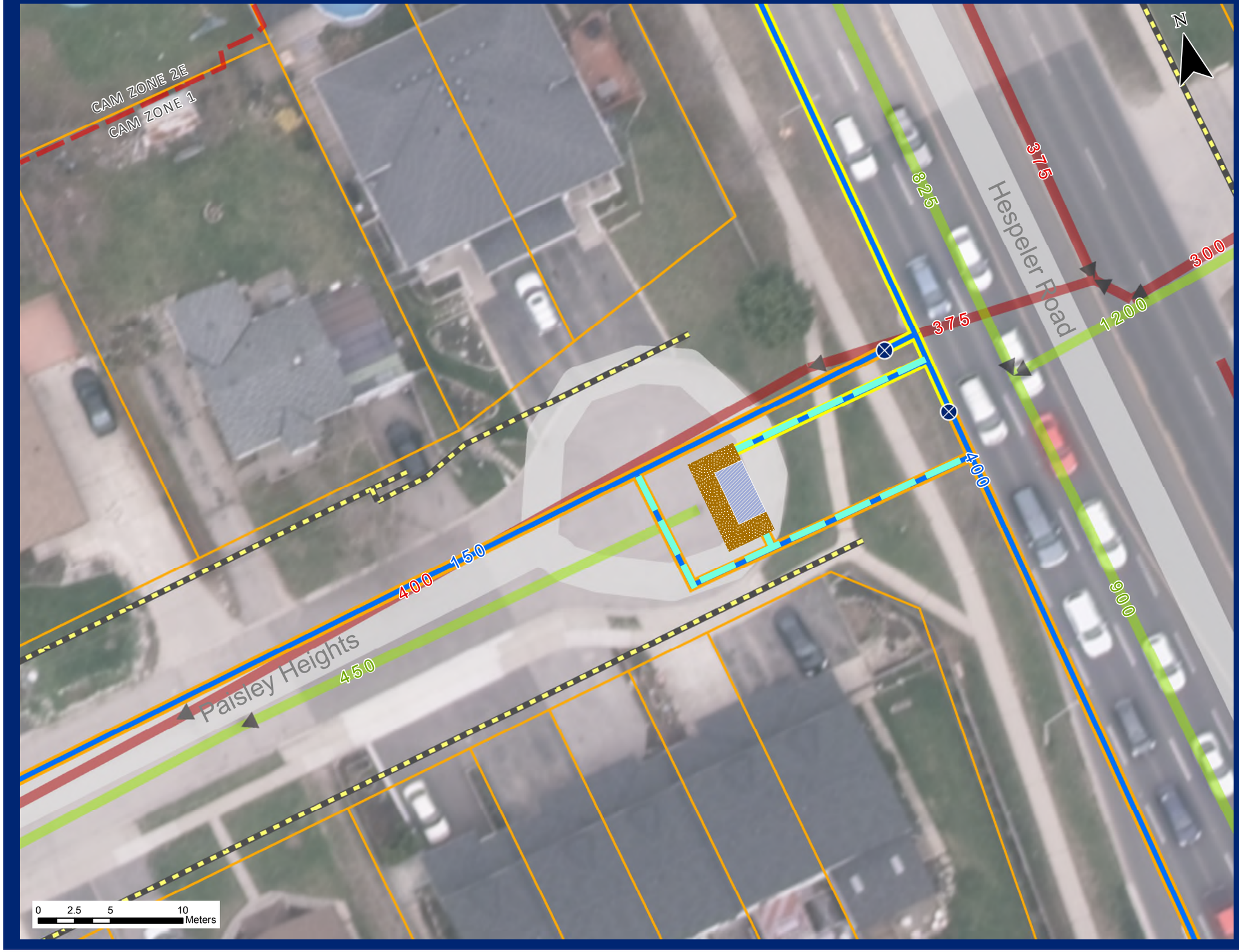
- New Isolated Valve
- Cam 1 Watermain
- Cam 2E Watermain
- New Cam 1 Watermain
- New Cam 2E Watermain
- Storm Pipes
- Sanitary Pipes
- Gas Without Service
- Cam 2E Expansion
- Parcels

Environmental Features

- Creeks
- Rivers
- Grand River Conservation Authority Limits
- Regulatory Floodplain
- Dumfries Conservation Area

BluePlan ENGINEERING

716015-21A-W-Hespeler PRV Spiers
March 2017
Data Source: Region of Waterloo
Scale: 1:250 | NAD 1983 UTM Zone 17N



Region of Waterloo

Creation of Cambridge Pressure Zone 1W Class EA

Figure 10

Option 2

Paisley Heights
Hespeler Road
Pressure Reducing Valve

- New Isolated Valve
- Cam 1 Watermain
- Cam 2E Watermain
- New Cam 1 Watermain
- New Cam 2E Watermain
- Storm Pipes
- Sanitary Pipes
- Gas Without Service
- Cam 2E Expansion
- Parcels

Environmental Features

- Creeks
- Rivers
- Grand River Conservation Authority Limits
- Regulatory Floodplain
- Dumfries Conservation Area

BluePlan ENGINEERING

716015-21B-W-Hespeler PRV Paisley
March 2017
Data Source: Region of Waterloo
Scale: 1:250 | NAD 1983 UTM Zone 17N

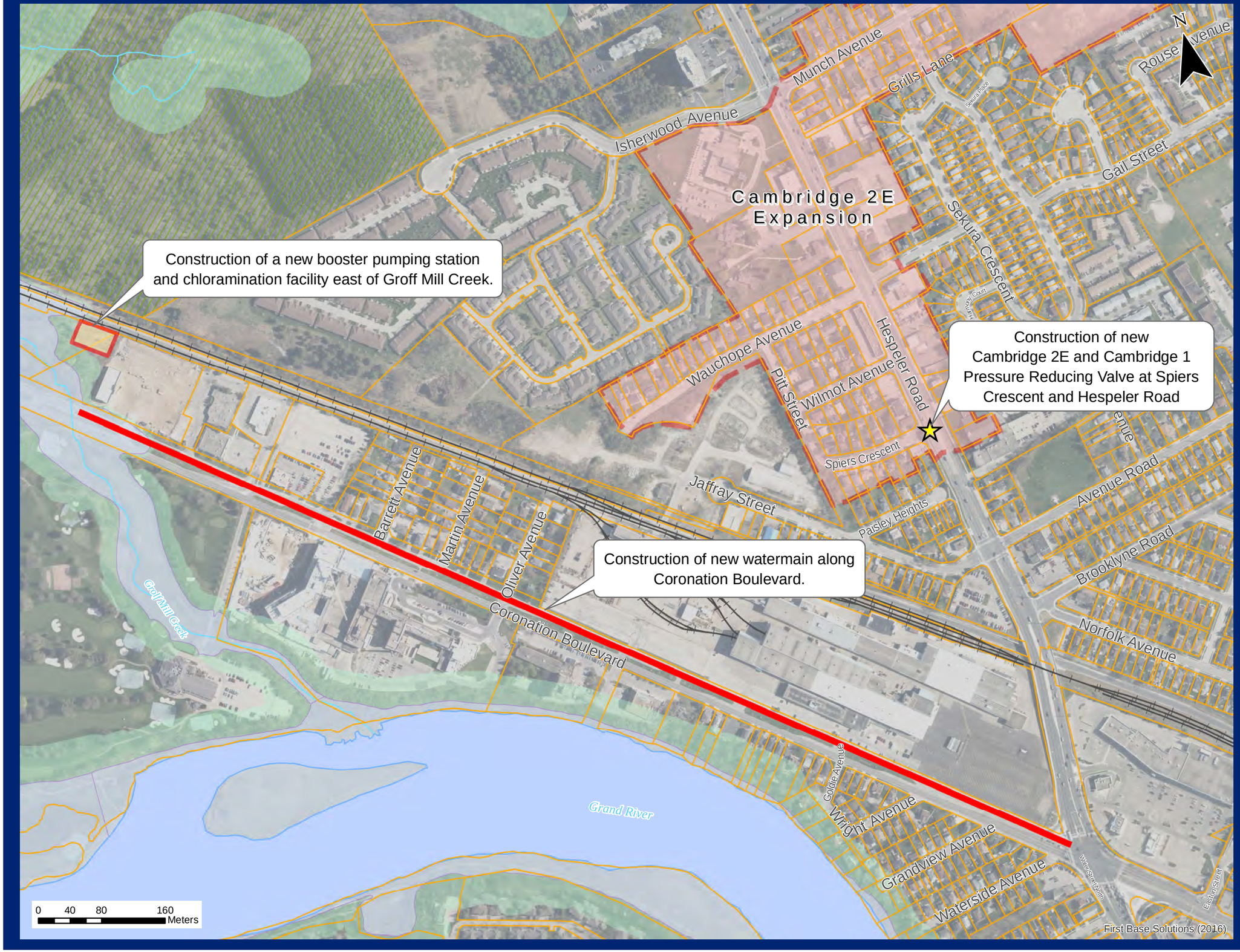
7 Cam 1W Infrastructure Recommendations

Through comprehensive analysis and feedback with key stakeholders and residents at the Public Consultation Centre (March 2, 2017*)*, the following summarizes the recommended infrastructure improvements that will comprise the new Cam 1 Pressure Zone, recommended Cam 1W operation strategy, infrastructure requirements, and infrastructure locations.

These recommended improvements include the following:

- **Constructing a new watermain along Coronation Boulevard** to support peak flows for the future Cam 1W Pumping and Chloramination Station while providing security of supply to the Cambridge Memorial Hospital. The new watermain will be sized to provide peak flows to the pumping station, and will be constructed within the Coronation Boulevard right-of-way.;
- **Constructing a new booster pumping station and chloramination facility** adjacent to Coronation Boulevard and east of Groff Mill Creek to serve as the primary source of water to the Cam 1W Pressure Zone system;
- **Re-purposing the existing Kress Hill Pumping Station as a PRV station** which will minimize implementation costs while providing operations with additional space, allowing for ease of future inspection and maintenance;
- **Construction of New Cam 2E and Cam 1 PRV** at Spiers Crescent, which will allow for the implementation of the proposed Cam Zone 1 boundary adjustment and strengthen the security of supply within the Cambridge water system; and,

Figure 11 illustrates the recommended infrastructure improvements that will establish the new Cambridge 1W Pressure Zone.



Region of Waterloo

Creation of Cambridge Pressure Zone 1W Class EA

Figure 11

Recommended Infrastructure Improvements

- Railway
- Preferred Alignment
- Preferred Pumping Station Site
- Cam 2E Expansion

Environmental Features

- Creeks
- Rivers
- Grand River Conservation Authority Limits
- Dumfries Conservation Area
- Regulatory Floodplain

BluePlan ENGINEERING

716015-25-W-Preferred Site and Alignment
March 2017
Data Source: Region of Waterloo
Scale: 1:4,560 | NAD 1983 UTM Zone 17N

Appendix H - Stage II Evaluation of Alignments

Table 4. Stage II Evaluation of Watermain Alignment Alternatives

Mostly Positive / Few Impacts

Positive and Negative / Some Impacts

Mostly Negative / Several Impacts

Servicing Strategy Options	Evaluation Factors				
	Technical	**Financial**	**Legal / Jurisdictional**	**Environmental**	**Socio / Cultural**
Key Differentiators	• **Option 1 is most compatible with existing and future infrastructure, would result in the least amount of scheduling and financial risk and would still be able to accommodate traffic during construction. Options 3a, 3b, 4a and 4b may be constrained by smaller rights-of-way, CN and CP rail crossings and its ability to maintain access to the Cambridge Memorial Hospital and St. John's ambulance station**	• **Option 1 will result in the smallest capital costs ($2.2 million) while Options 3a, 3b, 4a and 4b will experience higher capital costs for both the watermain alignment and acquisition of property and/or easements**	• **Option 1 is not anticipated to require any additional property, while Options 3a, 3b, 4a and 4b will most likely require additional property and significant coordination with CN and CP Rail for tunneling under their tracks**	• **None of the options are anticipated to significantly impact the natural environment**	• **All of the options will result in some impacts to residences and local commuters (which will be mitigated); but for each option, it is imperative to coordinate with Cambridge Memorial Hospital to ensure access and mobility issues are addressed as needed** • **Option 1 will avoid construction along residential streets**
Option 1: Coronation Boulevard	• Is compatible with existing and future infrastructure as it maintains two independent supplies to pumping station and hospital, avoids crossing the rail line, encompasses large right-of way for improvements, and has the opportunity to coordinate with future road improvements on Coronation Boulevard • Minimal project delivery risk as improvements would only occur within the Regional right-of-way, would avoid conflicts with major utilities, would require limited coordination with other jurisdictions and would avoid trench less technology • Because of its wide right-of-way, traffic on Coronation Boulevard would be maintained as two lanes could stay opened	• Open cut method of construction will result in $2.2 million in capital costs • No land acquisition or easements required	• No property acquisition anticipated • Complies with applicable local and Regional planning policies	• No significant environmental impacts anticipated • Small potential for contaminated soil to impact the project	• A limited number of residences and businesses along Coronation Boulevard will be impacted by the construction • Coordination with Cambridge Memorial Hospital is required to ensure access and mobility issues are addressed as needed • Modest impact to traffic on four-lane Coronation Boulevard as wide right-of-way will enable two lanes to be open during construction • Potential noise, vibration and dust impacts along Coronation Boulevard anticipated during open cut construction

Servicing Strategy Options	Evaluation Factors				
	Technical	Financial	Legal / Jurisdictional	Environmental	Socio / Cultural
Option 3a: Jaffray Street / Oliver Avenue / Coronation Boulevard	• Modest construction and financial risk as a result of increased jurisdictional issues, easement and property requirements and coordination with CN and CP railways (crossings) • Narrow rights-of-way could hinder access to hospital and to St. John's ambulance station	• Open cut and tunneling construction will results in $3.0 million in capital costs, • Additional costs associated with land acquisition and easements	• Acquisition of property or easements likely; coordination and the need for permits with CN or CP railways also likely • Complies with applicable local and Regional planning policies	• No significant environmental impacts anticipated • Potential brownfield site and contaminated soil will result in the need for contamination review / investigation / remediation	• A limited number of residences and businesses along Jaffray Street, Oliver Avenue and Coronation Boulevard will be impacted by the construction • Coordination with Cambridge Memorial Hospital is required to ensure access and mobility issues are addressed as needed • Access to St. John's ambulance station on Jaffray Street (single entry) needs to be maintained • Potential noise, vibration and dust impacts anticipated during open cut and tunneling construction
Option 3b: Jaffray Street / Boiler Lands / Coronation Boulevard	• Modest construction and financial risk as a result of increased jurisdictional issues, easement and property requirements and coordination with CN and CP railways (crossings) • Narrow rights-of-way could hinder access to hospital and to St. John's ambulance station	• Open cut and tunneling construction will result in additional $2.5 million in capital costs • Additional costs associated with land acquisition and easements	• Acquisition of property or easements likely; coordination and the need for permits with CN or CP railways also likely • Complies with applicable local and Regional planning policies	• No significant environmental impacts anticipated • Potential brownfield site and contaminated soil will result in the need for contamination review / investigation / remediation	• A limited number of residences and businesses along Jaffray Street, Oliver Avenue (east side) and Coronation Boulevard will be impacted by construction • Coordination with Cambridge Memorial Hospital is required to ensure access and mobility issues are addressed as needed • Access to St. John's ambulance station on Jaffray Street (single entry) needs to be maintained • Potential noise, vibration and dust impacts anticipated during open cut and tunneling construction

Servicing Strategy Options	Evaluation Factors				
	Technical	Financial	Legal / Jurisdictional	Environmental	Socio / Cultural
Option 4a: Spiers Crescent / Pitt Street / Wauchope Avenue / Oliver Avenue / Coronation Boulevard	• Modest construction and financial risk as a result of increased jurisdictional issues, easement and property requirements and coordination with CN and CP railways (crossings) • Narrow rights-of-way could hinder access to hospital and to St. John's ambulance station • Steep embankment on Wauchope Avenue would increase the potential for trenchless length	• Open cut and tunneling construction will result in additional $3.2 million in capital costs • Additional costs associated with land acquisition and easements	• Acquisition of property or easements likely; coordination and the need for permits with CN or CP railways also likely • Complies with applicable local and Regional planning policies	• No significant environmental impacts anticipated • Potential brownfield site and contaminated soil will result in the need for contamination review / investigation / remediation	• Several residences along Spiers Crescent, Pitt Street, Wauchope Avenue, Oliver Avenue and Coronation Boulevard will be impacted by the construction • Coordination with Cambridge Memorial Hospital is required to ensure access and mobility issues are addressed as needed • Potential noise, vibration and dust impacts anticipated during open cut and tunneling construction
Option 4b: Spiers Crescent / Pitt Street / Wauchope Avenue / Boiler Lands / Coronation Boulevard	• Modest construction and financial risk as a result of increased jurisdictional issues, easement and property requirements and coordination with CN and CP railways (crossings) • Narrow rights-of-way could hinder access to hospital and to St. John's ambulance station • Steep embankment on Wauchope Avenue would increase the potential for trenchless length	• Open cut and tunneling construction will result in additional $2.8 million in capital costs • Additional costs associated with land acquisition and easements	• Acquisition of property or easements likely; coordination and the need for permits with CN or CP railways also likely • Complies with applicable local and Regional planning policies	• No significant environmental impacts anticipated • Potential brownfield site and contaminated soil will result in the need for contamination review / investigation / remediation	• Several residences along Spiers Crescent, Pitt Street, Wauchope Avenue and Coronation Boulevard will be impacted by the construction • Coordination with Cambridge Memorial Hospital is required to ensure access and mobility issues are addressed as needed • Potential noise, vibration and dust impacts anticipated during open cut and tunneling construction

Appendix I - Estimated Project Costs

Appendix H – Estimated Project Costs

Option	Project ID	Component Type	Option	Description	Total Length (m)	Length of Open Cut (m)	Length of Trenchless (m)	Rail Cossing	# of Valve Chambers	# of Major Utility Crossings	# of Minor Utility Crossings	Base Construction Cost (2016$)	Total Project Cost (2016$)
1	1.1	Design and Construction	Coronation Blvd	450 mm watemain on Coronation Blvd from Hespeler Rd to new BPS site at Oliver Ave. Also includes watermain on Coronation Blvd from Oliver Ave to west side of Hospital	1,115	1,115	-	-	2	2	-	**1,930,000**	**2,517,000**
3a	3a.1	Design and Construction	Jaffray St / Oliver Ave / Coronation Blvd	450 mm watermain on Jaffray St and Oliver Ave from Hespeler Rd to new BPS site (west)	880	680	200	1	4	-	1	**2,914,000**	**3,992,000**
3b	3b.1	Design and Construction	Jaffray St / Babcock and Wilcox Lands / Coronation Blvd	450 mm watermain on Jaffray St and easement Ave from Hespeler Rd to new BPS site (east)	950	850	100	1	4	-	1	**2,361,000**	**3,234,000**
4a	4a.1	Design and Construction	Spiers Cres / Pitt St / Wauchope Ave / Oliver Ave / Coronation Blvd	450 mm watermain on Spiers Cres, Pitt St, Wauchope Ave and Oliver Ave from Hespeler Rd to new BPS site (west)	928	728	200	1	4	1	-	**3,086,000**	**4,228,000**
4b	4b.1	Design and Construction	Spiers Cres / Pitt St / Wauchope Ave / Babcock and Wilcox Lands / Coronation Blvd	450 mm watermain on Spiers Cres, Pitt St, Wauchope Ave and easement from Hespeler Rd to new BPS site (east)	1,059	959	100	1	4	1	-	**2,627,000**	**3,599,000**
A1	A1	Design and Construction	Extention to CMH Parking Lot Site	450 mm watermain on Coronation Blvd From West Side of Hospital to Extention to CMH Parking Lot Site	95	95	-	-	-	-	1	**140,000**	**183,000**
A2	A2	Design and Construction	Extention to Groff Mill Creek Site	450 mm watermain on Coronation Blvd From West Side of Hospital to Extention to Groff Mill Creek Site	335	335	-	-	2	1	-	**594,000**	**774,000**
A3	A3	Design and Construction	Extention to Montrose Site	450 mm watermain on Coronation Blvd From West Side of Hospital to Extention to Montrose Site	2,350	2,350	-	-	2	1	-	**3,841,000**	**5,262,000**

Appendix J - Stage II Evaluation of Pumping and Chloramination Stations

Mostly Positive / Few Impacts

Positive and Negative / Some Impacts

Mostly Negative / Several Impacts

Servicing Strategy Options	Evaluation Factors				
	Technical	**Financial**	**Legal / Jurisdictional**	**Environmental**	**Socio / Cultural**
Key Differentiators	• **Options 1 and 2 comprise lands that are owned partially or fully by a municipality, while Options 3,4, and 5 require the purchase of privately owned parcels** • **Risks to delivering the project are highest for those options where contamination is likely, access to the site is limited, and transferring property rights is challenging (Options 3, 4, and 5)**	• **Option 2 is the lowest cost among the six alternatives; Option 1 requires significant additional cost for watermain extension while Options 3, 4, and 5 necessitate the purchase of private property.**	• **Options 1 and 2 comply best with existing planning policies and require limited or no property acquisition**	• **None of the options comprise significant environmental impacts, although additional assessments and engagement should be undertaken for Option 1 (Groff Mill Creek crossing) and Option 2 (floodplain)**	• **With the exception of Option 2, all of the alternatives would be constructed within existing neighbourhoods (or in the case of Option 3, which would eliminate existing parking utilized by the Cambridge Memorial Hospital parking), requiring significant consultation with residents and adjacent land owners and the need for mitigation measures to minimize the impacts.**
Option 1: Montrose Street South	• Regional-owned site is located adjacent to the existing wastewater treatment plant but would require the watermain to be significantly extended beyond Coronation Boulevard • Provides sufficient capacity to meet future servicing needs • Low project delivery risk given the fact that the site is owned by the Region • Minimal traffic management issues in accessing site	• Relatively high costs associated with the pumping station and the significant extension of the watermain from Coronation Boulevard (an additional $4.1 for the extension)	• No land acquisition is required • The Region owns the site at 370 Montrose Street South	• Parcel is heavily vegetated but formal assessment indicates that little vegetation needs to be preserved • Crossing of Groff Mill Creek anticipated	• A residential community surrounds the proposed property, which will require consultation with residents and the local ratepayer group as needed
Option 8: Groff Mill Creek	• Located on land partially owned by the City of Cambridge; constitutes large parcel adjacent to proposed Coronation Boulevard watermain • Provides sufficient capacity to meet future servicing needs with opportunity for natural overflow • Parcel located within a floodplain increases overall delivery risk • Requires acquisition of property or easement for access	• Relatively modest costs associated with the pumping station and watermain extension ($0.6 million) as a portion of the facility would be constructed on City of Cambridge-owned land	• Property is partially owned by the City of Cambridge but access is regulated as a floodplain • Requires acquisition of property or easement for access • Current land is vacant and should not conflict with any adjacent uses	• Site partially located within GRCA regulated area requiring special permitting, but initial discussions with GRCA suggested no major issues with locating pumping station on this parcel • Species at Risk identified north of site at Dumfries Conservation area, but not at specific location where pumping station would be constructed	• Few properties surround the proposed site so (real or perceived) community impacts would be limited

Servicing Strategy Options	Evaluation Factors				
	Technical	Financial	Legal / Jurisdictional	Environmental	Socio / Cultural
Option 9: Cambridge Memorial Hospital Parking Lot	• Privately-owned land is located adjacent to proposed Coronation Boulevard watermain • Provides sufficient capacity to meet future servicing needs, but parcel may be limited due to existing use (hospital parking lot) • Hospital ownership of the parcel suggests significant delays in coordination, transferring the property and constructing the facility • Significant traffic issues during construction and maintenance as site is located within hospital parking lot	• Relatively modest costs associated with the pumping station and watermain extension ($0.2 million), although additional costs will result from property acquisition	• Existing parking lot utilized which is primarily utilized by Cambridge Memorial Hospital staff and visitors	• No significant environmental impacts, but potentially contaminated soil will result in the need for contamination review / investigation / remediation	• Potential community resistance would revolve around the location's potential impact on the hospital, emergency access, and parking availability • Significant traffic impacts may occur during construction in heavily used hospital parking lot
Option 11: Babcock and Wilcox at Coronation Boulevard	• Privately-owned land is located adjacent to proposed Coronation Boulevard watermain • Large parcel provides sufficient capacity to meet future servicing needs, but requires stormwater overflow • Parcel likely comprises significant contamination suggests delays in coordination, transferring the property and constructing the facility • No traffic impacts	• Relatively modest costs associated with the pumping station, although additional costs will result from property acquisition	• Property will need to be acquired through private land owner • May not conform with existing policies or uses	• No significant environmental impacts, but potentially contaminated soil will result in the need for contamination review / investigation / remediation	• A residential community on the west is adjacent to the proposed property, which will require consultation with residents
Option 12: Oliver Avenue and Coronation Boulevard	• Privately-owned land is located adjacent to proposed Coronation Boulevard watermain • Parcel provides sufficient capacity to meet future servicing needs, but is somewhat constrained by size and requires stormwater overflow • Parcel likely comprises significant contamination suggests delays in coordination, transferring the property and constructing the facility • Significant access issues as a result of its limited size and surrounding land uses	• Relatively modest costs associated with the pumping station, although additional costs will result from property acquisition	• Property will need to be acquired through private land owner • May not conform with existing policies or uses	• No significant environmental impacts, but potentially contaminated soil will result in the need for contamination review / investigation / remediation	• The proposed site is imbedded into a local neighbourhood which will require consultation with residents • Traffic impacts during construction may occur as a result of limited space and access into the site

Appendix K - Public Engagement and Consultation

Communication and Consultation Plan

Communication and Consultation Plan

Creation of Cambridge Zone 1W Pressure Zone

Class Environmental Assessment

Prepared by
GM BluePlan for:

Region of Waterloo

Project No. 716015

June 2016

GM BluePlan ENGINEERING

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1 Introduction

1.1 Background

Identified in the Implementation Plan for Cambridge Water System Upgrades, the creation of the new Zone 1W is key to the implementation of the overall strategy across Cambridge. In particular, the new zone will allow the Region to better utilize the existing Turnbull Reservoir.

The Cambridge Zone 1W strategy addresses the following key servicing elements:

- A new booster pumping station (BPS) and new pressure reducing valve (PRV) and settings will improve system pressures and system reliability in the Preston service area.
- The BPS also provides an effective means to change the disinfection from chlorine, as supplied from Cam 1 Middleton WTP, to chloramine in Zone Cam 1W. The change to chloramine will allow the zone to access supply from the chloraminated Cam 2W and Kit 2E zones through new and existing PRVs, eliminating current mixing issues.

The alternatives developed and evaluated under this Zone 1W Class EA will need to address some fundamental considerations:

- The Cam 1/1W boundary and location of the BPS must be so that the hospital remains within Cam 1 zone in order to maintain free chlorine residual at the hospital and avoid costly implementation and upgrades to the hospital's operations.
- The watermain alignments feeding the BPS should maximize the security of supply to Cam 1W and the hospital. The watermain will need to provide capacity to support full Cam 1W design flows from either or both Middleton WTP / Turnbull Reservoir.
- Staging of the upgrades must be viable to maintain level of service in the area and specifically for the hospital during the implementation of the system-wide upgrades.
- The operation of the new BPS and balancing of flow rate changes with the PRV settings will need to consider and minimize impacts to suction-side system pressures.
- How the location of the BPS will impact the overall Cam 1W zone delineation, the sizing, length and alignment of the trunk watermains, and PRV sizing and setting needs.

The study will be undertaken as a Schedule B Class EA and will satisfy Phases 1 and 2 of the Municipal Engineers Association (MEA) Class EA process, which is a planning process approved under Ontario's Environmental Assessment Act.

As with any Environmental Assessment Process, it is as much about public relations as it is about technical solutions. Allowing either approach to dominate may impede the process as the study proceeds. Given that the level of service and impacts due to disinfection change will be at the forefront of public and stakeholder attention, the project team will ensure that the solution is developed in a way that gives the public and stakeholders the understanding, confidence and satisfaction necessary to satisfy any potential concerns.

The success of the study rests with the ability of the project team to solicit, process and respond to public input. This document outlines the Communication Plan that will be implemented for this study. The document will be a living document updated throughout the Class EA process and will ultimately become an integral part of the Public Consultation File supporting the Class EA Study.

A number of items were considered in developing the Communication and Consultation Plan, including:

- Project Website;
- Public Consultation Program;
- Public Consultation Centre;
- Stakeholder Contacts;
- Stakeholder Workshops; and
- Agency Meetings.

1.2 Purpose and Approach

The purpose of the Communication and Consultation Plan is to provide a framework for informing and obtaining input from parties involved in the study and any outside parties interested in providing input. This Plan will provide the necessary amount of guidance for all aspects of the communication and public consultation process for the project including areas where coordination with other project teams is required. The intent is to avoid encountering issues with communication such that it affects project schedule or budget.

In planning the communication and consultation program, the overall approach is to:

- Meet the public and agency notification and consultation requirements for Phases 1 and 2 of the MEA Class EA process (October 2000, as amended 2007, 2011 and 2015); and,
- Build on past communication protocols and consultation plans from previous Class EA and municipal planning initiatives the Region has undertaken to ensure consistency and continuity.

1.3 Goals and Objectives of the Communication and Consultation Plan

Effective consultation with stakeholders, agencies, First Nations and the public will be one of the keys to success in this study. Thus, a primary goal and objective of this plan is to ensure meaningful consultation and to encourage two-way communication with the community, regulatory agencies, stakeholders and Region staff.

Methods outlined in this Plan are intended to:

- Present clear and concise information to stakeholders at key stages in the study process;
- Meet MEA Class EA consultation requirements;
- Solicit community, regulatory agency and Region staff input;
- Ensure that factual information is provided to interested and affected stakeholders as soon as reasonably possible; and,
- Make contact with external agencies to obtain legislative or regulatory approvals, or to collect pertinent technical information.

More specifically, the Communication and Consultation Plan will:

- Provide estimated timelines for meetings, workshops, presentations and Public Consultation Centre (PCC);
- Provide an outline of project documentation required, including comments management tracking, project website and a citizens document;
- Provide details on how and when external agencies will be able to be involved in the project; and,
- Provide details for First Nations consultation as required.

Clear and effective communication, coordination and cooperation with all stakeholders will start at the earliest stages and continue throughout. Different methods will be used to ensure effective and efficient two-way communication including public Notices (with full contact information and invitations to participate), direct mailings, informative website content, and meaningful and clear information available at the PCC.

2 Communication Plan

2.1 Class EA Study

2.1.1 Study Contact List

Any and all relevant agencies, stakeholders and interesed parties will be included in the project distribution list. A list of relevant review agencies and interested and affected parties has been prepared for this project based on the RFP, the Consultant's Project Team knowledge of the study area, and information provided by the Region. The list includes federal departments and agencies, provincial ministries and agencies, municipal departments and agencies, utilities, Hospitals, emergency services, First Nations, and other special interest groups who have previously enquired about similar studies. The contact list is attached in Appendix A.

Further to the study contact list, residents and local businesses within close proximity to the proposed sites in the City of Cambridge will receive notification via mail.

Throughout the Class EA process, the study contact list will be revised, as appropriate, to reflect only those agencies/parties who wish to continue to be directly notified. In this manner, the project contact list will constantly be updated to ensure that all possible effort is made to include all interested agencies/parties throughout the EA process.

2.1.2 Study Notifications

Public Notices for this project will be distributed to announce Commencement of the Study in Fall 2016, the Public Consultation Centre to be held in January 2017, and Completion of the Study in April 2017.

2.1.3 Notice of Study Commencement

GM BluePlan will prepare a Notice of Study Commencement to be issued in Fall 2016. Once approved, the Region will publish the Notice of Study Commencement in two rounds of the **Waterloo Region Record** (publishes daily) and the **Cambridge Times** (publishes on Tuesday and Thursday each week).

The Notice will also be published on the Region's website. Region and GM BluePlan PM contacts will be provided in the Notice, from whom interested parties can obtain additional information or request that they be added to the Study Contact List.

In addition to the newspaper Notices, the GM BluePlan Team will prepare a Notice in letter format and mail to the established list of stakeholders, local businesses and residents. The GM BluePlan Team will follow up with select agencies in person or by mail, e-mail or phone to facilitate the coordination of input into the study. The GM BluePlan Team will maintain a file of all correspondence sent and received. This documentation will be included in the final Citizens Document.

A summary of tasks and responsibilities for tasks associated with all Notices is provided below.

Task	Responsibility
Prepare draft Ad / Letter format Notices for review	GM BluePlan
Organize and place Notices in the papers	Region of Waterloo
Finalize and mail Ad / Letter format Notices	GM BluePlan
Distribute Notices to internal Region and City of Cambridge Staff (e.g. Fire & Emergency Services, Councillors)	Region of Waterloo
Prepare and maintain a Comment Tracking Sheet	GM BluePlan
Prepare any required written responses to questions and issues	GM BluePlan & Region of Waterloo

Internal contacts and notification will be coordinated via the Region's PM. The study will take an integrated project approach with Notices and PCC to ensure that the strategy, its project components and their relationship are clearly understood by stakeholders.

2.1.4 Notice of Public Consultation Centre

There is one PCC planned as part of this study. The GM BluePlan Team will prepare a Notice of PCC for the PCC event. Once approved, the Region will publish the Notice of PCC in two rounds of the local newspapers, as with the Notice of Commencement.

The Notice will also be published on the Region's website. The first Notice will be issued two to three weeks in advance of the PCC, the second the week following thereafter. In addition to the newspaper Notices, the GM BluePlan Team will prepare a Notice in letter format and mail to the established list of stakeholders, residents and local businesses, as with the Notice of Commencement.

2.1.5 Notice of Study Completion

Once the study draws completion in April 2017, a Notice of Study Completion will be prepared. The purpose of this Notice is to announce the study's completion, summarize the preferred solution, and begin the 30-day public review period for the final Class EA report. Copies of the final report will be filed at agreed public facilities and made available for the minimum 30-day review period.

The Notices will be published in two editions of the local newspapers, as with the Notices of Commencement and PCC. The Notice will also be published on the Region's website. The GM BluePlan Team will also prepare a Notice in letter format and mail to the established list of stakeholders, as with the Notices of Commencement and PCC.

3 Consultation Plan

3.1 Public Consultation Centre

There is one PCC planned for this study in January 2017 following identification of the preliminary preferred solution for the creation of the Cambridge Zone 1W Pressure Zone.

This PCC is a mandatory point of contact in the EA process and will satisfy Phases 1 and 2 of the Class EA process. The PCC will be located at a venue within or within close proximity to the study area and will follow an "Open House" format with display boards presenting project information.

In preparation for the PCC, the GM BluePlan Team will:

- Prepare the Notice of PCC for the Region to advertise in local newspapers;
- Provide two drafts of the PCC display board material for Region's review;
- Provide PCC boards in PDF format to the Region six weeks in advance;
- Prepare all coloured displays, sign-in sheets and comment forms;
- Provide professional staff and facilitate the PCC event;
- Prepare draft responses to written comments/concerns raised by attending public members and stakeholders for Region's review;
- Issue approved response letters; and,
- Update the project contact list to include additional public members and stakeholders who wish to be directly notified of future project related events.

3.2 Region Staff Input

3.2.1 Team Meetings

The GM BluePlan & Region Project Team will hold monthly team meetings (12 in total) to discuss the development of the project.

3.2.2 Stakeholder Workshops

Stakeholder meetings will be held to engage, inform and enable technical, policy and regulatory input at key decision-making points. These are intended to include a wider audience than the Project Team, such as the Region's Planning and Operations and Maintenance staff and City of Cambridge staff.

3.2.3 Regional Council and Committee Presentations

Members of the GM BluePlan Team will be available to present project information to Regional and City Councils. These meetings will be organized by and at the request of the Region PM.

3.3 External Agency Input

3.3.1 Conservation Authorities

There is one local conservation authority within the study area: Grand River Conservation Authority (GRCA). GRCA is considered a key stakeholder and will have particular interest in this project as the City of Cambridge is within its jurisdictional and regulatory limits. Moreover, the Grand River and some tributary creeks are in and around the new Cambridge Zone 1W.

3.3.2 Ministries

A number of provincial and federal Ministries will receive notifications related to this study throughout the process. Some of the key Ministries include:

- Ontario Ministry of the Environment and Climate Change
- Ontario Ministry of Aboriginal Affairs
- Ontario Ministry of Transportation
- Ontario Ministry of Natural Resources and Forestry
- Ontario Ministry of Culture, Tourism and Sport
- Aboriginal Affairs and Northern Development Canada
- Environment Canada
- Fisheries and Oceans Canada

3.3.3 Municipalities, Agencies, Special Interest Groups

Given the location of the study area and the integration of the water system with its lower tier and neighbouring municipalities, the following technical and review agency stakeholders will need to be consulted throughout the process:

- City Cambridge, and
- City of Kitchener.
- Local Hospital

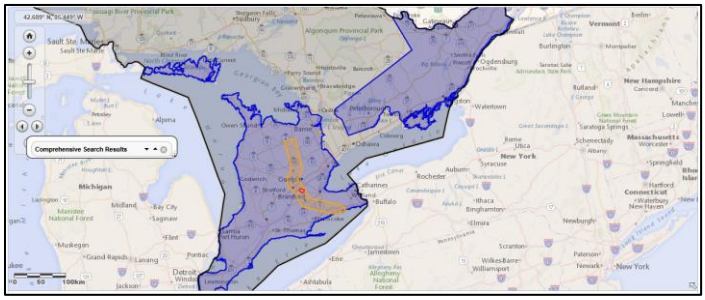
Other special interest groups and community/ratepayer/environmental groups will be informed via the public notification process.

3.3.4 Aboriginal Communities

With respect to consultation with Aboriginal communities (First Nations and Métis communities), the study will build off existing methods and protocol that the Region has used in past studies and provide awareness, understanding and opportunity to provide input into the study.

A list of Aboriginal communities pertinent to the study area was identified through the Government of Canada's web-based, geographic information system called the Aboriginal and Treaty Rights Information System (ATRIS). The search using ATRIS resulted in the following 23 Aboriginal groups being identified:

1. Métis Nation of Ontario
2. Zhiibaahaasing First Nation
3. Walpole Island
4. Six Nations of the Grand River
5. Sheguiandah
6. Saugeen
7. Mohawks of the Bay of Quinte
8. Mohawks of Akwesasne
9. Mississaugas of the Credit
10. Mississauga's of Scugog Island First Nation
11. M'Chigeeng First Nation
12. Hiawatha First Nation
13. Curve Lake
14. Chippewas of the Thames First Nation
15. Chippewas of Rama First Nation
16. Chippewas of Nawash First Nation
17. Chippewas of Kettle and Stony Point
18. Chippewas of Georgina Island
19. Beausoleil
20. Aundeck-Omni-Kaning
21. Alderville First Nation
22. Aamjiwnaang



Screen Capture of ATRIS Results for Study Area

These Aboriginal communities will be included in the study contact list.

3.4 Public Documentation

3.4.1 Comments Management Tracking

All the contact information will be contained in a database such that all comments received can be linked directly to it and stored easily and efficiently. It is expected that multiple comments will be received so maintaining an organized structure is key. All comments will be initially directed to Project Managers Kevin Dolishny and Julien Bell via the website, newspaper Notices, or letter correspondence.

3.4.2 Project Website

The Region of Waterloo will be setting up a page on their corporate website for this Class EA study. This website will provide a space for any interested party to obtain information on the project, upcoming events, and contact information. This website will be maintained by Region staff and the GM BluePlan will coordinate with the Region Communications team to provide content for posting when required.

Notice of Study Commencement

Region of Waterloo

TRANSPORTATION AND
ENVIRONMENTAL SERVICES
Water Services

150 Frederick Street 7th Floor
Kitchener Ontario N2G 4J3 Canada
Telephone: 519-575-4400
TTY: 519-575-4608
Fax: 519-575-4452
www.regionofwaterloo.ca

November 8, 2016

Client
Address
City, Province
Postal Code

Dear Mr./Ms. Last Name:

Re: Notice of Study Commencement for the Creation of Cambridge Pressure Zone 1W Schedule 'B' Class Environmental Assessment

The Region of Waterloo has initiated the Creation of Cambridge Pressure Zone 1W Schedule 'B' Class Environmental Assessment (EA) to create a new pressure zone in the City of Cambridge in order to complete a key step in implementing its planned Cambridge water system upgrades.

Please find enclosed the Notice of Study Commencement which includes further information about the study.

As part of the Study's consultation program you are currently included in the Study Contact List. If you wish to be removed or would like to suggest an alternative representative, please contact the undersigned. Should we not hear from you, your details will remain on the Study Contact list and you will be notified of all future consultation opportunities during the undertaking of this Class EA.

Should you have any questions, please do not hesitate to contact me at your convenience.

Sincerely,



Kevin Dolishny, P.Eng.
Senior Project Engineer- Servicing and Development Planning
Email: kdolishny@regionofwaterloo.ca
Phone: 519-575-4757 x 3862

Enclosure

Region of Waterloo

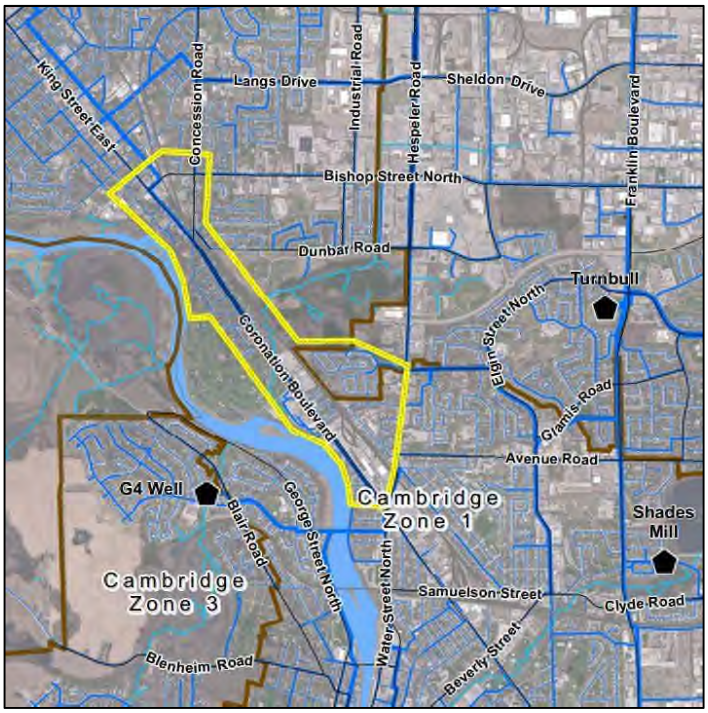
Notice of Study Commencement
Creation of Cambridge Pressure Zone 1W
Schedule B Class Environmental Assessment

The Study

The Region of Waterloo has initiated a study to create a new pressure zone (Zone 1 West) in the City of Cambridge in order to complete a key step in implementing its planned Cambridge water system upgrades. This new pressure zone will enhance the current water system by increasing water pressure to local residents, while improving the security of supply and flexibility of system operations. The study will assess new servicing elements, such as a booster pumping station and pressure reducing valves to improve water pressure. The study will also examine changing the disinfection method from chlorine to chloramine.

The Process

The study is being completed as a separate Schedule 'B' Class EA study to comply with Phases 1 and 2 of the Municipal Class Environmental Assessment, which is an approved process under the Ontario Environmental Assessment Act.



Public Input

The Region invites residents to participate in this planning process and learn more about the creation of the Cambridge Zone 1W Pressure Zone. The Region will be hosting one Public Consultation Centre (PCC) for this study to: discuss the need for a new pressure zone, present the alternatives, identify the most feasible solution(s), and summarize the next steps. Additional details on the PCC will be provided at a later date.

Please visit our website for more information about this project at: http://www.regionofwaterloo.ca/en/aboutTheEnvironment/MasterPlansandProjects.asp. If you wish to submit comments or would like to be notified about future project activities, please contact:

Kevin Dolishny, P.Eng.
Senior Project Engineer – Water Services
Region of Waterloo
150 Frederick Street, 7th Floor
Kitchener ON N2G 4J3
Phone: 519-575-4757 x 3862
Email: kdolishny@regionofwaterloo.ca

Mr. Julien Bell, P.Eng.
Infrastructure Planning, Partner
GM Blue Plan Engineering Limited
Royal Centre, 3000 Highway 7, Suite 402
Vaughan, ON L4K 4M3
Phone: 416-703-0667
Email: julien.bell@gmblueplan.ca

This notice was first issued on November 1, 2016.

All comments and information received from individuals, stakeholder groups and agencies regarding this project are being collected under the authority of the "Municipal Act" to assist the Region of Waterloo in making a decision. Under the "Municipal Act", personal information such as name, address, telephone number, and property location that may be included in a submission becomes part of the public record. Questions regarding the collection of this information should be referred to Kevin Dolishny at the Region of Waterloo.

Stakeholder Meetings

Grand River Conservation Authority

REGION OF WATERLOO

Creation of Cambridge Pressure Zone 1W Class EA

GMBP File No. 716015

Project Stakeholder Meeting GRCA - Agenda

MEETING DATE: November 9th, 2016
LOCATION: 400 Clyde Road, Cambridge ON

ATTENDEES: Kevin Dolishny – Region of Waterloo
John Brum – GRCA
Julien Bell – GM BluePlan
Chris Campbell – GM BluePlan

COPIES TO: All Attendees

Meeting Objectives:

- Review of Project Objectives & Study Area
- General Area Opportunities and Constraints
- Review of Shortlisted Options
- GRCA Input on Options

Agenda:

1) **Cam 1W EA Overview**
   - Overview of System Upgrade Strategy
   - Scope of Cam 1W
   - Guiding Principles and Criteria

2) **Review of Study Area**
   - General Review Study Area and General Opportunities and Constraints

3) **Potential PS Site and Review of Groff Mill Creek Site**
   - Review of BPS Sties
   - Review Groff Mill Creek Site
   - GRCA Input

4) Potential Watermain Alignments and Review of Groff Mill Creek Crossing

- Review of Watermain Alignments
- Review of Potential Groff Mill Creek Crossing
- GRCA Input

5) Overview of Other Works

- Hespeler Road PRVs
- Kress Hill PRV

7) Next Steps

- Stakeholder Input (City & GRCA)
- Detailed Evaluation
- PCC - February

8) Other

Region of Waterloo
Creation of Cambridge Pressure Zone 1W
Class EA



GRCA Stakeholder Meeting

November 9th, 2016

AGENDA

1. Cam 1W EA Overview
2. Review of Study Area and General Opportunities and Constraints
3. Potential PS Sites and Review of Groff Mill Creek Site
4. Potential Watermain Alignments and Review of Groff Mill Creek Crossing
5. Overview of Other Sites
6. Next Steps

OBJECTIVES

1. Review Proposed Cam 1W Zone
2. Review General Area Opportunities and Constraints
3. Identify Opportunities and Constraints Groff Mill Creek & Adjacent Property

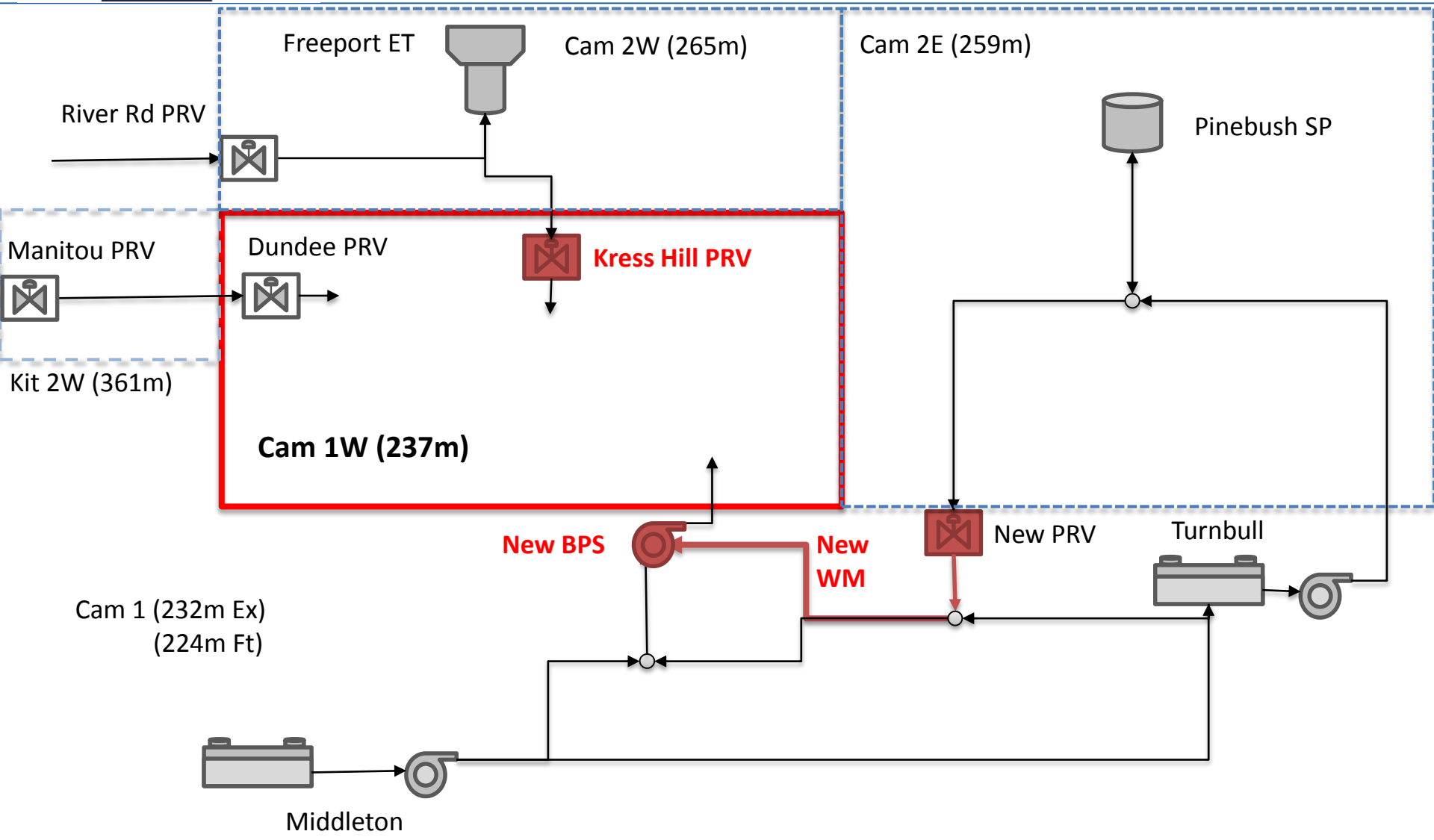
PROJECT OVERVIEW

- First Step - Implementation of Cambridge Water Upgrades
- EA Study
  - EA Report
  - PIC
  - Documentation and Communications
- Technical Confirmation
  - Zone Operations and Infrastructure Needs
  - Pump Station Location
  - Watermain Alignment
  - PRV Location
- Conceptual Design of Key Components

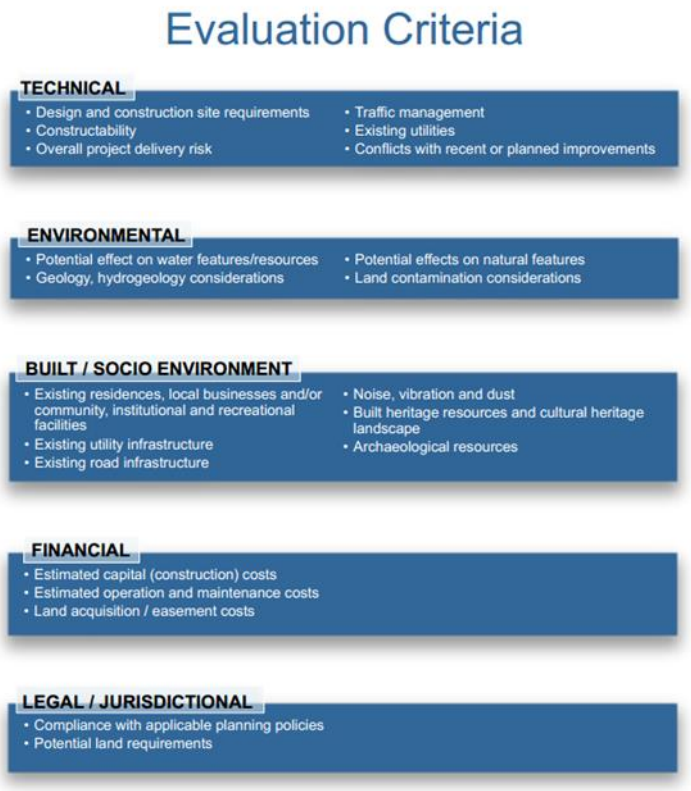
- Creation of New Cam 1W Pressure Zone
  - New Cam 1 to Cam 1W BPS
  - Chloramination Facility at BPS
  - Removal of Kress Hill PS and New Kress Hill PRV
  - New Cam 2E to Cam 1 Hespeler Road PRV
  - New Cam 1 to Cam 1W Transmission Main (From PRV to BPS)
- System Operational Changes
  - Dundee PRV Operations
  - Rahmans / Pinebush / G05/P09/P15 - Separate Review

- Increase Pressures in Preston
  - Low Pressures
  - Allow Cam 1 HGL Change (Turnbull Strategy)
- Security of Supply
  - Cam 2W and Kit 2E PRV - Full Capacity Supply
  - New Watermain
    - Multi Source Supply (Middleton, Turnbull Res, or Cam 2E (via PRV)
    - Security of Supply to CMH
- Water Quality - Chloramination
  - BPS simplifies Chloramination
  - Allows feed from Cam 2W and Kit 2E – Mixing Issue

Cam 1W - System Configuration



- Agree Step 1 – Agree Pass Fail Screening Criteria
  - Ability to Address Problem/Opportunity
  - Technical Viability
  - Reasonable
- Agree Step 2 - Five Point Evaluation Criteria

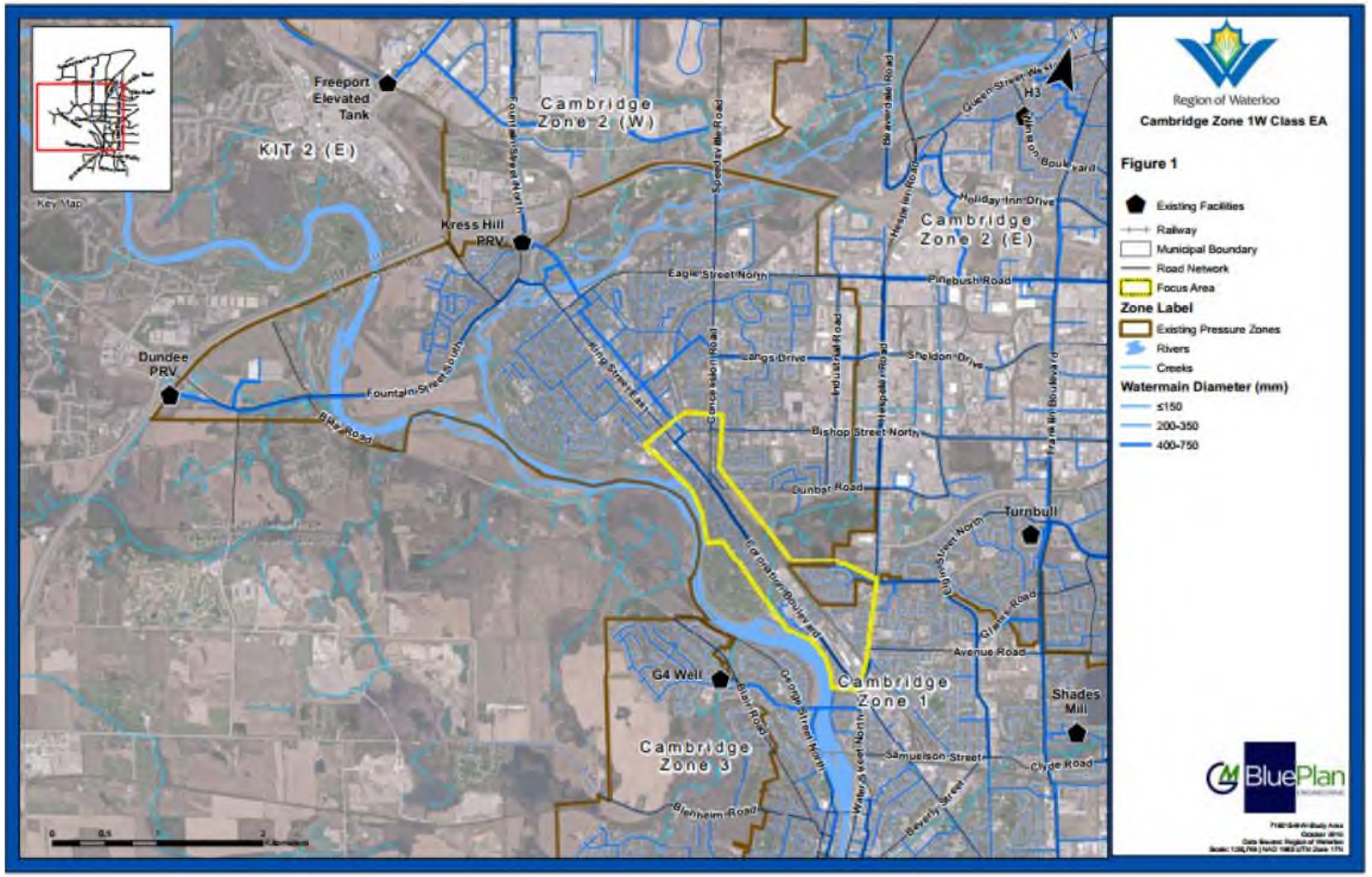


Technical Criteria Impacting Screening and Evaluation:

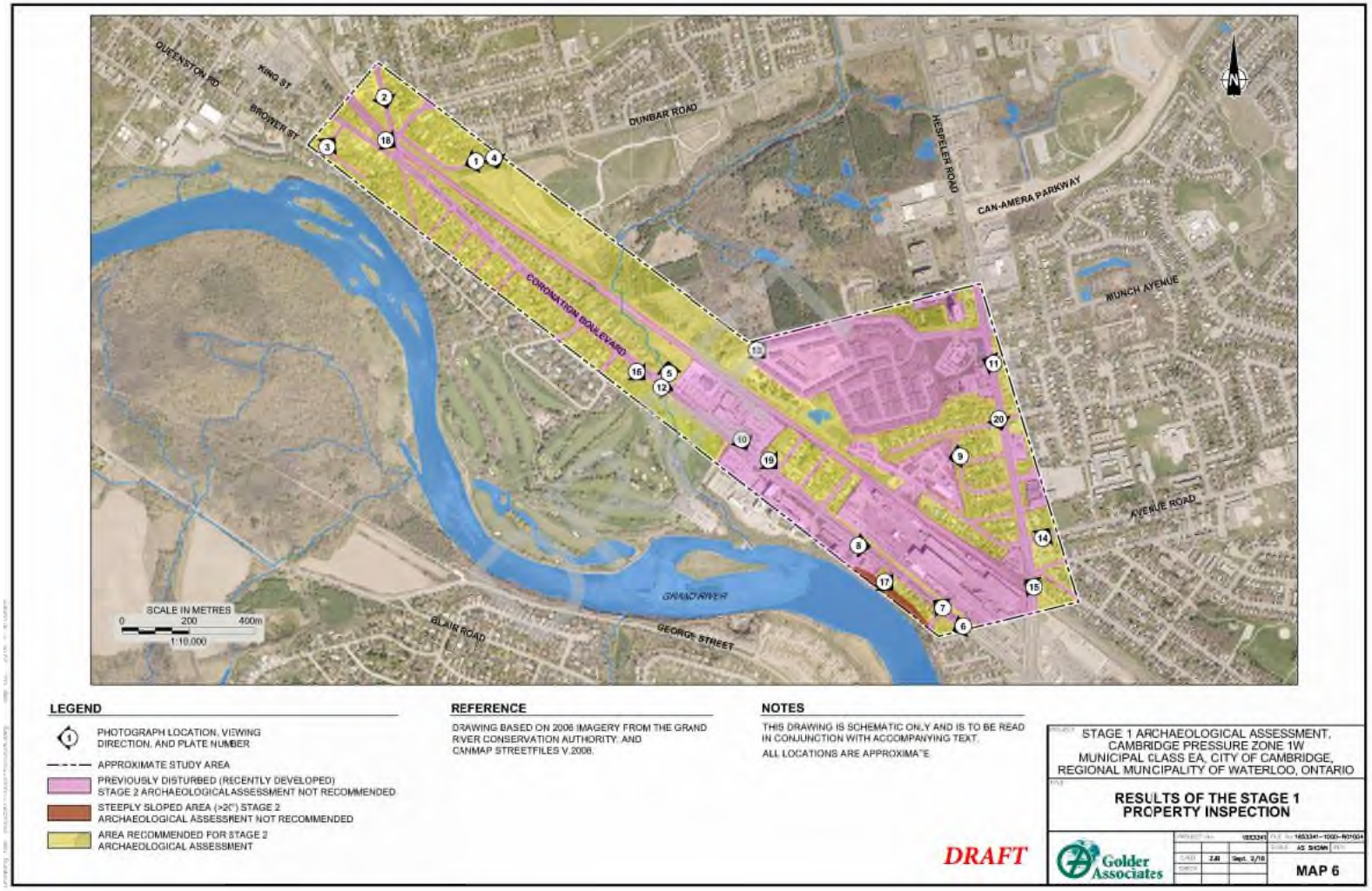
- Zone Operation Strategy
- Pumping Station Location & Size
- PRV Location
- WM Redundancy Requirement

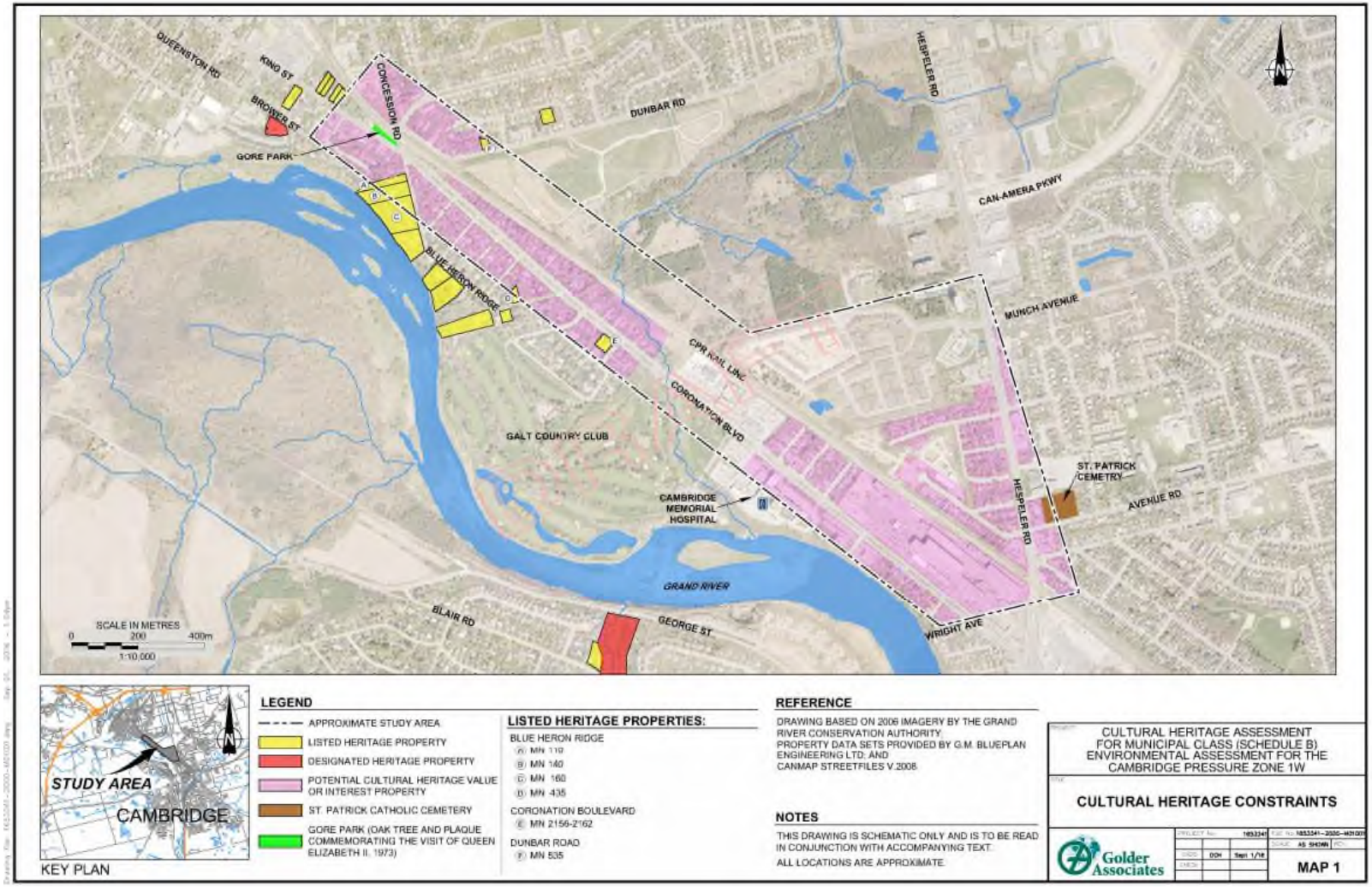
STUDY AREA

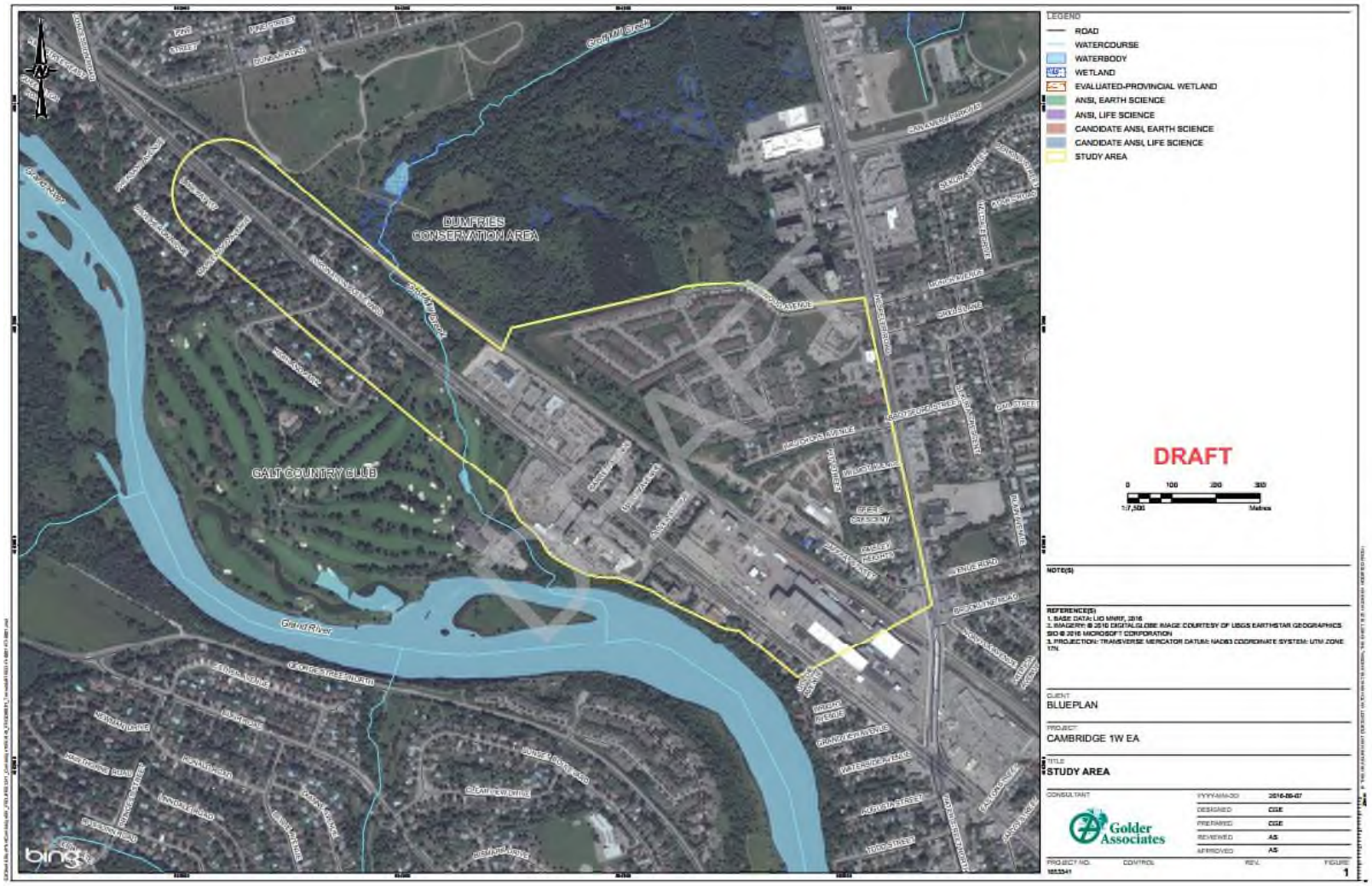
Study Area


Region of Waterloo
Cambridge Zone 1W Class EA
Figure 1
Existing Facilities
Railway
Municipal Boundary
Road Network
Focus Area
Zone Label
Existing Pressure Zones
Rivers
Creeks
Watermain Diameter (mm)
≤150
200-350
400-750
Key Map
Freeport Elevated Tank
KIT 2 (E)
Cambridge Zone 2 (W)
Kress Hill PRV
Dundee PRV
Cambridge Zone 2 (E)
Turnbull
G4 Well
Cambridge Zone 1
Cambridge Zone 3
Shades Mill
Eagle Street North
Pinebush Road
Bishop Street North
Dunbar Road
Avenue Road
Clyde Road
Samuelson Street
Blenheim Road
Beverly Street
Bird Road
Fountain Street North
Fountain Street South
Sheldon Drive
Holiday Inn Drive
Queen Street North
Hespeler Road
Conestoga Blvd
Water Street North
Cedar Street North
Elgin Street North
Clyde Road

Archeological Reports




QUEENSTON RD
KING ST
BROWER ST
GORE PARK
CONCESSION RD
DUNBAR RD
HESPELER RD
CAN-AMERA PKWY
BLUE HERON RIDGE
MUNCH AVENUE
CPR RAIL LINE
CORONATION BLVD
GALT COUNTRY CLUB
ST. PATRICK CEMETRY
AVENUE RD
CAMBRIDGE MEMORIAL HOSPITAL
HESPELER RD
GRAND RIVER
BLAIR RD
GEORGE ST
WRIGHT AVE
SCALE IN METRES
0 200 400m
1:10,000
STUDY AREA
CAMBRIDGE
KEY PLAN
LEGEND
APPROXIMATE STUDY AREA
LISTED HERITAGE PROPERTY
DESIGNATED HERITAGE PROPERTY
POTENTIAL CULTURAL HERITAGE VALUE OR INTEREST PROPERTY
ST. PATRICK CATHOLIC CEMETERY
GORE PARK (OAK TREE AND PLAQUE COMMEMORATING THE VISIT OF QUEEN ELIZABETH II, 1973)
LISTED HERITAGE PROPERTIES:
BLUE HERON RIDGE
(A) MN 110
(B) MN 140
(C) MN 160
(D) MN 435
CORONATION BOULEVARD
(E) MN 2156-2162
DUNBAR ROAD
(F) MN 535
REFERENCE
DRAWING BASED ON 2006 IMAGERY BY THE GRAND RIVER CONSERVATION AUTHORITY.
PROPERTY DATA SETS PROVIDED BY G.M. BLUEPLAN ENGINEERING LTD. AND
CANMAP STREETFILES V.2006
NOTES
THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.
ALL LOCATIONS ARE APPROXIMATE.
CULTURAL HERITAGE ASSESSMENT FOR MUNICIPAL CLASS (SCHEDULE B) ENVIRONMENTAL ASSESSMENT FOR THE CAMBRIDGE PRESSURE ZONE 1W
CULTURAL HERITAGE CONSTRAINTS
Golder Associates
MAP 1


LEGEND
ROAD
WATERCOURSE
WATERBODY
WETLAND
EVALUATED-PROVINCIAL WETLAND
ANSI, EARTH SCIENCE
ANSI, LIFE SCIENCE
CANDIDATE ANSI, EARTH SCIENCE
CANDIDATE ANSI, LIFE SCIENCE
STUDY AREA
DUMFRIES CONSERVATION AREA
GALT COUNTRY CLUB
GRAND RIVER
DRAFT
NOTE(S)
REFERENCE(S)
1. BASE DATA: LIO MNRF, 2016
2. IMAGERY: © 2016 DIGITALGLOBE IMAGE COURTESY OF USGS EARTHSTAR GEOGRAPHICS SIO © 2016 MICROSOFT CORPORATION
3. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD83 COORDINATE SYSTEM: UTM ZONE 17N
CLIENT
BLUEPLAN
PROJECT
CAMBRIDGE 1W EA
TITLE
STUDY AREA
CONSULTANT
Golder Associates
FIGURE
1

BPS SITES

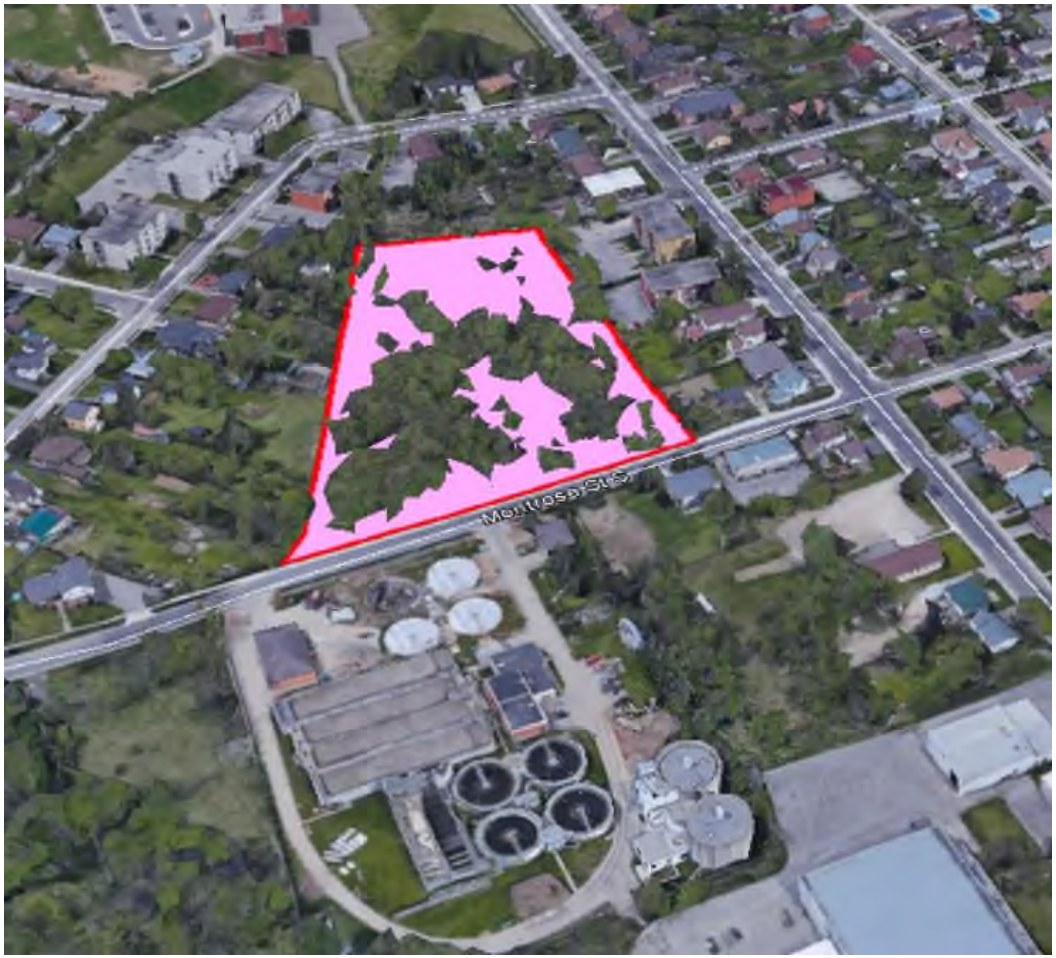
- New BPS will range from 4 to 6 pumps
- Desired BPS Site Area
  - 30m x 15m Building
  - 60m x 30 m Land
- Minimum BPS Site Area (4 Pumps)
  - 15m x 10m Building
  - 30m x 20 m Land
- BPS Peak Overflow – 0.5 m^3/s

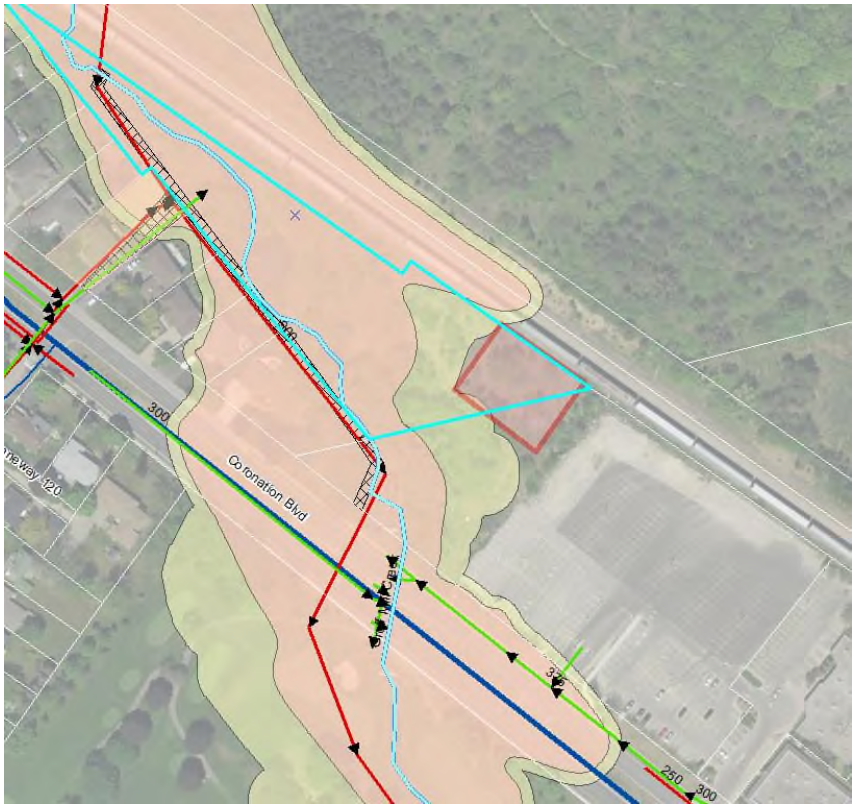
BPS – Site Options



BPS – Site Options







- Partially on City Owned Parcel
- Next/On GRCA Regulated Area
- Access Through
  - GRCA Regulated/Floodplain Area
  - Easement through neighboring commercial Property

Adjacent to Regulated Area

- PS Building
  - Main floor
    - Pumps & Process piping
    - Electrical Room
    - Chemical Storage Room (Chlorine & Ammonia Sulfide)
    - Washroom
  - Basement
    - Process Piping
- Portable Genenarator Pad
- Parking, Landscaping, & Fencing
- Yard Piping

Within Regulated/Floodplain

- Site Access – Driveway
- Watermains – PS Feed and Discharge
- Site Servicing
  - Sanitary service
  - Storm service
  - Electrical
- PS Overflow to Creek

- Overflow - Protect Against zone Over-Pressurization
- Sized for Peak Flow – 0.5 m^3/s
- Source Water is Chloraminated
- Discharge to a Chamber with Passive De-Chloramination Chemicals
- Overflow from Chamber to Creek/Storm via Dedicated Stormsewer

- GRCA Commentary of Site Opportunities and Constraints
  - Access
  - Services/watermains
  - Restrictions/Limitations
  - Incorporation of LID & Other Protection Features
  - Permitting and Approval Requirements

WATERMAIN ALIGNMENTS

- 450 mm size
- Service Connection to CMH
- Redundant Feed to Cam 1W BPS
  - Adequate Separation from Existing Coronation Blvd Watermain – Prevent Joint Failure

Option 1 – Coronation Blvd

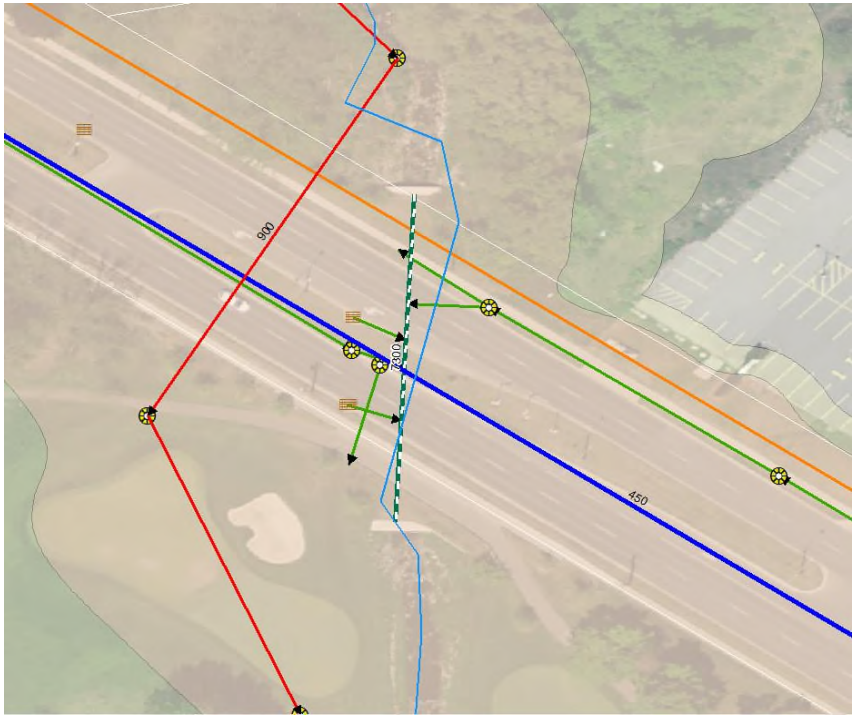


Option 2a/2b - Jaffray St.



Option 3a/3b - Wauchope





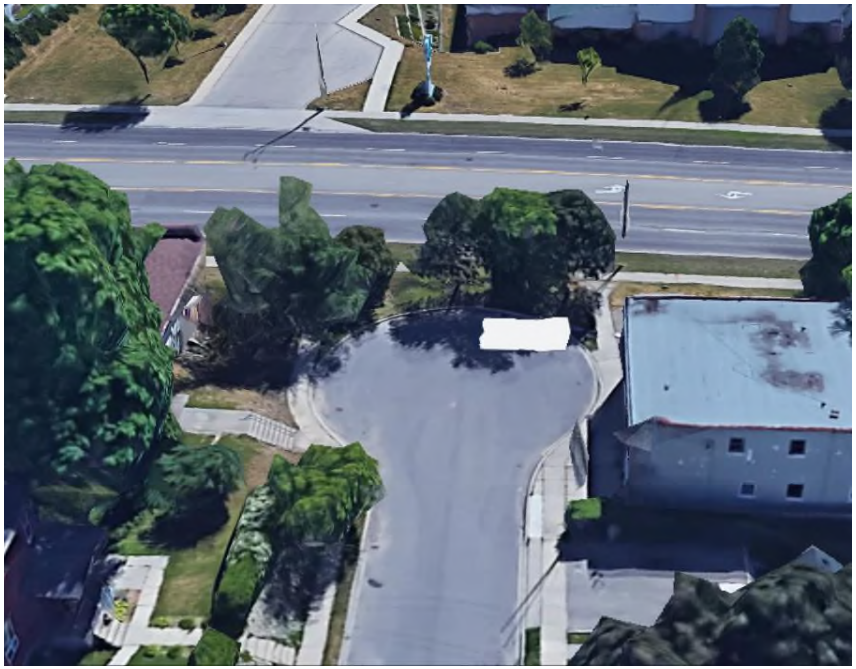
- Existing 7 m Culvert
  - Storm Sewer Tie-in to Culvert
- Existing 450 mm WM
- Existing 900 mm WW Sewer Parallel
- Existing Gasmain

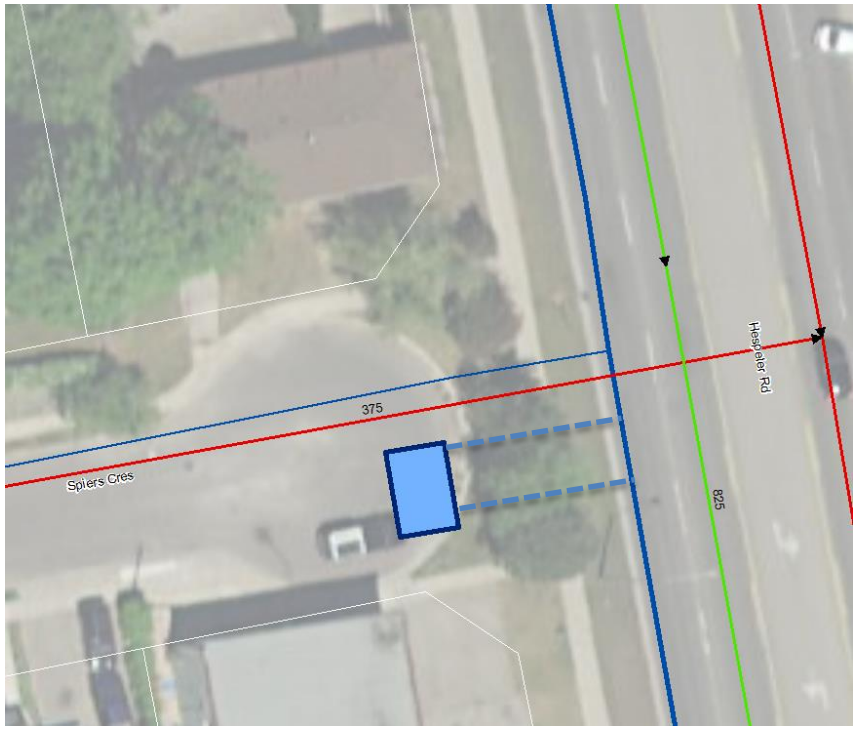
- Potential Watermain Crossing of Groff Mill Creek
  - Crossing dependent on BPS location
  - Trying to avoid creek crossing
- Potential for Watermain Work South Creek
  - Connection between existing Coronation Blvd. watermain and BPS
- Potential Service connection to existing Coronation Blvd. sanitary sewer

- GRCA Commentary of Site Opportunities and Constraints
  - Restrictions/Limitations
  - Permitting and Approval Requirements

OTHER WORKS

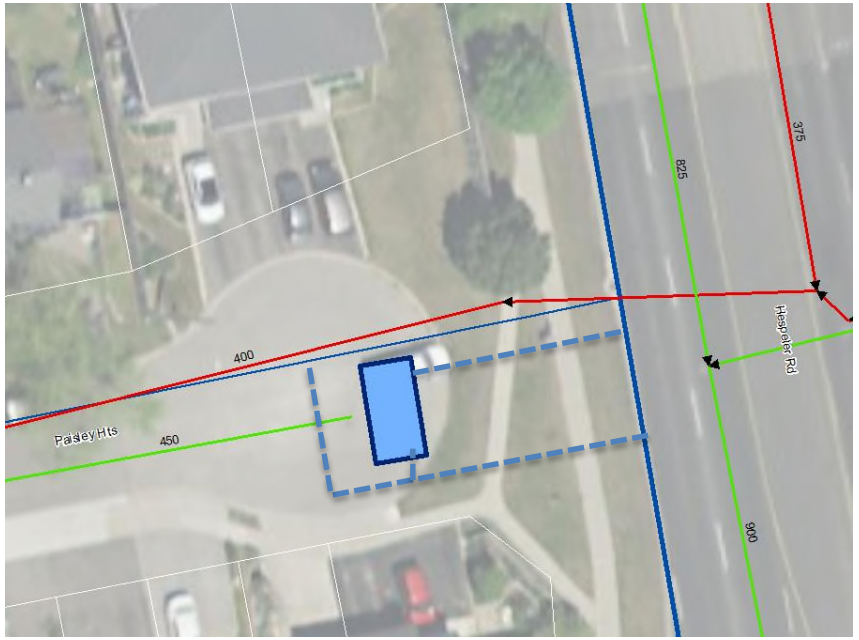
Hespeler PRV Option 1 - Spires

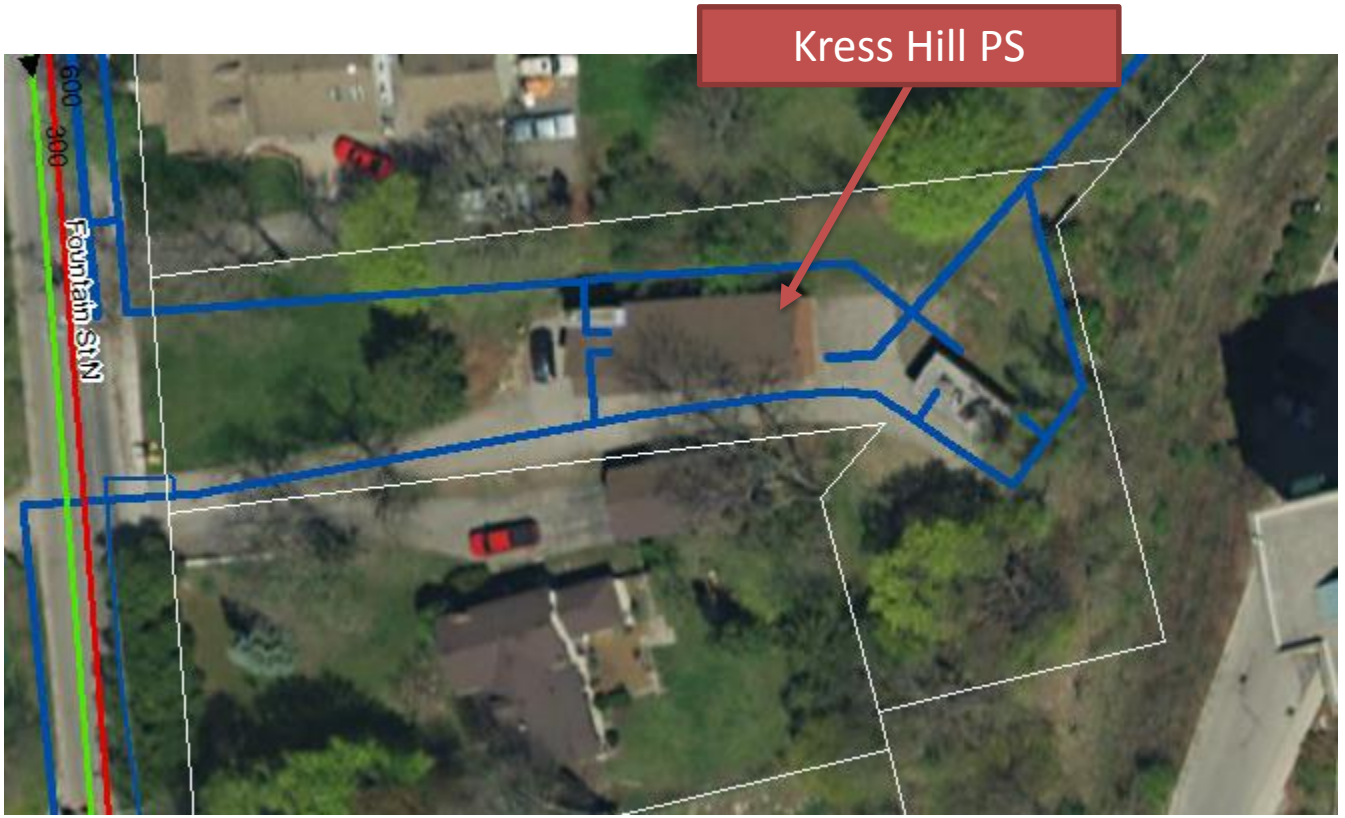




Hespeler PRV Option 2 - Paisley






Kress Hill PS
600
300
Fountain St N

NEXT STEPS

- Stakeholder Discussion - November
- Alternatives Evaluation – November/December
- Draft EA Report – December/January
- PPC –February 2017
- Final EA Report – February 2017
- Conceptual Design – January – Mar 2017
- Conceptual Design Report – April 2017

Q&A

City of Cambridge

REGION OF WATERLOO

Creation of Cambridge Pressure Zone 1W Class EA

GMBP File No. 716015

Project Stakeholder Meeting City of Cambridge - Agenda

MEETING DATE: October 31th, 2016
LOCATION: 150 Frederick St. Cambridge ON

ATTENDEES: Kevin Dolishny – Region of Waterloo
Jamie Austin – City of Cambridge
James Etienne – City of Cambridge
Julien Bell – GM BluePlan
Chris Campbell – GM BluePlan

COPIES TO: All Attendees

Meeting Objectives:

- Review of Project Objectives
- Review of Shortlisted Options
- City of Cambridge Input on Alternatives

Agenda:

1) **Cam 1W EA Overview**

2) **Cambridge Water System Upgrade Overview and Cam 1W Zone Objectives**
   - Overview of System Upgrade Strategy
   - Scope of Cam 1W
   - Guiding Principles and Criteria

3) **Review of BPS Short Listed Sites**
   - Review of BPS Sties
   - City Input

4) Review of Shortlisted Watermain Alignments

- Review of Watermain Alignments
- Watermain Separation Criteria
- Existing Easements and Rail Crossings

5) Review of Hespeler Road PRV Sites

- New Zone Boundary
- Review Potential Site

6) Review of Kress Hill Options

- Review On Site Options

7) Next Steps

- Stakeholder Input (City & GRCA)
- Detailed Evaluation
- PCC - February

8) Other

Region of Waterloo
Creation of Cambridge Pressure Zone 1W Class EA



City of Cambridge Stakeholder Meeting

October 31, 2016

AGENDA

1. Cam 1W EA Overview
2. Cambridge Water System Upgrades Overview
3. New Cam 1W Pressure Zone Objectives
4. Review of BPS Short Listed Sites
5. Review of Shortlisted Watermain Alignments
6. Review of Hespeler Road PRV Sites
7. Review of Kress Hill Options
8. Next Steps

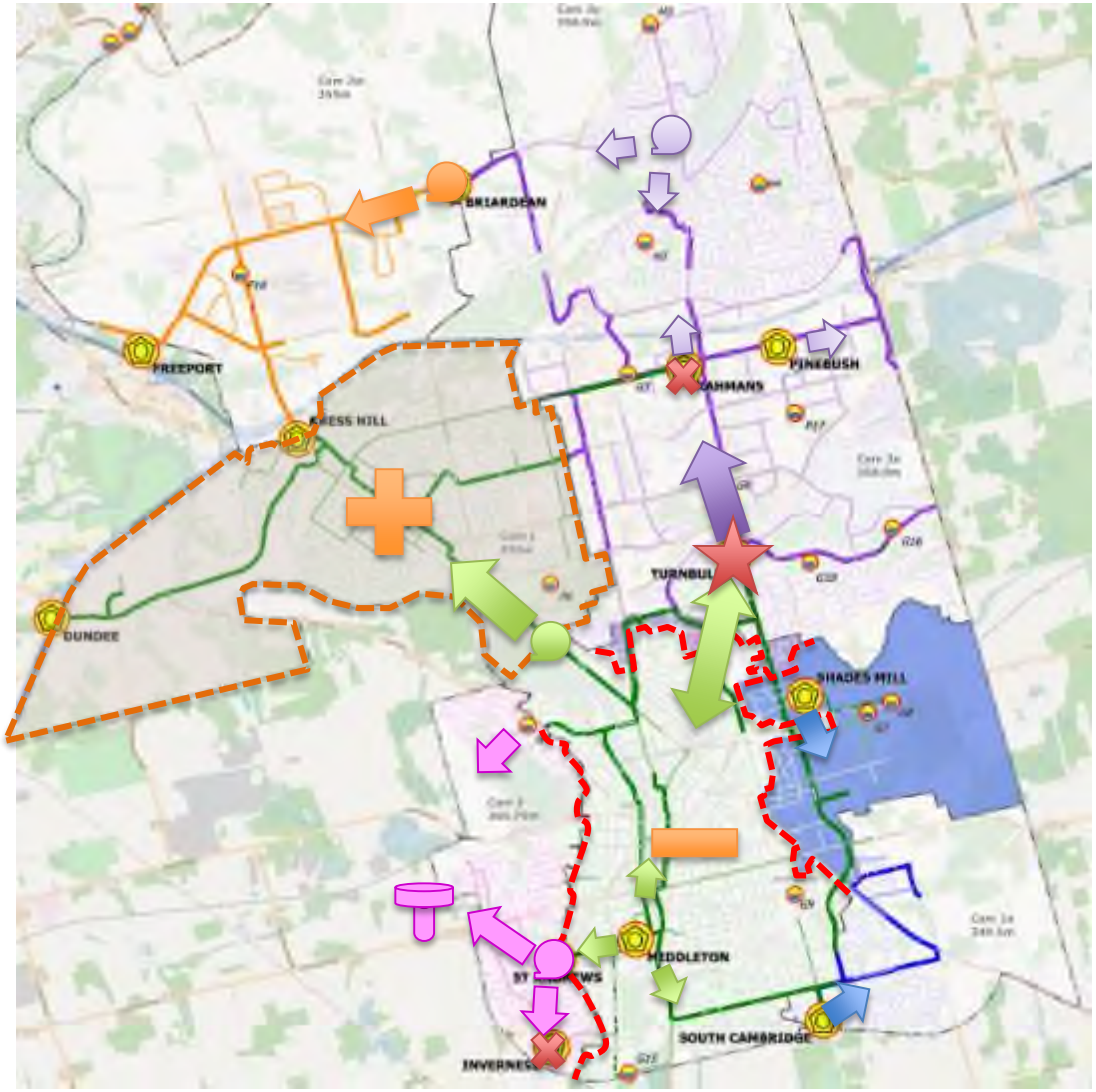
OBJECTIVES

1. Review Proposed Cam 1W Zone
2. Review of Shortlisted Options
3. City of Cambridge Input on Alternatives

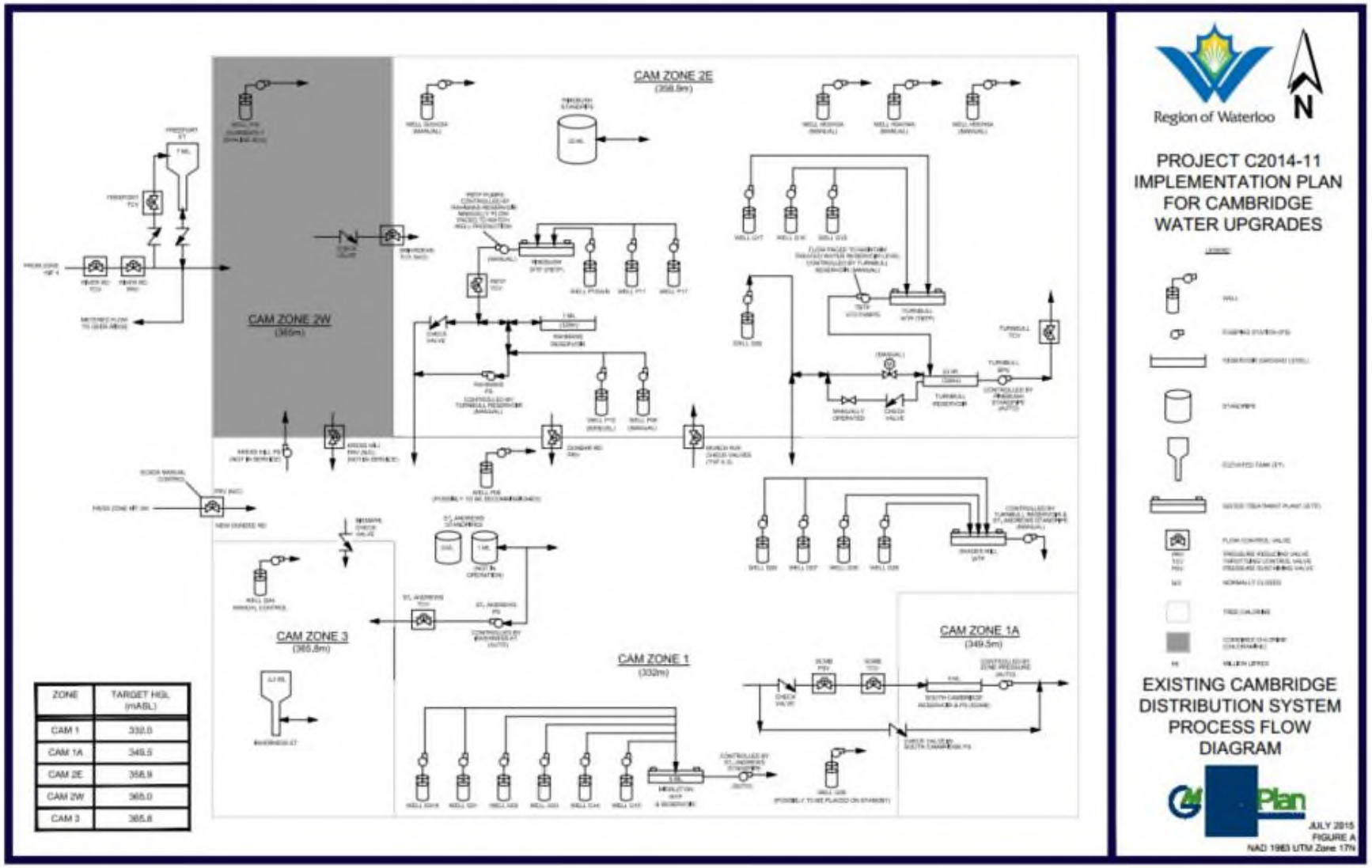
PROJECT OVERVIEW

- First Step - Implementation of Cambridge Water Upgrades
- EA Study
  - EA Report
  - PIC
  - Documentation and Communications
- Technical Confirmation
  - Zone Operations and Infrastructure Needs
  - Pump Station Location
  - Watermain Alignment
  - PRV Location
- Conceptual Design of Key Components

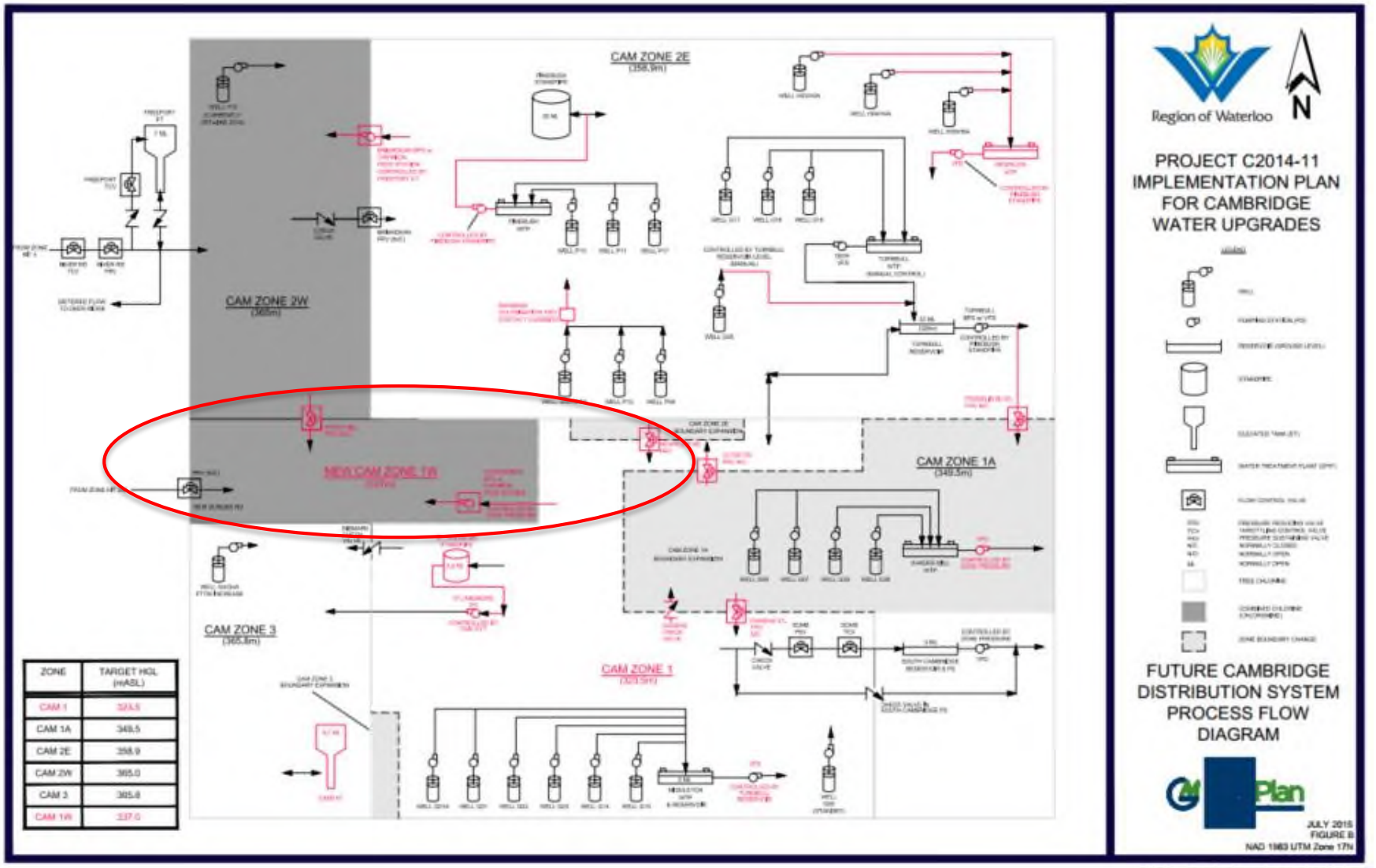
Cambridge Water System Optimization



Existing Cambridge System



Future Cambridge System

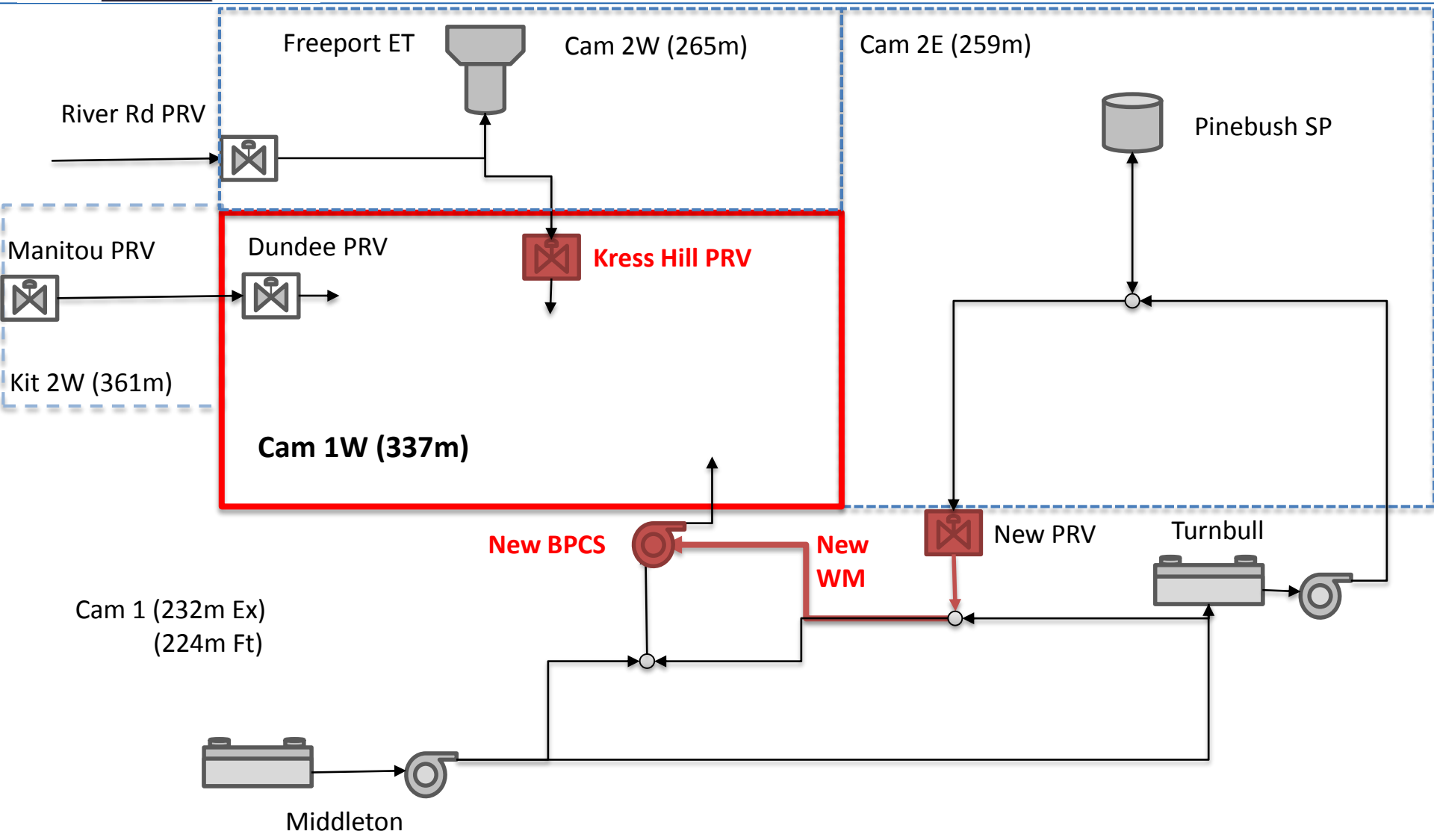


- Creation of New Cam 1W Pressure Zone
  - New Cam 1 to Cam 1W BPS
  - Chloramination Facility at BPS
  - Removal of Kress Hill PS and New Kress Hill PRV
  - New Cam 2E to Cam 1 Hespeler Road PRV
  - New Cam 1 to Cam 1W Transmission Main (From PRV to BPS)
- System Operational Changes
  - Dundee PRV Operations
  - Rahmans / Pinebush / G05/P09/P15 - Separate Review

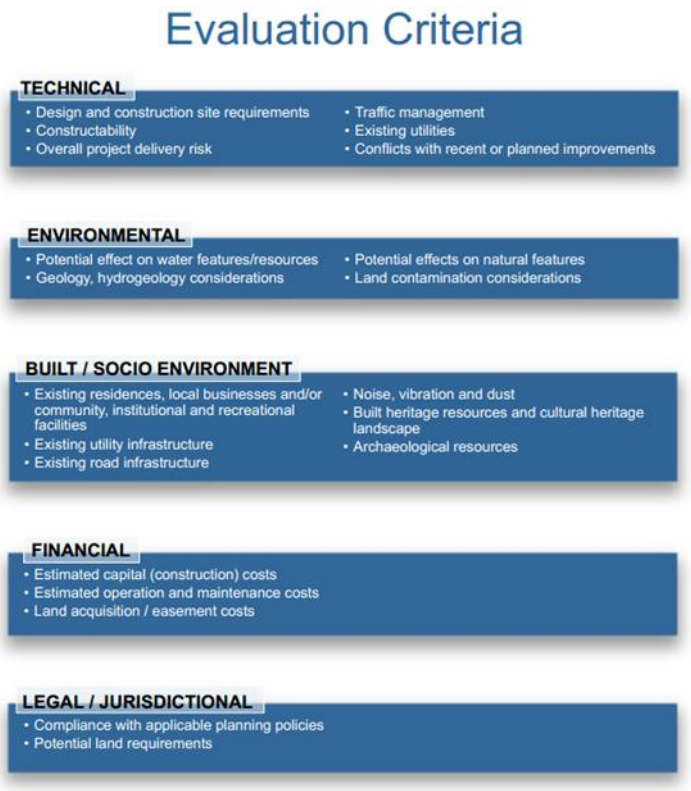
Cam 1W Strategy

- Increase Pressures in Preston
  - Low Pressures
  - Allow Cam 1 HGL Change (Turnbull Strategy)
- Security of Supply
  - Cam 2W and Kit 2E PRV - Full Capacity Supply
  - New Watermain
    - Multi Source Supply (Middleton, Turnbull Res, or Cam 2E (via PRV)
    - Security of Supply to CMH
- Water Quality - Chloramination
  - BPS simplifies Chloramination
  - Allows feed from Cam 2W and Kit 2E – Mixing Issue

Cam 1W - System Configuration



- Agree Step 1 – Agree Pass Fail Screening Criteria
  - Ability to Address Problem/Opportunity
  - Technical Viability
  - Reasonable
- Agree Step 2 - Five Point Evaluation Criteria



Technical Criteria Impacting Screening and Evaluation:

- Zone Operation Strategy
- Pumping Station Location & Size
- PRV Location
- WM Redundancy Requirement

BPS SITES

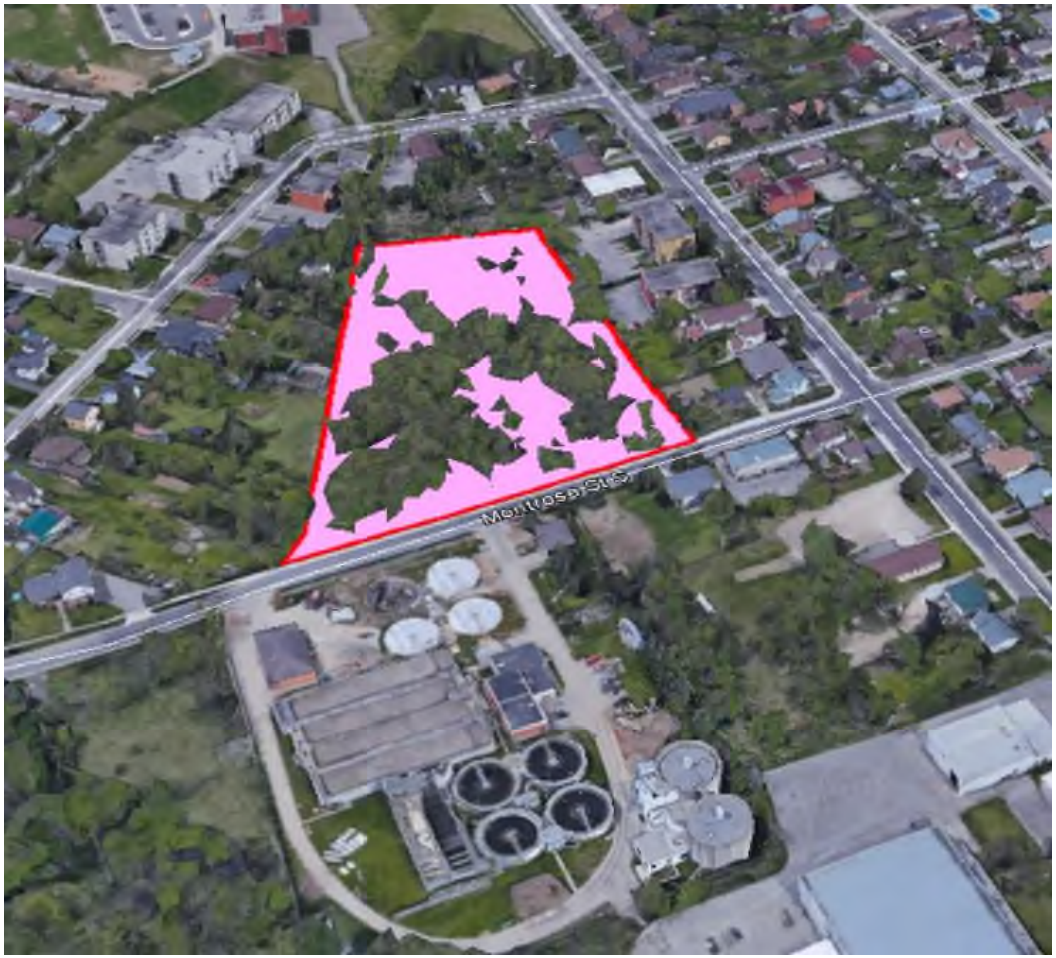
- New BPS will range from 4 to 6 pumps
- Desired BPS Site Area
  - 30m x 15m Building
  - 60m x 30 m Land
- Minimum BPS Site Area (4 Pumps)
  - 15m x 10m Building
  - 30m x 20 m Land
- BPS Peak Overflow

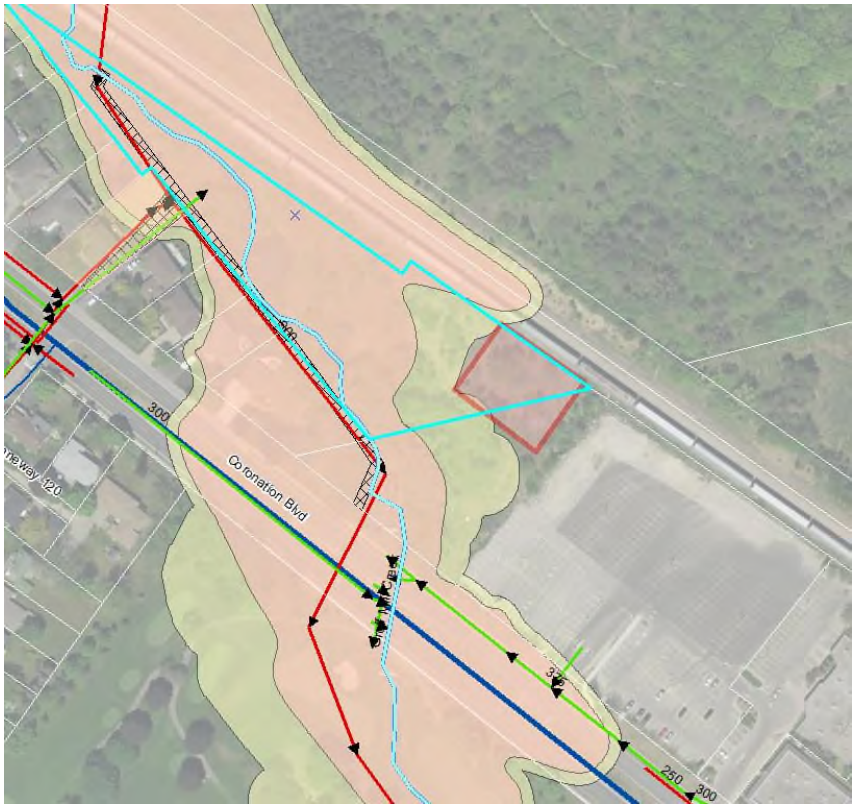
BPS – Site Options



BPS – Site Options

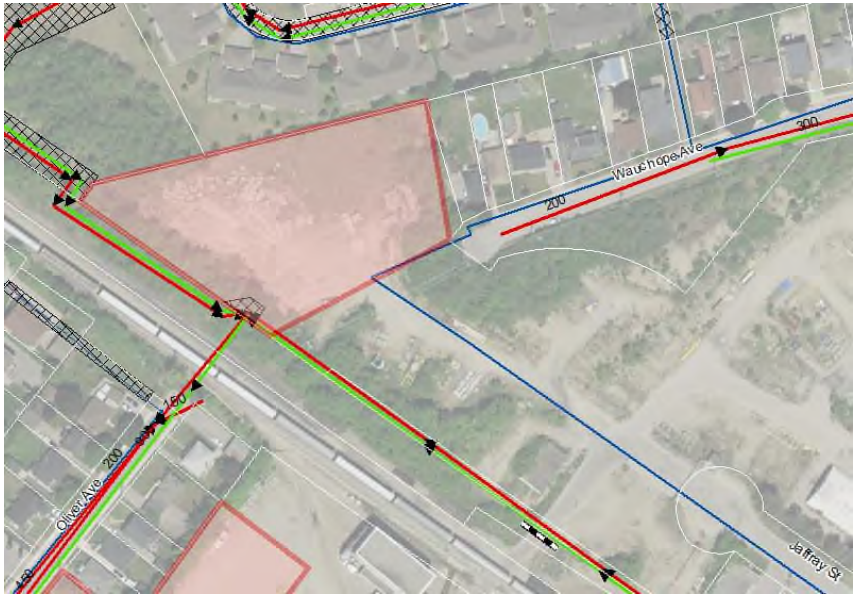




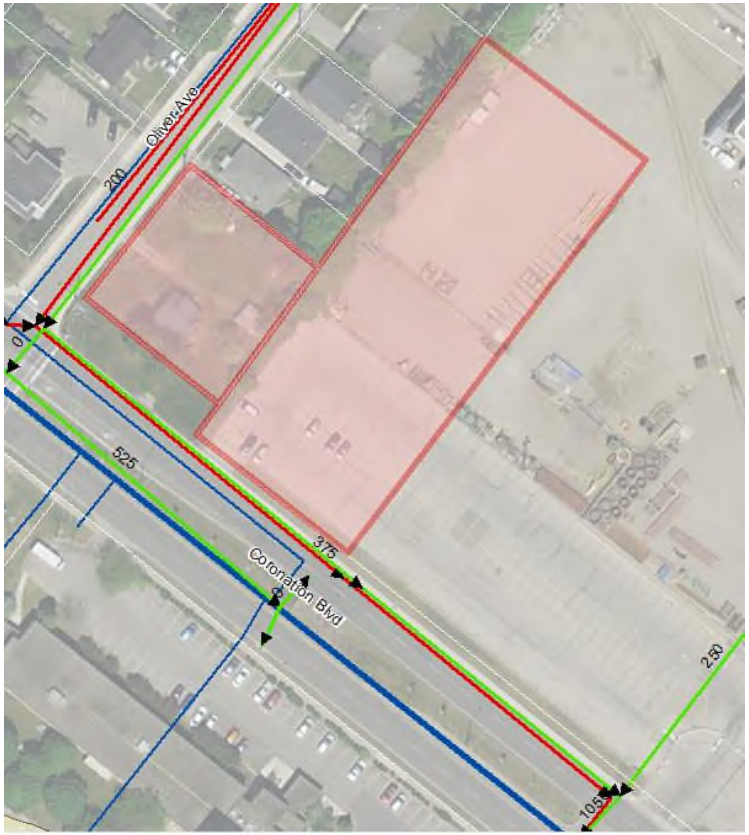


- Partially on City Owned Parcel
- Next/On GRCA Regulated Area
- Access Through
  - GRCA Regulated/Floodplain Area
  - Easement through neighboring commercial Property

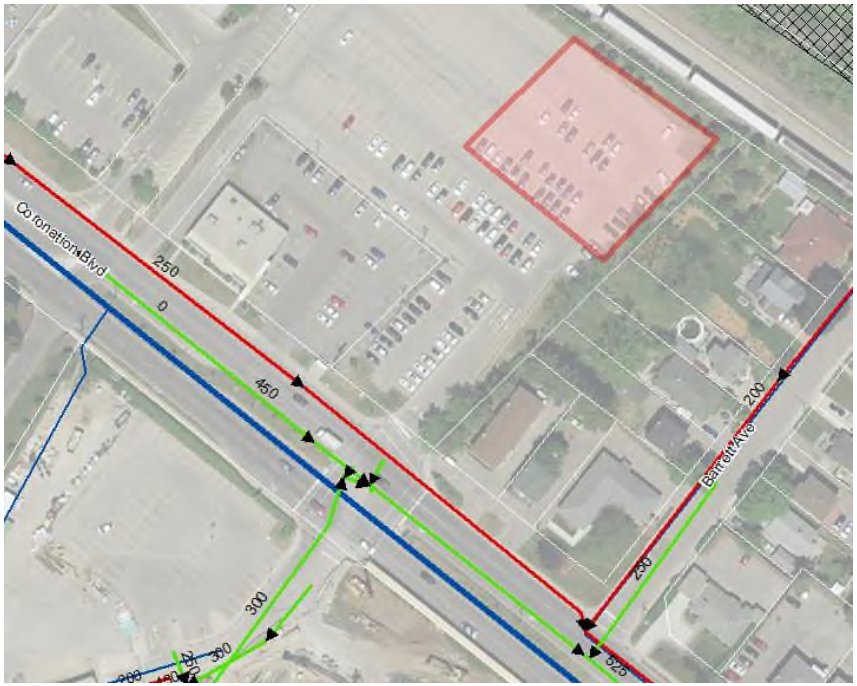
BW - Jaffey



BW - Coronation



CMH - Parking



Montrose



WATERMAIN ALIGNMENTS

- 450 mm size
- Service Connection to CMH
- Redundant Feed to Cam 1W BPS
  - Adequate Separation from Existing Coronation Blvd Watermain – Prevent Joint Failure
  - System Configuration for Separate Feed from Middleton and Turnbul

Option 1 – Coronation Blvd



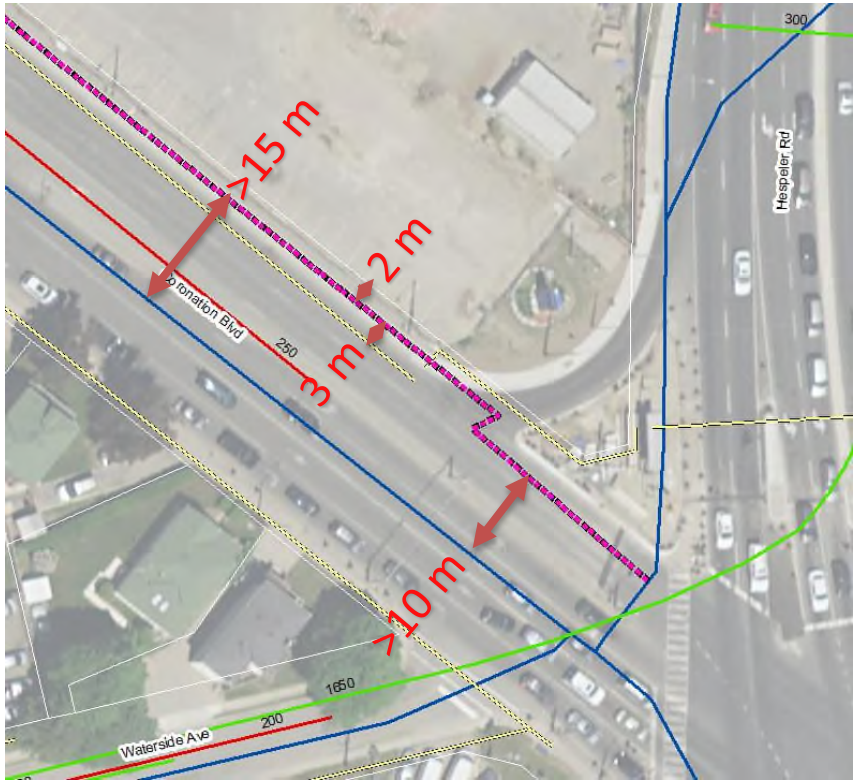
Option 2a/2b - Jaffray St.



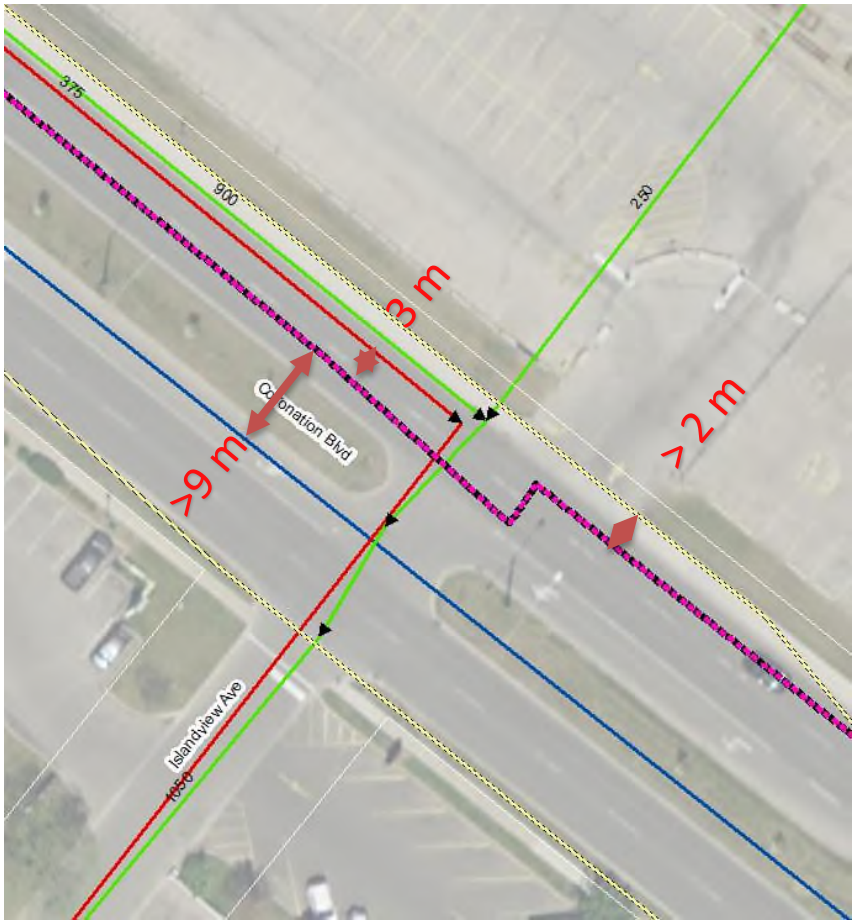
Option 3a/3b - Wauchope

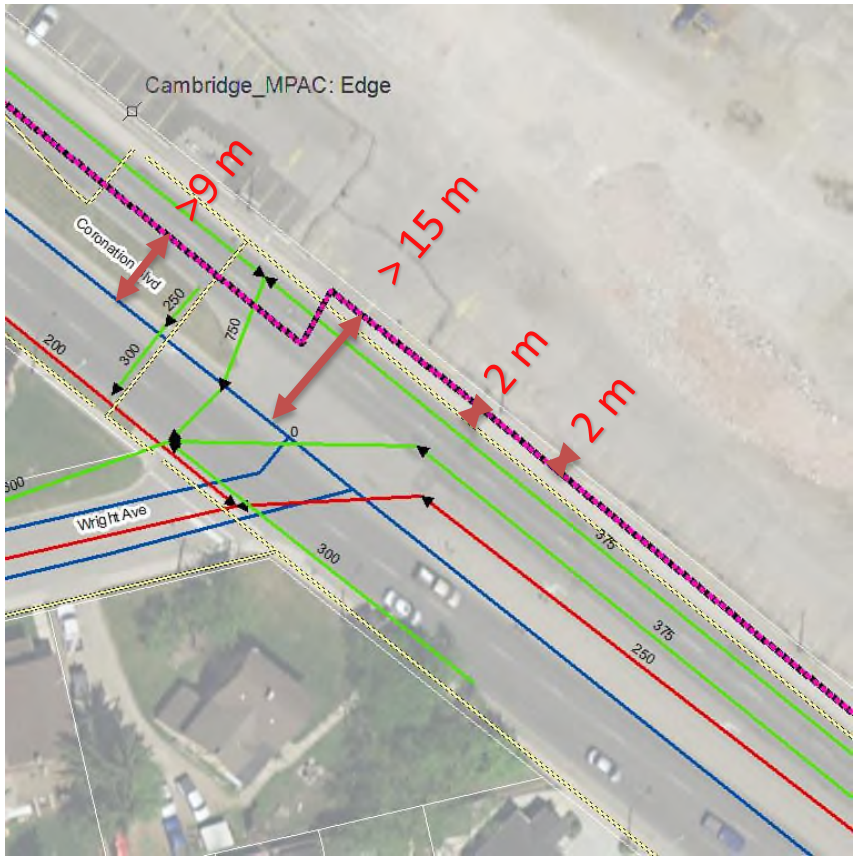


- Traffic Impacts
- Watermain Separation
- Gas Main Separation

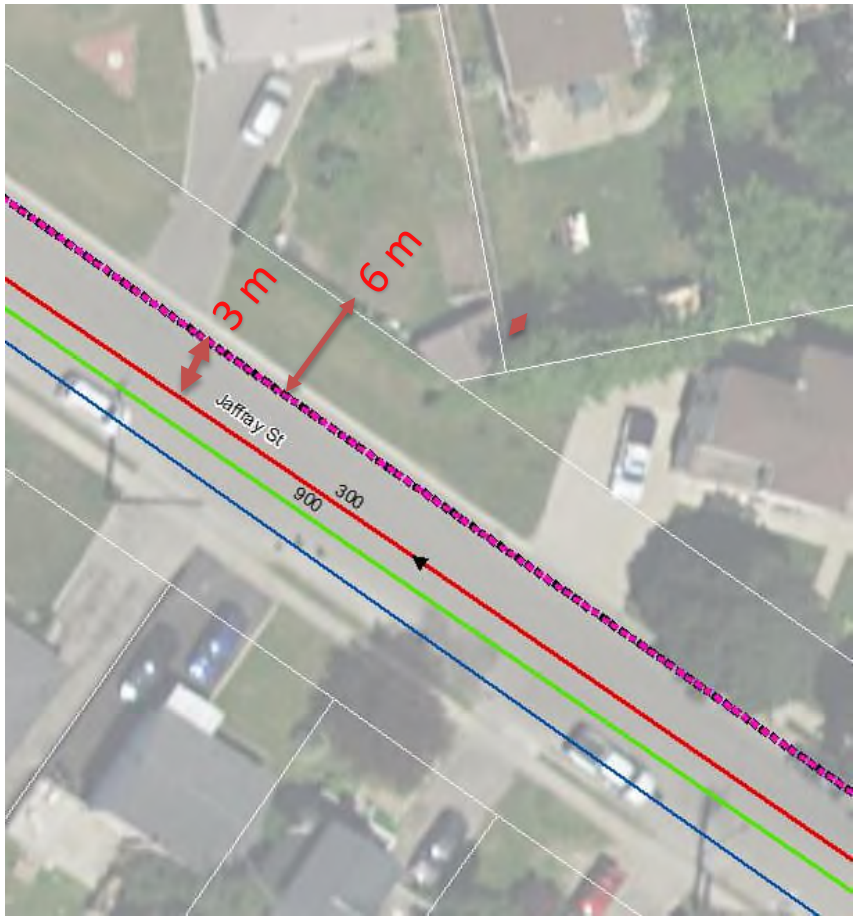


Option 1 - Discussion

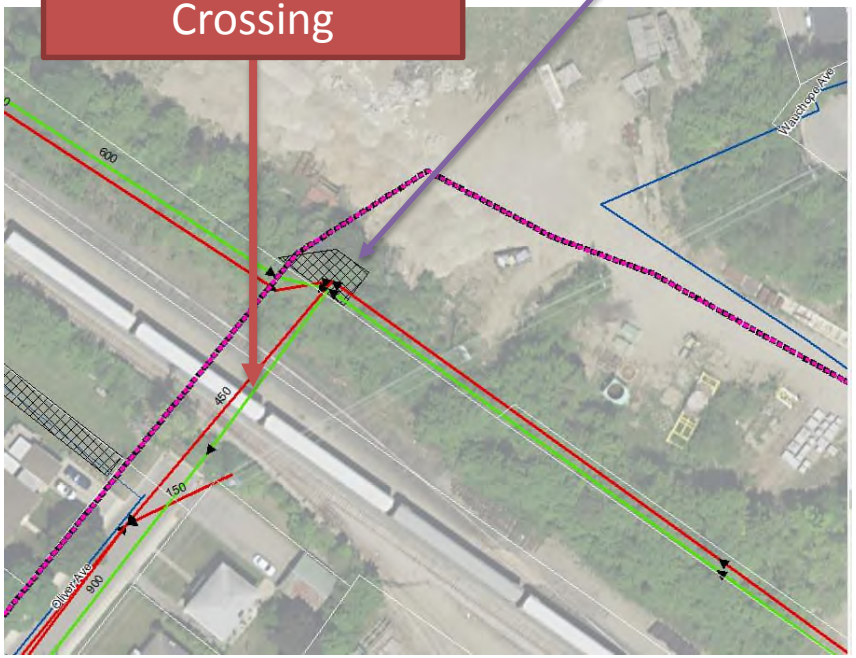


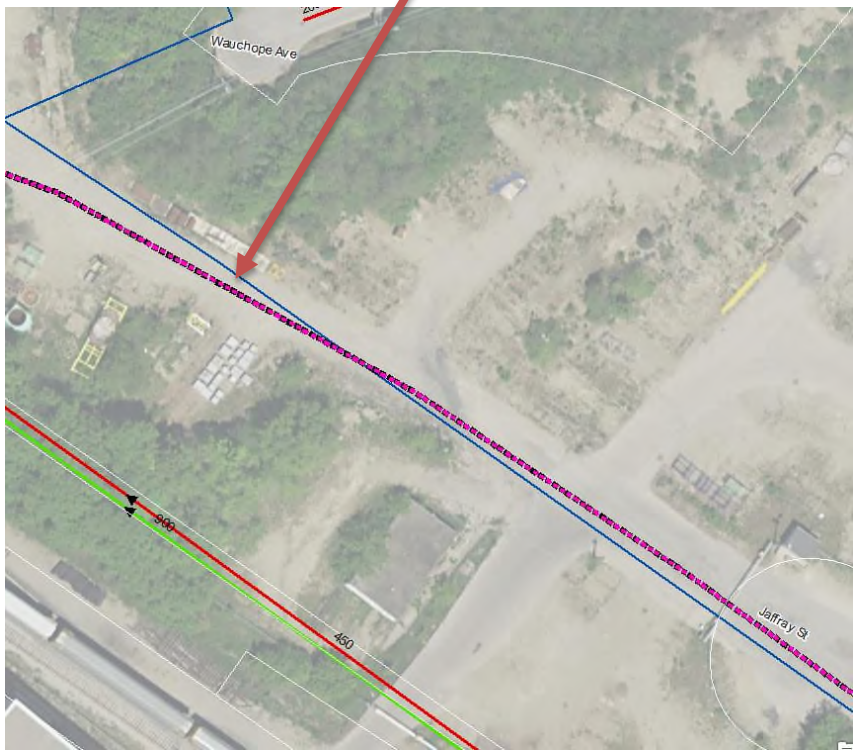


- Road RoW
- Easements
- Rail Crossing



Option 2/3 - Discussion

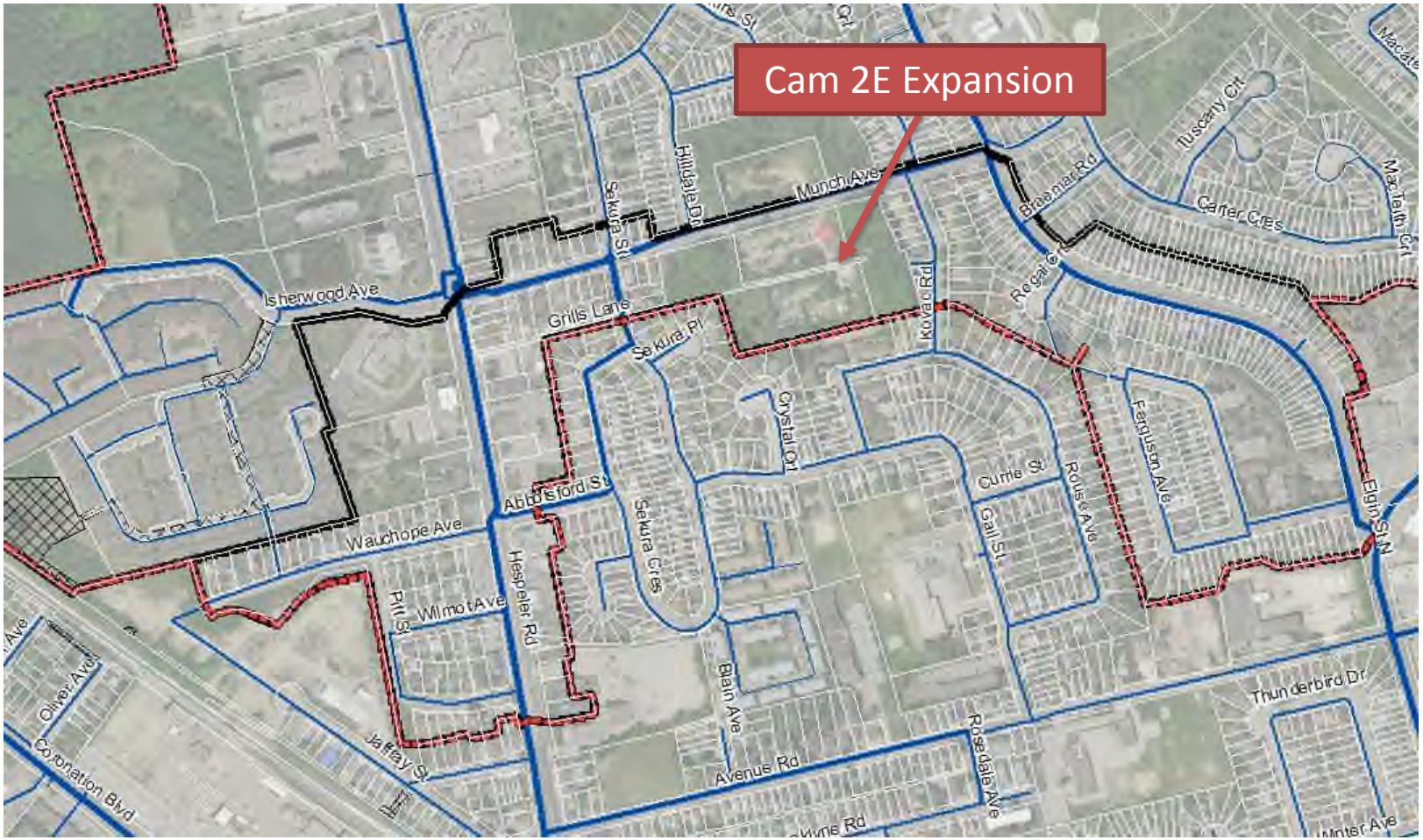




HESPELER PRV

- Cam 2E to Cam 1 PRV
- Use for Emergency Conditions (Normally Closed)
- Locations
  - Hespeler Trunk Watermain
  - Future Cam 1/Cam 2E Zone Boundary

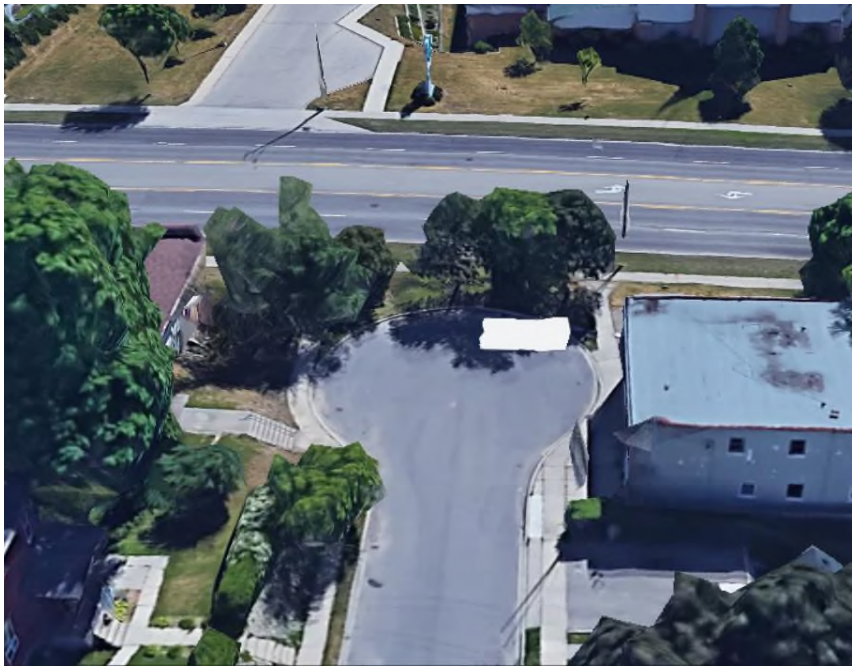
Cam 1 Boundary Adjustment

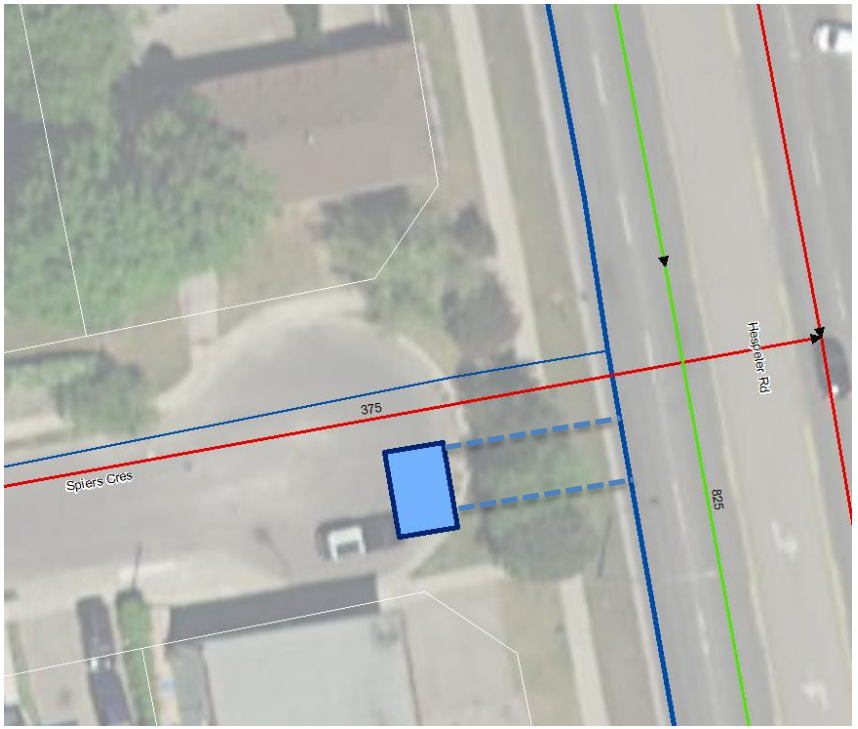


Cam 1 Boundary Adjustment



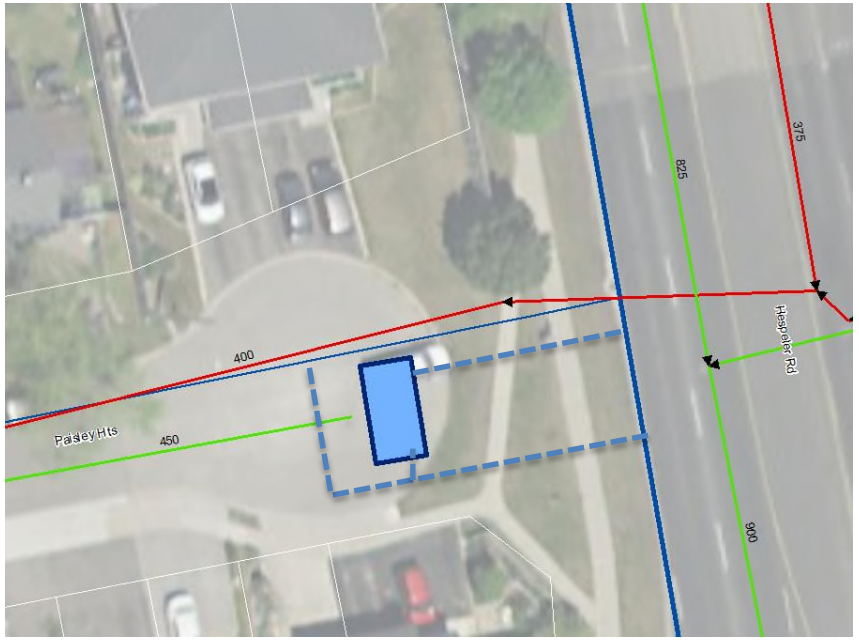
Hespeler PRV - Spiers





Hespeler PRV - Paisley

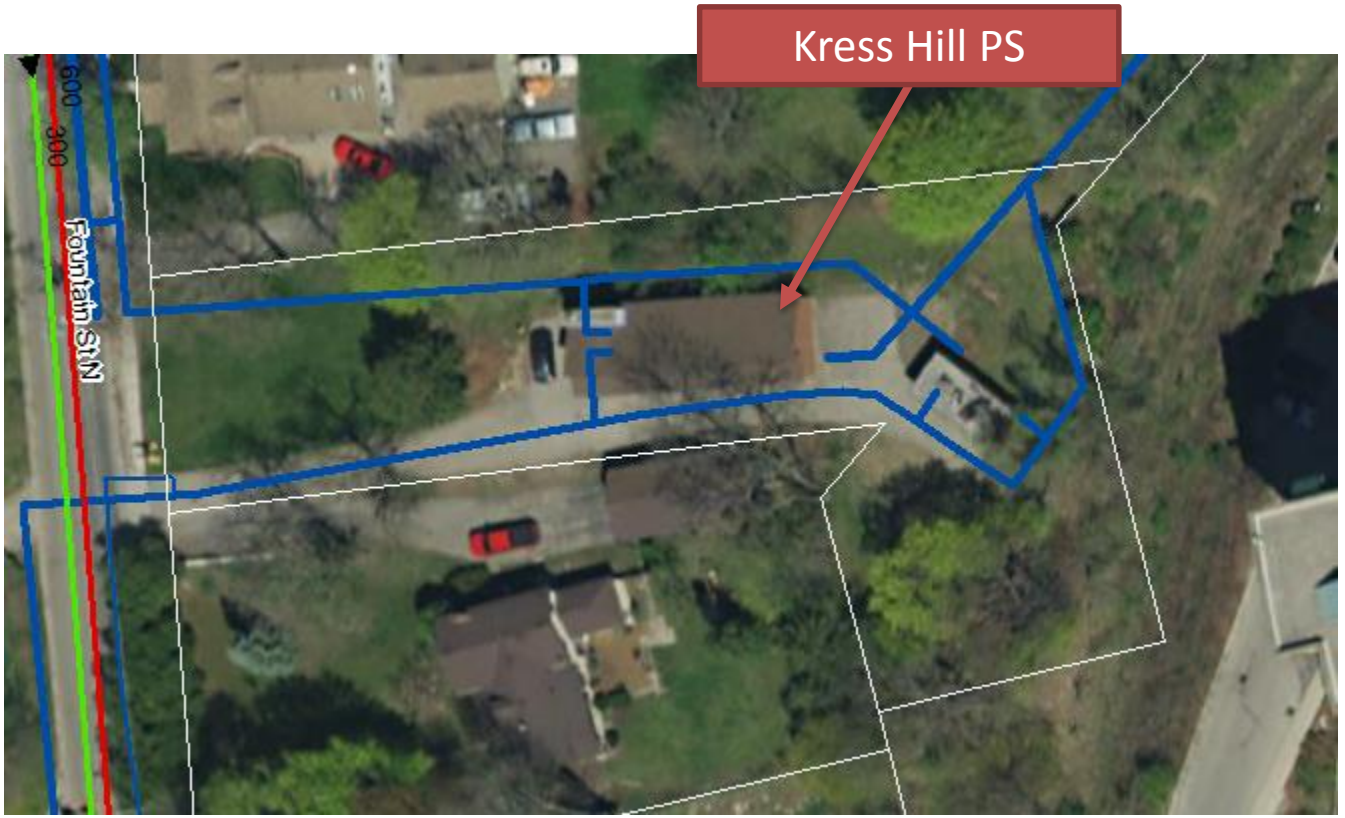




KRESS HILL PRV

Kress Hill PRV - Objectives

- Cam 2W to Cam 1W PRV
- Redundant Supply to Cam 1W – Sized to Provide Peak Flow
- Potential for Use Under Normal Operating Conditions – Pump Optimization
- 3 PRV Option Considered
- Use existing Kress Hill PS Site


Kress Hill PS
600
300
Fountain St N

Kress Hill PRV - Options

- Option 1
  - Demolish Existing PS Building
  - PRVs in New Ground Level Chamber
- Option 2
  - Partial Demolishing of Existing PS
  - Use Portion of Existing Basement as Camber
- Option 3
  - Repurpose PS as PRV station
  - PRVs Replace Existing Pumps + Basement Piping Cleanup

OTHER

- City's Planned Work
  - Along potential WM alignments
  - Near potential PS sites
- Ongoing Secondary Plan
  - Timeline
  - Change to Road RoW?
- Groff Mill Creek Culvert and WM Crossing
- Potential Property Acquisition
  - City Property
  - Adjacent Property

- Stakeholder Discussion - November
- Alternatives Evaluation – November/December
- Draft EA Report – December/January
- PPC –February 2017
- Final EA Report – February 2017
- Conceptual Design – January – Mar 2017
- Conceptual Design Report – April 2017

Q&A

Alternative Review Workshop

REGION OF WATERLOO

Creation of Cambridge Pressure Zone 1W

GMBP File No. 716015

Alternative Review Workshop - Agenda

MEETING DATE: December 1th, 2016
LOCATION: 150 Frederick St. Kitchener ON

ATTENDEES: Kevin Dolishny – Region of Waterloo
Leigh McDermott – Region of Waterloo
Adelaide Batista – Region of Waterloo
Matt Bender – Region of Waterloo
John Melfi – Region of Waterloo
Jorge Cavalcante – Region of Waterloo
Olga Vrentzos – Region of Waterloo
Chris Campbell – GM BluePlan
Julien Bell – GM BluePlan
Colin Wiebe – GM BluePlan
Loren Polonsky – GM BluePlan

COPIES TO: All Attendees

Meeting Objectives:

- Overview of Cam 1W Objectives
- Overview of Evaluation Methodology
- Review and Discussion of Alternatives
- Achieve Consensus of Preferred Alternatives

Agenda:

1) **Cambridge Water System Upgrades and Cam 1W EA Overview**

2) **Cam 1W Pressure Zone Objectives**

3) **Discussion of Alternative Evaluation Criteria and Approach**

4) **Watermain Alignments Evaluation and Recommendation**
   - Longlist and Screening
   - Identified Opportunities and Constraints
   - Shortlist Evaluation
   - Recommended Preferred

5) Pump Station Sites Evaluation and Recommendation

- Longlist and Screening
- Identified Opportunities and Constraints
- Shortlist Evaluation
- Recommended Preferred

6) Kress Hill and Hespeler Road PRV

- Site Options
- Identified Opportunities and Constraints
- Recommendation

7) Other

Master Contact List

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			Cambridge Memorial Hospital	Finance Department		700 Coronation Boulevard	Cambridge	ON	N1R 3G2	519-621-2330		
			Kinsmen Children's Centre			651 Concesion Road	Cambridge	ON	N3H 4L1			
			Waterloo Regional Police Service			176 Hespeler Rd	Cambridge	ON	N1R 6V7			

Public Consultation Centre

Public Consultation Centre

Notice

Notice of Study Commencement
Creation of Cambridge Pressure Zone 1W
Schedule 'B' Class Environmental Assessment

The Study

The Region of Waterloo initiated a study to create a new pressure zone (Zone 1 West) in order to complete a key step in implementing its planned Cambridge water system upgrades. This new pressure zone will enhance the current water system by increasing water pressure to local residents, while improving the security of supply and flexibility of system operations. The study examined new servicing elements to improve water pressure, including a new pumping station and trunk watermain. The study also evaluated changing the disinfection method from chlorine to chloramine.



The Process

The study is being completed as a separate Schedule 'B' Class EA study to comply with Phases 1 and 2 of the Municipal Class Environmental Assessment, which is an approved process under the Ontario Environmental Assessment Act.

Preliminary Recommended Improvements

Based on the analyses completed during the study, the Region recommends the following improvements:

- Construct a new watermain alignment within the Coronation Boulevard right-of-way between Hespeler Road and west of Cambridge Memorial Hospital
- Construct a new pumping station north of Coronation Boulevard and east of Groff Mill Creek
- Convert the residual disinfectant in drinking water from chlorine to chloramine, which is already used safely in Kitchener, Waterloo and throughout Canada

Residents Invited to Attend Public Consultation Centre to Discuss Recommendations

The Region invites residents to participate in a Public Consultation Centre (PCC) to learn more about the creation of the Cambridge Zone 1W Pressure Zone, review the alternatives, discuss the preliminary recommendations and next steps. The PCC will be held:

Date / Time	March 2, 2017 – 5pm to 7pm
Location	Galt Country Club 750 Coronation Blvd Cambridge ON

(*Please see back for more information*)

Notice of Study Commencement
Creation of Cambridge Pressure Zone 1W
Schedule 'B' Class Environmental Assessment

Please visit our website for more information about this project at: http://www.regionofwaterloo.ca/en/aboutTheEnvironment/MasterPlansandProjects.asp. If you wish to submit comments or would like to be notified about future project activities, please contact:

Kevin Dolishny, P.Eng.
Senior Project Engineer – Water Services
Region of Waterloo
150 Frederick Street, 7th Floor
Kitchener ON N2G 4J3
Phone: 519-575-4757 x 3862
Email: kdolishny@regionofwaterloo.ca

Mr. Julien Bell, P.Eng.
Infrastructure Planning, Partner
GM Blue Plan Engineering Limited
Royal Centre, 3000 Highway 7, Suite 402
Vaughan, ON L4K 4M3
Phone: 416-703-0667
Email: julien.bell@gmblueplan.ca

All comments and information received from individuals, stakeholder groups and agencies regarding this project are being collected under the authority of the "Municipal Act" to assist the Region of Waterloo in making a decision. Under the "Municipal Act", personal information such as name, address, telephone number, and property location that may be included in a submission becomes part of the public record. Questions regarding the collection of this information should be referred to Kevin Dolishny at the Region of Waterloo.

Public Consultation Centre

Display Boards

Creation of Cambridge Pressure Zone 1W Class Environmental Assessment

Public Consultation Centre

Thursday, March 2, 2017 - 5:00 p.m. to 7:00 p.m.

Galt Country Club, 750 Coronation Blvd, Cambridge, ON

Region of Waterloo

Ours to protect water and conserve

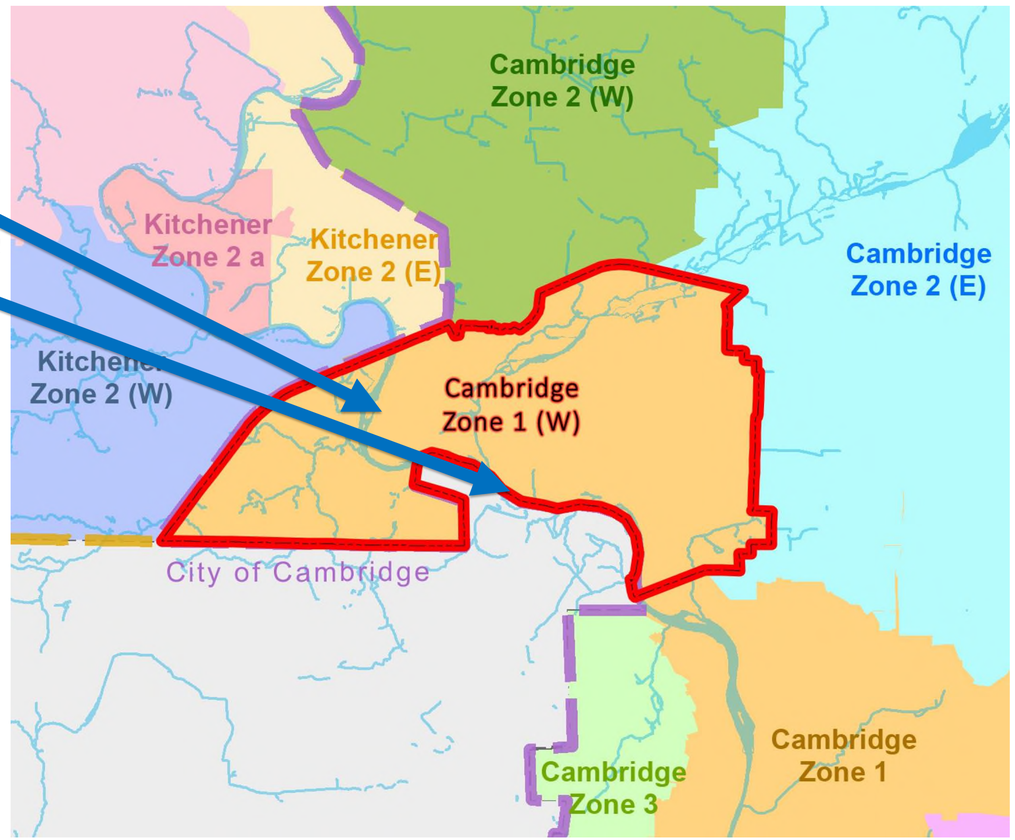
Region of Waterloo Water Services | www.regionofwaterloo.ca/water

Recommendations from Previous Studies

The 2015 *Water Supply and Distribution Master Plan* and subsequent *Cambridge Implementation Plan* recommended the completion of eight projects

This study focuses on two of the recommended projects

1. Optimization of Cambridge Zone 3
2. **New Kress Hill Pressure Reducing Valve**
3. **Creation of New Cambridge 1 West Pressure Zone**
4. Optimization of Cambridge Zone 1
5. Pinebush System Re-configuration
6. Rahmans System Re-configuration
7. Consolidation of Hespeler Wells
8. New Cambridge 2 East to Cambridge 2 West Booster Pumping Station



Why is this Study being Undertaken?

Improve the Water Pressure, Flow, and Operational Flexibility in Cambridge

- To improve the level of service while increasing overall security of water supply and flexibility of system operations
- To establish a new Cambridge Pressure Zone 1W is the first step in a larger plan to improve the overall operations of the Cambridge water supply system



Study Overview

This Schedule ‘B’ Class Environmental Assessment (EA) Study will:

- Identify the essential infrastructure, system modifications and operational changes needed to create the new Cambridge Pressure Zone 1W
- Identify the location of new infrastructure including:
  - New trunk watermain
  - New pumping station
  - Pressure reducing valves

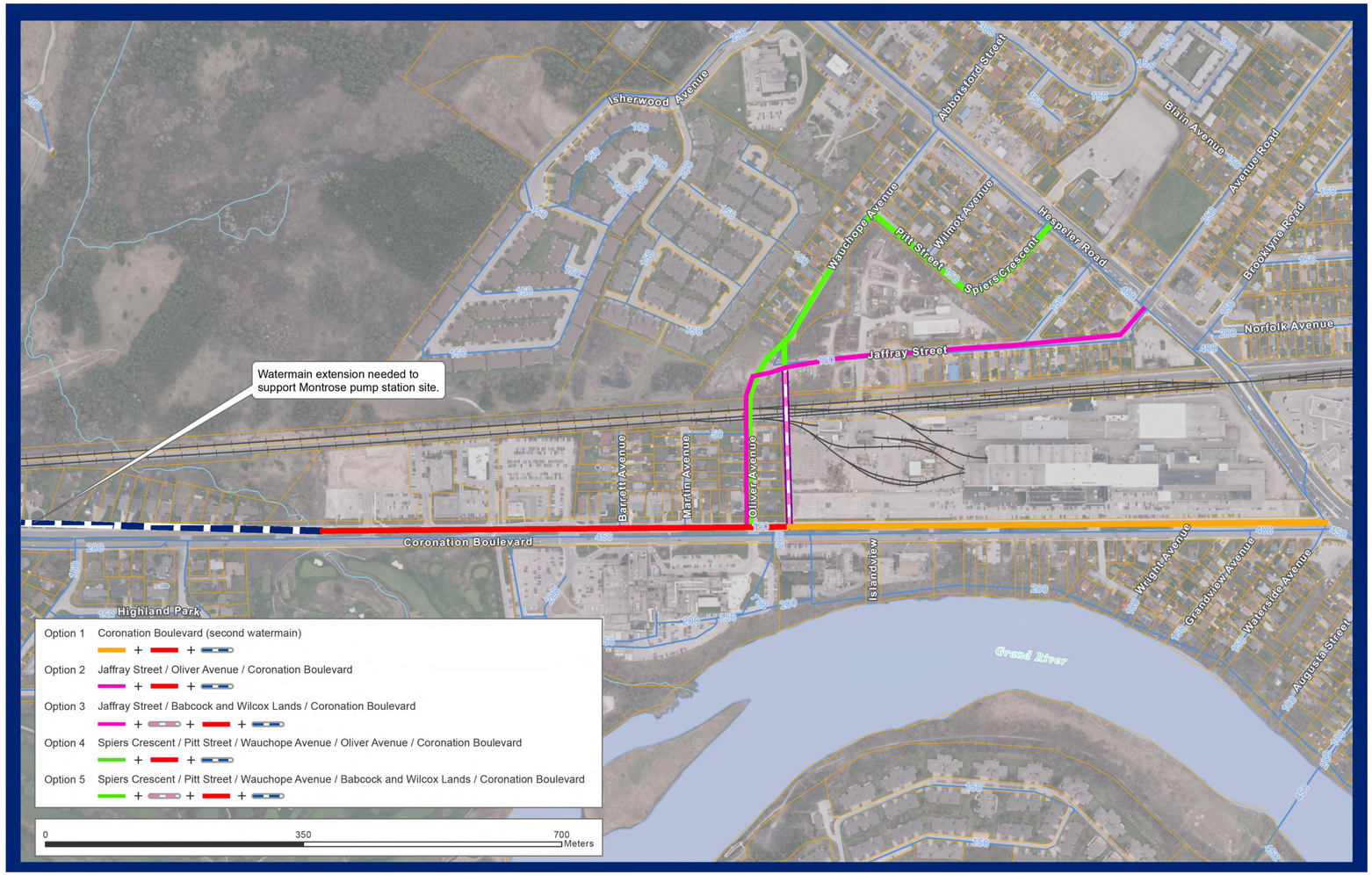
Phase 1: Problem/Opportunity	Phase 2: Alternative Solutions
What is the problem and/or opportunity?	How can the problem/opportunity be addressed?

The two-phase Schedule ‘B’ Class EA planning process

Trunk Watermain Alignment Options

Why is a New Trunk Watermain Needed?

- To provide redundancy to the future Cambridge 1W pumping station and to Cambridge Memorial Hospital
- To provide operational and maintenance flexibility



Five possible trunk watermain alignments were chosen for evaluation

Evaluation of the Trunk Watermain Alignment Options

Mostly positive / Few impacts

Positive & Negative/ Some impacts

Mostly Negative/ Several impacts

	No Build	Option 1	Option 2	Option 3	Option 4	Option 5
Technical Feasibility						
Financial Viability (costs)						
Legal / Jurisdictional						
Environmental Impacts						
Socio/ Cultural Impacts						



Preliminarily Recommended: Option 1 - Coronation Boulevard

- Most compatible with existing and future infrastructure
- Lowest construction cost ($2.2 million)
- Not likely to require any additional property
- Least scheduling and financial risk, and can accommodate traffic during construction
- Potential to coordinate with other proposed road work

Pump Station Site Options

Why is a New Pumping Station Needed?

- To create the new pressure zone Cambridge 1 West
- To maintain consistent water flows and pressure in Cambridge 1 West
- To allow other water system upgrades in the City of Cambridge
- To improve the efficiency of the Cambridge's water system

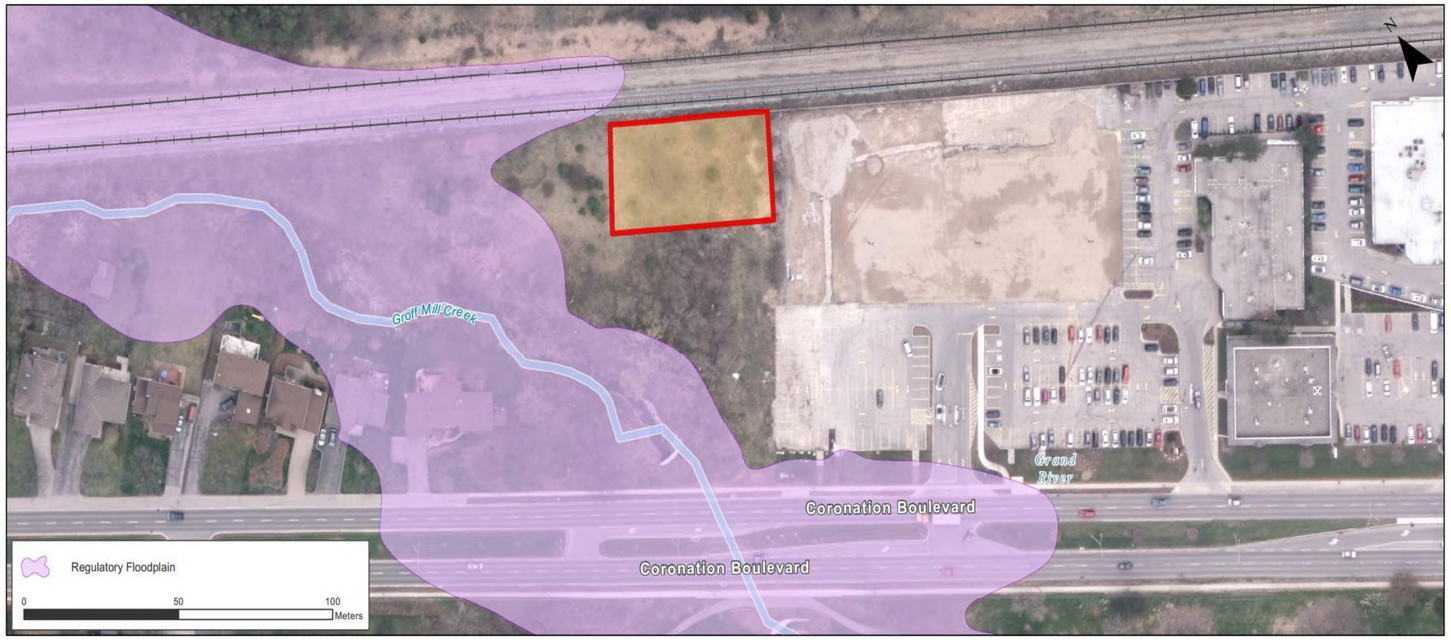


Four pumping station sites were identified to support the recommended Coronation Boulevard watermain alignment

Evaluation of Pump Station Sites

Mostly positive / Few impacts **Positive & Negative/ Some impacts** **Mostly Negative/ Several impacts**

	No Build	**Option 1** Groff Mill Creek	**Option 2** Hospital Parking Lot	**Option 3** B&W/ Coronation	**Option 4** Oliver/ Coronation
Technical Feasibility					
Financial Viability (costs)					
Legal / Jurisdictional					
Environmental Impacts					
Socio/ Cultural Impacts					



Preliminarily Recommended: Option 1 - Groff Mill Creek

- Minimal community impacts –no residential properties surrounding the proposed site
- Located across two open space parcels and is adjacent to the proposed Coronation Boulevard watermain
- Modest additional cost for extension of watermain to site
- Access to the site is partially located within a regulated floodplain and will require Grand River Conservation Authority permitting

Conceptual Drawings of Proposed Groff Mill Creek Pumping Station*



Birds-eye view of proposed
Groff Mill Creek Pumping Station



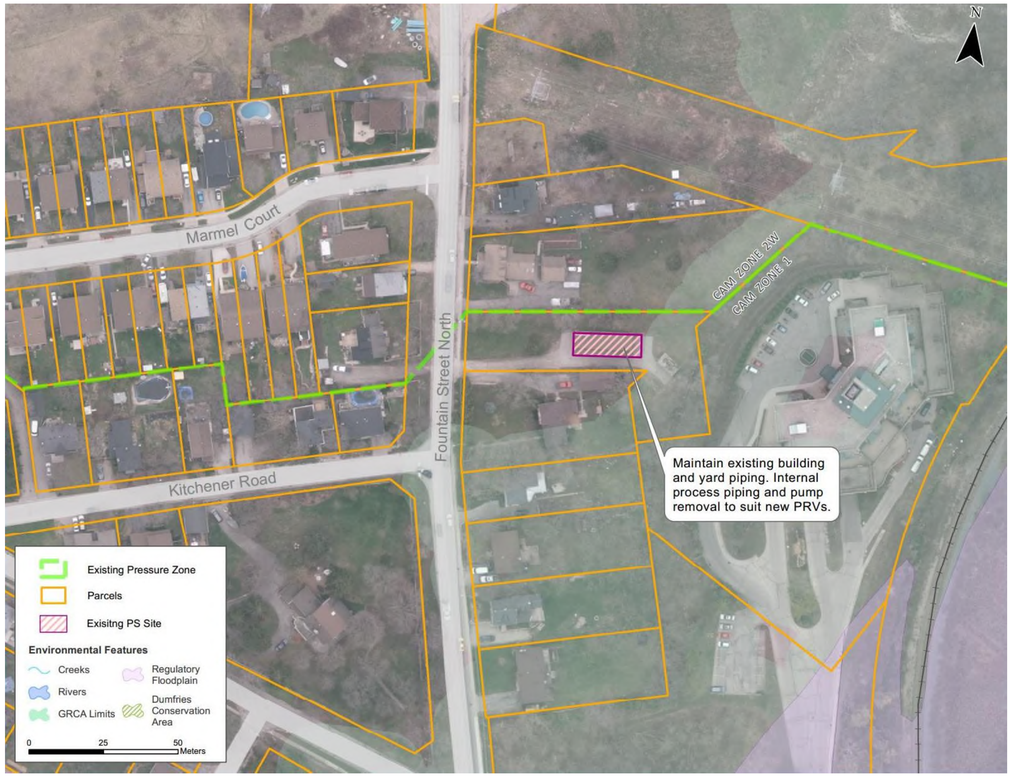
Street-level view of proposed
Groff Mill Creek Pumping Station

*Image is currently conceptual and may change as pumping station design evolves

Pressure Reducing Valves (PRVs)

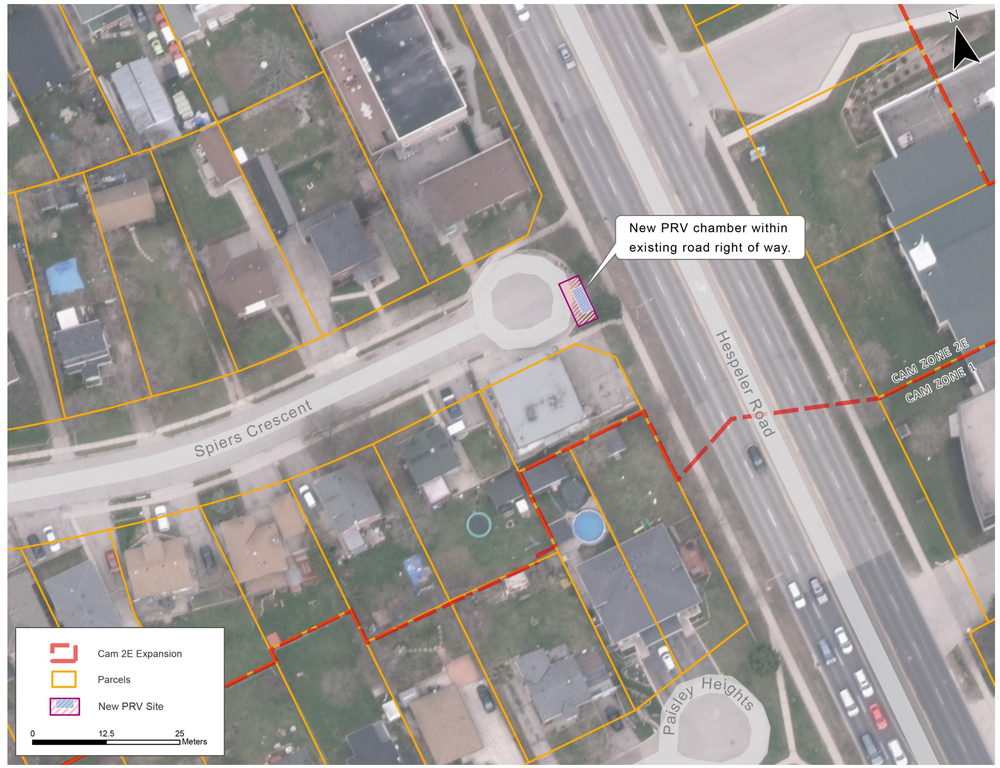
New PRV stations are also needed to establish the Cambridge 1W Pressure Zone and to support overall Cambridge water system optimization

Kress Hill PRV



The Kress Hill Pumping Station building – which is currently not in use – will be converted into a PRV station

Hespeler Road / Spiers Crescent PRV



A new PRV will be located at the Spiers Crescent cul-de-sac, upstream of the new watermain, and will support the new pump station flow under emergency conditions

Cambridge 1W Zone to Include New Disinfection Method

New Cambridge 1W Zone to convert residual disinfectant in drinking water from chlorine to chloramine

Chloramine is a combination of chlorine and ammonia and has several advantages over chlorine, including its effectiveness against a wide variety of germs, and its ability to maintain high quality water for a longer period of time

This change is needed to allow the new Cam 1W zone to also be supplied by the Kitchener system. This will increase the operational flexibility and will strengthen water supply to the new pressure zone

- The Region already safely uses chloramine for disinfecting water in Kitchener, Waterloo and other communities
- Approximately 80% of the water in the Region is treated with Chloramines
- Chloramine has been used safely throughout Canada for several years
- Chloraminated water is safe for drinking, bathing, cooking and for all general uses

Chloramines are Safe

Just like with chlorinated water, some users should take precautions:

Kidney Dialysis Patients

- Chloramine must be removed from water that is used for kidney dialysis machines. If you are a dialysis patient, please contact your physician or treatment centre for more information



Fish / Reptile Owners

- Chloramines can be harmful to fish, reptiles and amphibians, but can be neutralized or removed with treatment products

Chloramines have been used in Canada since the 1930s. Chloramines are safely used in Kitchener, Waterloo, Ottawa, Edmonton, and St. John's in Canada.

Next Steps

- Refine the preliminary recommendations, as needed
- File the Environmental Assessment report for public review
- Coordinate property and utilities requirements
- Refine watermain alignment and pumping station locations
- Continue to work with the City of Cambridge and Grand River Conservation Authority for permits
- Develop an infrastructure staging plan
- Determine construction timing



Do you have any questions, comments or want to stay up-to-date? Please contact:

Kevin Dolishny, P.Eng.
Senior Project Engineer
150 Frederick Street, 7th Floor
Kitchener, Ontario N2G 4J3
Tel: 519-575-4757 ext. 3862
Email: kdolishny@regionofwaterloo.ca

Please note that information related to this study will be collected in accordance with the *Freedom of Information and Protection of Privacy Act*. All comments received will become part of the public record and may be included in the study documentation prepared for public review.

Thank You for Attending!

Public Consultation Centre

Sign-in Sheet

Region of Waterloo

Cambridge Zone 1W Pressure Zone Class EA Study
Public Consultation Centre #1 – March 2, 2017

SIGN-IN SHEET

Name (Organization if applicable)	Street Address	City	Phone Number	Email
James Etienne C+C	50 Dickson St	Cambridge	(519) 6210740145546	jetienne@cambridge.ca
Jamie Austin	1310 Bishop St (Public Works)	"	519-621-0740	austinj@cambridge.ca
Michael Collins	[redacted]	"	[redacted]	[redacted]
GODFREY FEARN		"		
FRED ROSINA		CAMBRIDGE		
[illegible]				
Marilyn [illegible]		Cambridge		
Ed Alexander		Cambridge		
VICKI POWER		Camb		

With the exception of personal information, all comments will become part of the public record of the study. The study is being conducted according to the requirements of the Municipal Class Environmental Assessment, which is a planning process approved under Ontario's Environmental Assessment Act.

Public Consultation Centre

Fact Sheet

Converting Chlorine to Chloramine

Frequently Asked Questions

Q: What is chlorine?

A: Chlorine is a disinfectant used in water distribution systems to provide primary and secondary disinfection.

A: Chlorine can kill/inactivate most microorganisms found in drinking water. This eliminates bacteria and viruses.

Q: What is chloramine?

A: Chloramine is another disinfectant used in water distribution systems to provide secondary disinfection. This removes bacteria and viruses.

A: Chloramine is a combination of small amounts of chlorine and ammonia which has reacted to form chloramine.

Q: Why change from chlorine to chloramine?

A: Chloramine lasts longer in the water system and is effective against a wide variety of germs.

A: It is widely reported by many customers that chloramine improves the taste and odour of drinking water.

Q: Is chloramine safe to use?

A: Yes, it is safe for people and animals to drink and use for all general household activities.

A: It is recognized and approved by the Ministry of Environment and Climate Change (MOECC) and Healthy Canada as a safe disinfectant.

Q: Who else uses chloramine?

A: Waterloo, Kitchener, Toronto, Niagara, Hamilton, Ottawa, Edmonton, St. John's, and many others in Canada and the USA.

Q: How does this impact dialysis patients?

A: It is safe for dialysis patients to drink the water.

A: However, chloramine must be removed through the dialysis equipment. Contact a physician for more information.

Q: How does this impact specialized businesses?

A: Companies may need to adjust their filtration systems to accommodate the change.

Q: How does this impact pet owners?

A: Chloramine is harmful to fish (saltwater and freshwater) and amphibians.

A: Like chlorine, chloramine must be removed from the water before use in fish tanks, ponds and aquariums.

A: Chloramine can be removed from water with inexpensive products (drops or tablets) or specified carbon filters. These can be found at most local pet supply stores.

Q: Will chlorine affect my plants?

A: No, the little amount present in the water should not affect plants.

A: Good bacteria needed for plants are generally protected by the soil.

Q: Will letting the water sit or boiling the water remove chloramine?

A: Unlike chlorine, chloramine does not evaporate into the air. It can take weeks to dissipate.

A: Letting it sit or boiling will not remove chloramine.

Q: How can I remove chloramine?

A: Use a carbon filter with a high quality granular activated carbon.

A: Water treatment products designed specifically to remove chloramines.

Q: Will chloramine affect my pool?

A: No, swimming pools still require a “free-chlorine” residual to slow algae and bacterial growth. Chloramination has the advantage of creating fewer nuisance by-products compared to chlorine. However, you will need to “shock” the pool whenever you top-up from your municipal supply.

For more information please visit the project website at:
http://www.regionofwaterloo.ca/en/aboutTheEnvironment/MasterPlansandProjects.asp.
or contact:

Kevin Dolishny, P.Eng.
Senior Project Engineer – Water Services
Region of Waterloo
Phone: 519-575-4757 x 3862
Email: kdolishny@regionofwaterloo.ca

Mr. Julien Bell, P.Eng.
Infrastructure Planning, Partner
GM Blue Plan Engineering Limited
Phone: 416-703-0667
Email: julien.bell@gmblueplan.ca



Notice of Study Completion

Region of Waterloo

TRANSPORTATION AND
ENVIRONMENTAL SERVICES
Water Services

150 Frederick Street 7th Floor
Kitchener Ontario N2G 4J3 Canada
Telephone: 519-575-4400
TTY: 519-575-4608
Fax: 519-575-4452
www.regionofwaterloo.ca

May 15, 2017

Client
Address
City, Province
Postal Code

Dear Mr./Ms. Last Name:

Re: Notice of Study Completion for the Creation of Cambridge Pressure Zone 1W Schedule 'B' Class Environmental Assessment

The Region of Waterloo has completed the Schedule 'B' Class Environmental Assessment (EA) study to assess the Creation of Cambridge Pressure Zone 1W to create a new pressure zone in the City of Cambridge. The study was initiated in order to complete a key step in implementing its planned Cambridge water system upgrades.

Please find enclosed the Notice of Study Completion which includes additional information about the study's recommendations. Should you have any questions, please do not hesitate to contact me at your convenience.

Sincerely,

Kevin Dolishny, P.Eng.
Senior Project Engineer- Servicing and Development Planning
Email: kdolishny@regionofwaterloo.ca
Phone: 519-575-4757 x 3862

Enclosure

Region of Waterloo

Notice of Study Completion

Creation of Cambridge Pressure Zone 1 West
Municipal Class Environmental Assessment

The Study

The Region of Waterloo has completed a study to create a new pressure zone (Pressure Zone 1 West) in order to finalize a key step in implementing its planned Cambridge water system upgrades. This new pressure zone will enhance the current water system by increasing water pressure to local residents, while improving the security of supply and flexibility of system operations. This study examined new servicing elements to improve water pressure, including a new pumping station, trunk watermain, and other system modifications.



The Study Process

The Cambridge Pressure Zone 1 West study was completed as a Schedule 'B' Class EA study to comply with Phases 1 and 2 of the Municipal Class Environmental Assessment process, which is approved under the Ontario Environmental Assessment Act.

Based on the analyses completed during the study, the Region has recommended the following improvements:

- Construct a new watermain alignment within the Coronation Boulevard right-of-way between Hespeler Road and west of Cambridge Memorial Hospital
- Construct a new Booster Pumping and Chloramination Station north of Coronation Boulevard and east of Groff Mill Creek
- Construct new Cambridge 2E and Cambridge 1 Pressure Reducing Valves at Spiers Crescent to allow for implementation of Cambridge 1 Pressure Zone boundary adjustments and strengthened security of the water system
- Re-purpose the existing Kress Hill Pumping Station as a Pressure Reducing Valve station to minimize implementation costs and allow for ease of future inspection and maintenance
- Change the residual disinfectant used in the new pressure zone from chlorine to chloramine, which is already used safely in Kitchener, Waterloo and throughout Canada

As part of the study process, the Region hosted a Public Information Centre on March 2, 2017 to engage residents and stakeholders on the recommendations while complying with the Class EA process.

Completion

The Cambridge Pressure Zone 1 West Class EA has been prepared to document the planning and decision-making process undertaken for this study. By this notice, the report (Project File) is being placed on the public record for a 30-day review period (starting May 26th, 2017 and ending June 26th, 2017) in accordance with the requirements of the Municipal Class EA. The Cambridge Pressure Zone 1 West study Project File is available for public review on the Region's website (regionofwaterloo.ca) and at the following locations:

Region of Waterloo Headquarters	**Cambridge City Hall**
150 Frederick Street	50 Dickson Street
Waterloo, ON N2J 4A8	Cambridge, ON N1R 8S1
2nd Floor, Clerks Department	2nd Floor, Clerks Department

Comments

If you have any questions or wish to submit comments, please contact:

Kevin Dolishny, P.Eng.	**Julien Bell, P.Eng.**
Senior Project Engineer, Water Services	Infrastructure Planning, Partner
Region of Waterloo	GM BluePlan Engineering Limited
150 Frederick Street, 7th Floor	Royal Centre, 3300 Highway 7, Suite 402
Waterloo ON N2J 4A8	Vaughan, ON L4K 4M3
Tel: 519-575-4757, Ext. 3862	Tel: 416-703-0667
Email: kdolishny@regionofwaterloo.ca	Email: julien.bell@gmblueplan.ca

During the 30-day public review period, residents are encouraged to read the Project File and provide comments to the study's Project Manager at the address provided above.

If, after consulting with the Region of Waterloo, you have significant unresolved concerns with the study, you have the right to make a written request to the Minister of the Environment and Climate Change (The Honourable Glen R. Murray, 11th Floor, Ferguson Block, 77 Wellesley Street West, Toronto, Ontario M7A 2T5) to appeal the study results – also known a Part II Order request. The Part II Order request must be received by the Minister of the Environment during the 30-day review period and a copy of the request should be forwarded to the Director of the Ministry of the Environment and Climate Change's Environmental Approvals Branch (Director, MOECC Environmental Approvals Branch, 135 St. Clair Avenue West, 1st floor, Toronto ON, M4V 1P5) and the Region of Waterloo. If there are no outstanding concerns after the end of the public review period, the study will be considered to have met the requirements of the Municipal Class EA, and the project may proceed to implementation.

With the exception of personal information, all comments will become part of the public record of the study. The study is being conducted according to the requirements of the Municipal Class Environmental Assessment, which is a planning process approved under Ontario's Environmental Assessment Act.