Halifax Water Meeting Agenda

Haifax Water Board of Commissioners	
Date: January 25, 2024 Location: MS Teams Virtual Meeting	Meeting Time: 9:00 a.m.
Commissioner Colleen Rollings, Chair	

IN CAMERA AGENDA	Presenting	Time
1C. Governance Matter	Chair	2 min
2C. Governance Matter	Chair	2 min
3C. Approval of Minutes of the In-Camera Meeting held on Thursday, November 23, 2023	Chair	2 min
***Motion**: That the Halifax Water Board approve the In-Camera minutes of November 23, 2023.*		
4C. Business arising from the minutes a.		
5C. Personnel Matter	Chair	5 min
6C. Personnel Matter	CEO & General Manager	5 min
7C. Approval of Minutes of the In-Camera Meeting held on Friday, January 19, 2024.	Chair	2 min
***Motion**: That the Halifax Water Board approve the In-Camera minutes of January 19, 2024.*		

PUBLIC AGENDA	Presenting	Time
Regular Reports		
1. Ratification of In-Camera motions	Chair	5 min
***Motion**: That the Halifax Water Board ratify the In-Camera Motions.*		
2. Approval of the order of business and approval of additions and deletions		
***Motion**: That the Halifax Water Board approve the order of business and approve additions and deletions.*		
3. Approval of minutes of the public meeting held on Thursday, November 23, 2023.	Chair	2 min
***Motion**: That the Halifax Water Board approve the minutes of the public meeting held on November 23, 2023.*		

4. Business Arising from the Minutes a. Enterprise Risk Management Policy Approval ***Motion**: That the Halifax Water Board approve approve the updated ERM Policy attached to this report.*	Enterprise Risk Management Program Manager	5 min

Financial Reports		
5. Operating Results for the Eight Months Ended November 30, 2023	Director, Corporate Services/CFO	5 min
6. Proposed 2024/25 Capital Budget ***Motion**: That the Halifax Water Board approve the proposed 2024/25 capital budget at a total value of $152,497,000 as detailed in the attached Schedule 1.*	Director, Engineering and Technology Services	30 min

Capital Approvals		
7.1 Mill Cove Wastewater Treatment Facility Upgrade – Funding Approval ***Motion**: That the Halifax Water Board approve approve funding in the amount of $10,000,000 for completing Phases 1 through 3 of the Mill Cove WWTF Upgrade and Expansion project.*	Director, Engineering and Technology Services	10 min
7.2 Dartmouth Wastewater Treatment Facility – UV Upgrades ***Motion**: That the Halifax Regional Water Commission Board approve funding in the amount of $7,275,000 for the Harbour Solutions WWTFs – UV Disinfection System Upgrades & Replacements project.*	Director, Engineering and Technology Services	5 min

Other Business		
8. Port Wallace Capital Cost Contribution (CCC) ***Motion**: That the Halifax Water Board approve:* *1. The proposed Capital Cost Contribution initial base rate for Port Wallace at an estimated value of $3,164/acre for water and $12,367/acre for wastewater with density adjustments as detailed within Table 1 of the report.* *2. Preparation and submission of application for necessary Nova Scotia Utility and Review Board approvals and amendments.*	Senior Manager, Regulatory Approvals	20 min

Halifax Water Meeting Agenda

Information Reports
1-I. Operational Performance Report
2-I. Halifax Water Compliance Statement – Q3 Certification
3-I. HRM Master Trust Investment Performance Q3 2023
4-I. 2023 Annual Report – Pension and Benefits Advisory Committee
5-I. Enterprise Risk Management – Semi Annual Report to the Board
6-I. Capital Project Status Dashboard

Prepared By:

Lorna Skinner

Digitally signed by Lorna Skinner
Date: 2024.01.24 13:21:29 -04'00'

Lorna Skinner
Governance Coordination Assistant

ITEM #4a

Halifax Water Board

January 25, 2024

TO: Colleen Rollings, P.Eng., PMP., Chair and Members of the Halifax Regional Water Commission Board

SUBMITTED BY: Louis de Montbrun — Digitally signed by Louis de Montbrun Date: 2024.01.19 10:14:40 -04'00'

Louis de Montbrun, Director, Corporate Services/CFO

APPROVED: Tareq Al-Zabet — Digitally signed by Tareq Al-Zabet Date: 2024.01.19 10:28:33 -04'00'

Tareq Al-Zabet, Ph.D., CEO & General Manager

DATE: January 17, 2024

SUBJECT: **Revisions to the Enterprise Risk Management Policy**

ORIGIN

Enterprise Risk Management (ERM) Policy & Framework and Enterprise Risk Management Board Committee Business Cycle.

RECOMMENDATION

It is recommended that the Board approves the updated ERM Policy attached to this report.

BACKGROUND

A report was provided to the Halifax Water Board on November 23, 2023, recommending changes to the ERM Policy. At the meeting, the Board on November 23, 2023, the Board discussed proposed changes to the Policy and made the following request:

> ***The Board requested that some of the language in the Policy be amended; therefore, it was decided that the ERM Policy would go back to the ERM Committee to review the suggested changes and then be brought back to the Board for approval.***

At the ERM Board Committee meeting on January 10, 2024, the ERM Committee reviewed additional proposed changes to the ERM Policy and passed the following motion:

> ***It is recommended that the ERM Committee endorse the additional changes to the ERM Policy as suggested by the Board and recommend to the Board approval of the updated ERM Policy attached to this report.***

DISCUSSION

Further changes to the ERM Policy were made to:

1. To appropriately describe the Halifax Water Risk Appetite Statement
2. To explore alternative words that are less misinterpreted.

Key Changes

The following sections in the policy document had additional changes:

- Risk Appetite Statement
- Roles & Responsibilities

The report to the ERM Committee including the redline and clean version of the policy, and the report with the motion that was approved by the ERM Committee is attached.

Also, for your reference, the original Halifax Water Board report dated November 17, 2023, is attached.

ATTACHMENTS

Attachment 1: Revisions to the Enterprise Risk Management Policy dated January 2, 2024.
Attachment 2: Revisions to the Enterprise Risk Management Policy dated November 17, 2023

Report Prepared by: Digitally signed by Adedamola M. Akande Date: 2024.01.19 09:38:11 -04'00'

Adedamola M. Akande, ERM Program Manager

Financial Review by: Louis de Montbrun Digitally signed by Louis de Montbrun Date: 2024.01.19 10:14:59 -04'00'

Louis de Montbrun, CPA, CA

Director, Corporate Services/CFO

ITEM 1

Halifax Water Enterprise Risk Management Committee

January 10, 2024

TO: Chair, and Members of the Halifax Regional Water Commission Enterprise Risk Management Committee

SUBMITTED BY: Digitally signed by Louis de Montbrun Date: 2024.01.09 08:10:33 -04'00'

Louis de Montbrun, Director, Corporate Services/CFO

APPROVED: Tareq Al-Zabet Digitally signed by Tareq Al-Zabet Date: 2024.01.09 11:02:55 -04'00'

Tareq Al-Zabet, Ph.D., CEO & General Manager

DATE: January 02, 2024

SUBJECT: **Revisions to the Enterprise Risk Management Policy**

ORIGIN

Enterprise Risk Management (ERM) Policy & Framework and ERM Board Committee Business Cycle.

RECOMMENDATION

It is recommended that the ERM Committee endorse the additional changes to the ERM Policy as suggested by the Board and recommend to the Board approval of the updated ERM Policy attached to this report.

BACKGROUND

Following the submission of the reviewed ERM Policy to the Halifax board for approval at the November 23, 2023, Board meeting, additional changes were suggested to adequately represent Halifax Water's ERM program, these changes have now been adopted accordingly.

DISCUSSION

The updated ERM Policy has been revised:

1. To appropriately describe the Halifax Water Risk Appetite Statement

2. To explore alternative words that are less misinterpreted.

Key Changes

The following sections in the policy document had additional changes:

- Risk Appetite Statement
- Roles & Responsibilities

A redline and clean version of the policy are attached to this report.

ATTACHMENTS

Attachment 1: Updated ERM Policy
Attachment 2: Redline version of ERM Policy

Report Prepared by: 

Adedamola M. Akande, Enterprise Risk Management, Program Manager

Financial Review by:

Louis de Montbrun, CPA, CA
Director, Corporate Services/CFO

Intent
To promote a risk management awareness and ownership culture across the organization. This Policy applies to all Board commissioners, employees, and other stakeholders.

Purpose
The Enterprise Risk Management Policy is designed to implement a consistent approach towards managing risks within Halifax Water. The Policy provides all stakeholders with a clear perspective on the overall risk management strategies, it also specifies roles and responsibilities of all stakeholders towards achieving the core objectives of the Policy. Halifax Water recognizes that risk is present in all business activities and that the effective management of risk is a critical success factor in attaining Halifax Water's purpose and strategic objectives. Halifax Water is committed to raising awareness of ERM by:

- Establishing a systematic approach to managing and reporting key business risks;
- Facilitating a risk-based assessment of both new and existing opportunities;
- Integrating risk management into the design of processes and business decision making activities; and
- Implementing initiatives, activities, and decisions intended to attain the strategic objectives of the organization.

This Policy is intended to define ERM principles and specify expectations associated with Halifax Water's risk management activities and governance.

Introduction
Risk management has continuously evolved as an integral part of sustainable systems. Organizations that have maintained quality and service despite the various internal and external adverse factors are known to have a sound risk management framework and culture.

Halifax Water has adopted Enterprise Risk Management (ERM) as a governance and operational best practice.

ERM consists of risk management practices and procedures applied across the organization to identify, measure, assess, respond to, monitor, report on principal risks and driving factors that affect the achievement of business objectives. ERM allows Halifax Water to holistically manage its risks across the various pillars of the organization and report key focus areas to the Halifax Water Board of Commissioners (Board).

Guiding risk appetite, definitions, and principles
Halifax Water's overall risk appetite statement is:
Halifax water seeks to proactively identify and effectively manage the risks inherent in providing high quality water, wastewater and stormwater services including but not limited to public health, public service, workplace safety and security, asset management, environmental and regulatory compliance risks.

The following principles were used to guide Halifax Water in building its ERM process:

- Creating value and transparency
- Driving action and business planning
- Addressing uncertainty
- Tailoring organizational capability to manage risk
- Facilitating evidence-based, balanced, and better decision making
- Protecting Halifax Water assets and resources
- Protecting public safety

The following definitions are relevant to ERM at Halifax Water:

Risk is a combination of potential threat and opportunity; it is the chance of an event, action, inaction, or incident that could affect Halifax Water's ability to achieve its business and strategic objectives and regulatory obligations.

Risk Universe identifies all of the risks identified for Halifax Water, which are ranked based on likelihood and impact, grouped based on the primary directorate ownership of the risk and its corresponding mitigation with control action, sorted based on risk category and documented in risk registers. The risk universe and risk registers are highly sensitive information which must be treated confidentially.

The corporate risk register is the record of the very significant risks that require input from the ERM Steering Committee, Senior Management and Board based on one or more of the following;
- Approval to implement resolution action items;
- Overall impact on occupational & public health; and
- Regulatory & environmental exposures

The corporate risk register is updated on a regular basis, to reflect the current exposure levels that the organization holds on each risk. The corporate risk register is an excerpt of high priority exposures identified from the various executive risk registers.

Executive risk registers are records of risks identified across the various business functions in the directorate and managed within the oversight of the executive in the group. An executive risk register is a combination of all business functional risk registers within the group.

Policy Statement

Halifax Water acknowledges that risks, and opportunities, are present in all business activities. Consequently, Halifax Water recognizes the need for ERM as a consideration in strategic and operational planning, day-to-day management, and decision-making at all levels in the organization.

This Policy recognizes and encourages the effective management of risk, promotes the attainment of Halifax Water's purposes and strategic objectives, and addresses critical risks before they materialize and negatively impact the organization.

ERM Methodology

Halifax Water ERM framework provides the implementation guidelines for coordinating the risk management activities to align with our strategic objectives. The framework adopts the following methodologies:

- Risk Governance
- Objective Setting
- Event Identification
- Risk Assessment
- Risk Response
- Control Activities
- Information & Communication
- Risk Monitoring
- Risk Reporting

An extensive detail on each methodology have been outlined in the framework document accordingly.

Procedures

Updating ERM System Components – Halifax Water commits to staying current with developments, being aware of emerging risks, and keeping pace with a changing environment.

Communication – Risk information shall be gathered, analyzed and communicated in a structured way to ensure the relevant individuals in the Utility are aware of the risks and take their responsibility for managing the risk.

The ERM shall perform periodic local campaigns, targeted at all personnel across the organization to spread enterprise risk management awareness.

Training – Halifax Water is committed to providing training and knowledge development in ERM. Halifax Water will ensure that all employees, particularly those with management, advisory, and decision-making responsibilities, obtain a sound understanding of ERM principles, and the requisite skills to implement ERM effectively.

Continual review and improvement – Halifax Water is committed to continuous improvement through monitoring performance and reviewing progress in ERM. Halifax Water will regularly monitor and review the progress being made in developing an appropriate ERM culture as well as the effective implementation of risk management strategies throughout the organization:

- The Board will review this Policy and the corporate risk register every two years at a minimum, and more frequently if and when a significant event occurs;

- In coordination with the ERM Program Manager, the ERM Steering Committee will review this Policy and the corporate risk register regularly and provide recommendations to the Executive Management Team, and escalate to the Board as necessary;
- The Executive Management Team will review the executive risk registers regularly and include this as an agenda item at their regularly scheduled meetings;
- The ERM Program Manager will monitor the ERM process for any conflicts, issues or discrepancies and report to the Board ERM Committee accordingly.

Roles and Responsibilities

Risk will be managed as part of Halifax Water's corporate governance and management processes. ERM is an integral part of all management and decision-making functions within Halifax Water. Identifying risk and implementing control strategies will be delegated by the Board and management as appropriate.

The risk oversight responsibilities are based on Halifax Water's seven broad risk categories, which align very closely to the Corporate Balance Scorecard key success factors:

- Financial & Asset Management: Halifax Water seeks to minimize financial risks and thus, has **some tolerance** towards any impact that could affect the annual operating results or affect the critical assets.

- Service: Halifax Water strives to maintain the highest of professional and ethical service standards. We have a **low tolerance** towards any actions that could adversely impact our reputation and ability to fulfil our service obligations.

- Public Health: Halifax Water has **zero tolerance** for actions or behaviours that adversely impact its ability to provide safe drinking water to its customers. Halifax Water has a **low tolerance** for wastewater or stormwater discharges that could adversely impact the health of the public.

- Regulatory Compliance: Halifax Water has a **low tolerance** for actions that attract negative regulatory attention.

- Workplace Safety & Security: Halifax Water has **zero tolerance** for behaviours or operations that put our employees or members of the public at risk.

- Environment: Halifax Water has **low tolerance** for any action that could negatively impact the quality and safety of the environment as a result of uncontrolled discharges of drinking water, wastewater, and stormwater or associated delivery/storage of chemical products.

- People: Halifax Water has a **low tolerance** towards behaviours that would adversely affect its ability to provide a positive, respectful culture of accountability, where employees are engaged and working together to achieve the organization's strategic objectives.

The Board is responsible for providing oversight and strategic direction on ERM at Halifax Water. The Board may delegate certain responsibilities to Board committees and/the Chief Executive Officer/General Manager as they see fit.

The Chief Executive Officer/General Manager is accountable for implementing this Policy and establishing the processes and activities necessary to manage Halifax Water's key risks.

The ERM Steering Committee provides guidance to employees and stakeholders charged with implementing ERM by establishing a corporate ERM program to identify, measure, mitigate, monitor, and report on potential events that may affect the business or operations of Halifax Water. The ERM Steering Committee shall provide input to the Executive Management Team regarding and recommend approval of Halifax Water's ERM plan.

The Executive Management Team is accountable for the management of risk within their executive risk registers. Providing oversight on the implementation of the ERM process, the Executive Management Team maintains the executive risk registers, prioritizes risk mitigation, identifies decision parameters, confirms the effective operation of ERM processes and provides timely and accurate updates to the Board when requested, and to employees when required.

The ERM, Program Manager maintains the corporate risk register and coordinates regular reviews and updates to the process. The ERM Program Manager provides ongoing advice and training related to ERM and this Policy and acts as a liaison to ERM external stakeholders.

Halifax Water Senior Managers, Managers and Supervisors have specific responsibilities for reporting and managing risks. All levels of management are expected to understand the risks that fall within their areas of responsibility as well as to manage and report on these risks in accordance with this Policy and the various the risk registers. Managers and Supervisors are responsible for ensuring the consistent application of the ERM Policy by their employees, and for confirming all direct reports are aware of their roles and responsibilities under this Policy.

Employees are responsible to understand and adopt this Policy, report inefficient, unnecessary, or unworkable ERM controls, report risk and loss events to their supervisor, and cooperate with management on incident investigations.

Implementation Date:	Nov. 19, 2021
Updated:	Dec. 20, 2023
Recommended for Board Approval:	Jan. XX, 2024
Approved by the Board:	Jan.

Intent
To promote a risk management awareness and ownership culture across the organization. This Policy applies to all Board commissioners, employees, and other stakeholders.

Purpose
The Enterprise Risk Management Policy is designed to implement a consistent approach towards managing risks within Halifax Water. The Policy provides all stakeholders with a clear perspective on the overall risk management strategies, it also specifies roles and responsibilities of all stakeholders towards achieving the core objectives of the Policy. Halifax Water recognizes that risk is present in all business activities and that the effective management of risk is a critical success factor in attaining Halifax Water's purpose and strategic objectives. Halifax Water is committed to raising awareness of ERM by:

- Establishing a systematic approach to managing and reporting key business risks;
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ERM consists of risk management practices and procedures applied across the organization to identify, measure, assess, respond to, monitor, report on principal risks and driving factors that affect the achievement of business objectives. ERM allows Halifax Water to holistically manage its risks across the various pillars of the organization and report key focus areas to the Halifax Water Board of Commissioners (Board).

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The following principles were used to guide Halifax Water in building its ERM process:

- Creating value and transparency
- Driving action and business planning
- Addressing uncertainty
- Tailoring organizational capability to manage risk
- Facilitating evidence-based, ~~balanced~~balanced, and better decision making
- Protecting Halifax Water assets and resources
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The following definitions are relevant to ERM at Halifax Water:

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The corporate risk register is the record of the very significant risks that require input from the ERM Steering Committee, Senior Management and Board based on one or more of the following;
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Policy Statement

Halifax Water ~~accepts~~ acknowledges that risks, and opportunities, are present in all business activities. Consequently, Halifax Water recognizes the need for ERM as a consideration in strategic and operational planning, day-to-day management, and decision-making at all levels in the organization.

This Policy recognizes and encourages the effective management of risk, promotes the attainment of Halifax Water's purposes and strategic objectives, and addresses critical risks before they materialize and negatively impact the organization.

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Procedures

Updating ERM System Components – Halifax Water commits to staying current with developments, being aware of emerging risks, and keeping pace with a changing environment.

Communication – Risk information shall be gathered, analyzed and communicated in a structured way to ensure the relevant individuals in the Utility are aware of the risks and take their responsibility for managing the risk.

The ERM shall perform periodic local campaigns, targeted at all personnel across the organization to spread enterprise risk management awareness.

Training – Halifax Water is committed to providing training and knowledge development in ERM. Halifax Water will ensure that all employees, particularly those with management, advisory, and decision-making responsibilities, obtain a sound understanding of ERM principles, and the requisite skills to implement ERM effectively.

Continual review and improvement – Halifax Water is committed to continuous improvement through monitoring performance and reviewing progress in ERM. Halifax Water will regularly monitor and review the progress being made in developing an appropriate ERM culture as well as the effective implementation of risk management strategies throughout the organization:

- The Board will review this Policy and the corporate risk register every two years at a minimum, and more frequently if and when a significant event occurs;

- In coordination with the ERM Program Manager, the ERM Steering Committee will review this Policy and the corporate risk register regularly and provide recommendations to the Executive Management Team, and escalate to the Board as necessary;
- The Executive Management Team will review the executive risk registers regularly and include this as an agenda item at their regularly scheduled meetings;
- The ERM Program Manager will monitor the ERM process for any conflicts, issues or discrepancies and report to the Board ERM Committee accordingly.

Roles and Responsibilities

Risk will be managed as part of Halifax Water's corporate governance and management processes. ERM is an integral part of all management and decision-making functions within Halifax Water. Identifying risk and implementing control strategies will be delegated by the Board and management as appropriate.

The risk oversight responsibilities are based on Halifax Water's seven broad risk categories, which align very closely to the Corporate Balance Scorecard key success factors:

- Financial & Asset Management: Halifax Water seeks to minimize financial risks and thus, has **some tolerance** towards any impact that could affect the annual operating results or affect the critical assets.

- Service: Halifax Water strives to maintain the highest of professional and ethical service standards. We have a **low tolerance** towards any actions that could adversely impact our reputation and ability to fulfil our service obligations.

- Public Health: Halifax Water has **zero tolerance** for actions or behaviours that adversely impact its ability to provide safe drinking water to its customers. Halifax Water has a **low tolerance** for wastewater or stormwater discharges that could adversely impact the health of the public.

- Regulatory Compliance: Halifax Water has a **low tolerance** for actions that attract negative regulatory attention.

- Workplace Safety & Security: Halifax Water has **zero tolerance** for behaviours or operations that put our employees or members of the public at risk.

- Environment: Halifax Water has **low tolerance** for any action that could negatively impact the quality and safety of the environment as a result of uncontrolled discharges of drinking water, wastewater, and stormwater or associated delivery/storage of chemical products.

- People: Halifax Water has a **low tolerance** towards behaviours that would adversely affect its ability to provide a positive, respectful culture of accountability, where employees are engaged and working together to achieve the organization's strategic objectives.

The Board is responsible for providing oversight and strategic direction on ERM at Halifax Water. The Board may delegate certain responsibilities to Board committees and/the Chief Executive Officer/General Manager as they see fit.

The Chief Executive Officer/General Manager is accountable for implementing this Policy and establishing the processes and activities necessary to manage Halifax Water's key risks.

The ERM ~~(to be confirmed and consistent throughout)~~ Steering Committee provides guidance to employees and stakeholders charged with implementing ERM by establishing a corporate ERM program to identify, measure, mitigate, monitor, and report on potential events that may affect the business or operations of Halifax Water. The ERM Steering Committee shall provide input to the Executive Management Team regarding and recommend approval of Halifax Water's ERM plan.

The Executive Management Team is accountable for the management of risk within their executive risk registers. Providing oversight on the implementation of the ERM process, the Executive Management Team maintains the executive risk registers, prioritizes risk mitigation, identifies decision parameters, confirms the effective operation of ERM processes and provides timely and accurate updates to the Board when requested, and to employees when required.

The ERM, Program Manager maintains the corporate risk register and coordinates regular reviews and updates to the process. The ERM Program Manager provides ongoing advice and training related to ERM and this Policy and acts as a liaison to ERM external stakeholders.

Halifax Water Senior Managers, Managers and Supervisors have specific responsibilities for reporting and managing risks. All levels of management are expected to understand the risks that fall within their areas of responsibility as well as to manage and report on these risks in accordance with this Policy and the various the risk registers. Managers and Supervisors are responsible for ensuring the consistent application of the ERM Policy by their employees, and for confirming all direct reports are aware of their roles and responsibilities under this Policy.

Employees are responsible to understand and ~~accept~~ adopt this Policy, report inefficient, unnecessary, or unworkable ERM controls, report risk and loss events to their supervisor, and cooperate with management on incident investigations.

Implementation Date: Nov. 19, 2021
Updated: Dec. 20, 2023
Recommended for Board Approval: Jan. XX~~10~~, 202~~43~~
Approved by the Board: Jan.

~~Implementation Date: Nov. 19, 2021~~
~~Updated: Nov. 01, 2023~~
~~Recommended for Board Approval: Nov 08, 2023~~
~~Approved by the Board: Nov.~~

Halifax Water

ITEM #10

Halifax Water Board

November 23, 2023

TO: Colleen Rollings, P.Eng., PMP., Chair and Members of the Halifax Regional Water Commission Board

SUBMITTED BY: Digitally signed by Louis de Montbrun Date: 2023.11.17 16:22:14 -04'00'

Louis de Montbrun, Director, Corporate Services/CFO

APPROVED: Tareq Al-Zabet Digitally signed by Tareq Al-Zabet Date: 2023.11.20 10:29:47 -04'00'

Tareq Al-Zabet, Ph.D., CRSP, P.Geo, CEO & General Manager

DATE: November 17, 2023

SUBJECT: **Revisions to the Enterprise Risk Management Policy**

ORIGIN

Enterprise Risk Management (ERM) Policy & Framework and ERM Board Committee Business Cycle.

RECOMMENDATION

It is recommended that the Halifax Water Board approve the revised ERM Policy as attached to report item #10 dated November 17, 2023.

BACKGROUND

At the November 8, 2023, meeting of the Halifax Water Enterprise Risk Management Committee, the changes to the ERM Policy were endorsed and the committee recommended the Halifax Water Board approve the revised ERM Policy attached to this report.

Following the commencement of the Halifax Water Enterprise Risk Management (ERM) Program, the policy document which provides the guidance on implementing the framework was developed alongside other risk management tools. This was reviewed shortly after the delivery of the program and was approved for use. As Halifax Water is an essential service provider and operated in a dynamic business, the ERM Program Manager initiated a review of the policy to further represent the peculiarity of our risks and the approach to managing them.

DISCUSSION

The ERM Policy has been revised:

1. To minimize ambiguity in the current policy document and attempt to be more comprehensive.
2. To specify clear strategies on the scope of risks and approach to managing them.
3. To conceptualize the risk appetite statement in a way that it represents the entirety of our services.
4. To promote ownership and accountability of key risks and the completion of required analysis and mitigation strategies.
5. To define a clear cycle for every risk item from identification through response and monitoring.

Key Changes

The following sections in the policy document had changes:

- Purpose
- Introduction
- Risk Appetite Statement
- Definitions
- Methodology
- Roles & Responsibilities

A redline and clean version of the policy are attached to this report.

Impact on the ERM Program

The review of the ERM Policy will impact the ERM framework, which in turn leads to changes on the risk management tools and the process of improving the risk management communication and culture across the entire governance structure.

Next Steps

Following adoption of the revised ERM Policy, the review of the ERM Framework will commence and will lead to changes to the ERM tools which will be implemented. Some of which includes.

1. Redesign of the ERM Risk Register
2. Implementation of the Remediation Action Tracker
3. Implementation of the Key Risk Indicators Monitoring Tools
4. Commencement of Organization-wide Risk Assessment Exercise
5. Expansion of the Business Continuity Management Program to cover the entire organization.

It is expected this ERM committee will be engaged in January to review the risk register. Other steps in this process will be presented to this committee as needed and as they mature.

ATTACHMENTS

Attachment 1: Report to the ERM Committee

Report Prepared by: 

Adedamola M. Akande, Enterprise Risk Management, Program Manager

ITEM 3

Halifax Water Enterprise Risk Management Committee

November 8, 2023

TO: Chair, and Members of the Halifax Regional Water Commission Enterprise Risk Management Committee

SUBMITTED BY: Digitally signed by Louis de Montbrun Date: 2023.11.07 17:14:29 -04'00'

Louis de Montbrun, Director, Corporate Services/CFO

APPROVED: _____

Tareq Al-Zabet, Ph.D., CRSP, P.Geo, CEO & General Manager

DATE: November 2, 2023

SUBJECT: **Revisions to the Enterprise Risk Management Policy**

ORIGIN

Enterprise Risk Management (ERM) Policy & Framework and ERM Board Committee Business Cycle.

RECOMMENDATION

It is recommended that the ERM Committee endorse the changes to the ERM Policy and recommend to the Board approval the revised ERM Policy attached to this report.

BACKGROUND

Following the commencement of the Halifax Water Enterprise Risk Management (ERM) Program, the policy document which provides the guidance on implementing the framework was developed alongside other risk management tools. This was reviewed shortly after the delivery of the program and was approved for use. As Halifax Water is an essential service provider and operated in a dynamic business, the ERM Program Manager initiated a review of the policy to further represent the peculiarity of our risks and the approach to managing them.

DISCUSSION

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The following sections in the policy document had changes:

- Purpose
- Introduction
- Risk Appetite Statement
- Definitions
- Methodology
- Roles & Responsibilities

A redline and clean version of the policy are attached to this report.

Impact on the ERM Program

The review of the ERM Policy will impact the ERM framework, which in turn leads to changes on the risk management tools and the process of improving the risk management communication and culture across the entire governance structure.

Next Steps

Following adoption of the revised ERM Policy, the review of the ERM Framework will commence and will lead to changes to the ERM tools which will be implemented. Some of which includes.

1. Redesign of the ERM Risk Register
2. Implementation of the Remediation Action Tracker
3. Implementation of the Key Risk Indicators Monitoring Tools
4. Commencement of Organization-wide Risk Assessment Exercise
5. Expansion of the Business Continuity Management Program to cover the entire organization.

It is expected this committee will be engaged in January to review the risk register. Other steps in this process will be presented to this committee as needed and as they mature.

ATTACHMENTS

Attachment 1: Revised ERM Policy
Attachment 2: Redline version of ERM Policy

Report Prepared by: 
Digitally signed by Adedamola M. Akande
Date: 2023.11.07 15:22:12 -04'00'

Adedamola M. Akande, Enterprise Risk Management, Program Manager

Financial Review by: 
Digitally signed by Louis de Montbrun
Date: 2023.11.08 09:03:01 -04'00'

Louis de Montbrun, CPA, CA

Director, Corporate Services/CFO

Intent
To promote a risk management awareness and ownership culture across the organization. This Policy applies to all Board commissioners, employees, and other stakeholders.

Purpose
The Enterprise Risk Management Policy is designed to implement a consistent approach towards managing risks within Halifax Water. The Policy provides all stakeholders with a clear perspective on the overall risk management strategies, it also specifies roles and responsibilities of all stakeholders towards achieving the core objectives of the Policy. Halifax Water recognizes that risk is present in all business activities and that the effective management of risk is a critical success factor in attaining Halifax Water's purpose and strategic objectives. Halifax Water is committed to raising awareness of ERM by:

- Establishing a systematic approach to managing and reporting key business risks;
- Facilitating a risk-based assessment of both new and existing opportunities;
- Integrating risk management into the design of processes and business decision making activities; and
- Implementing initiatives, activities, and decisions intended to attain the strategic objectives of the organization.

This Policy is intended to define ERM principles and specify expectations associated with Halifax Water's risk management activities and governance.

Introduction
Risk management has continuously evolved as an integral part of sustainable systems. Organizations that have maintained quality and service despite the various internal and external adverse factors are known to have a sound risk management framework and culture.

Halifax Water has adopted Enterprise Risk Management (ERM) as a governance and operational best practice.

ERM consists of risk management practices and procedures applied across the organization to identify, measure, assess, respond to, monitor, report on principal risks and driving factors that affect the achievement of business objectives. ERM allows Halifax Water to holistically manage its risks across the various pillars of the organization and report key focus areas to the Halifax Water Board of Commissioners (Board).

Guiding risk appetite, definitions and principles
Halifax Water's overall risk appetite statement is:
Halifax water seeks to accept and effectively manage the risks inherent in providing high quality water, wastewater and stormwater services including but not limited to public health, public service, workplace safety and security, asset management, environmental and regulatory compliance risks.

The following principles were used to guide Halifax Water in building its ERM process:

- Creating value and transparency
- Driving action and business planning
- Addressing uncertainty
- Tailoring organizational capability to manage risk
- Facilitating evidence-based, balanced and better decision making

The following definitions are relevant to ERM at Halifax Water:

Risk is a combination of potential threat and opportunity; it is the chance of an event, action, inaction, or incident that could affect Halifax Water's ability to achieve its business and strategic objectives and regulatory obligations.

Risk Universe identifies all of the risks identified for Halifax Water, which are ranked based on likelihood and impact, grouped based on the primary directorate ownership of the risk and its corresponding mitigation with control action, sorted based on risk category and documented in risk registers. The risk universe and risk registers are highly sensitive information which must be treated confidentially.

The corporate risk register is the record of the very significant risks that require input from the ERM Steering Committee, Senior Management and Board based on one or more of the following;
- Approval to implement resolution action items;
- Overall impact on occupational & public health; and
- Regulatory & environmental exposures

The corporate risk register is updated on a regular basis, to reflect the current exposure levels that the organization holds on each risk. The corporate risk register is an excerpt of high priority exposures identified from the various executive risk registers.

Executive risk registers are records of risks identified across the various business functions in the directorate and managed within the oversight of the executive in the group. An executive risk register is a combination of all business functional risk registers within the group.

Policy Statement

Halifax Water accepts that risks, and opportunities, are present in all business activities. Consequently, Halifax Water recognizes the need for ERM as a consideration in strategic and operational planning, day-to-day management, and decision-making at all levels in the organization.

This Policy recognizes and encourages the effective management of risk, promotes the attainment of Halifax Water's purposes and strategic objectives, and addresses critical risks before they materialize and negatively impact the organization.

ERM Methodology

Halifax Water ERM framework provides the implementation guidelines for coordinating the risk management activities to align with our strategic objectives. The framework adopts the following methodologies:

- Risk Governance
- Objective Setting
- Event Identification
- Risk Assessment
- Risk Response
- Control Activities
- Information & Communication
- Risk Monitoring
- Risk Reporting

An extensive detail on each methodology have been outlined in the framework document accordingly.

Procedures

Updating ERM System Components - Halifax Water commits to staying current with developments, being aware of emerging risks, and keeping pace with a changing environment.

Communication - Risk information shall be gathered, analyzed and communicated in a structured way to ensure the relevant individuals in the Utility are aware of the risks and take their responsibility for managing the risk.

The ERM shall perform periodic local campaigns, targeted at all personnel across the organization to spread enterprise risk management awareness.

Training - Halifax Water is committed to providing training and knowledge development in ERM. Halifax Water will ensure that all employees, particularly those with management, advisory, and decision-making responsibilities, obtain a sound understanding of ERM principles, and the requisite skills to implement ERM effectively.

Continual review and improvement - Halifax Water is committed to continuous improvement through monitoring performance and reviewing progress in ERM. Halifax Water will regularly monitor and review the progress being made in developing an appropriate ERM culture as well as the effective implementation of risk management strategies throughout the organization:

- The Board will review this Policy and the corporate risk register every two years at a minimum, and more frequently if and when a significant event occurs;
- In coordination with the ERM Program Manager, the ERM Steering Committee will review this Policy and the corporate risk register regularly and provide recommendations to the Executive Management Team;

- The Executive Management Team will review the executive risk registers regularly and include this as an agenda item at their regularly scheduled meetings;
- The ERM Program Manager will monitor the ERM process for any conflicts, issues or discrepancies and report to the Board ERM Committee accordingly.

Roles and Responsibilities

Risk will be managed as part of Halifax Water's corporate governance and management processes. ERM is an integral part of all management and decision-making functions within Halifax Water. Identifying risk and implementing control strategies will be delegated by the Board and management as appropriate.

The risk oversight responsibilities are based on Halifax Water's seven broad risk categories, which align very closely to the Corporate Balance Scorecard key success factors:

- Financial & Asset Management: Halifax Water seeks to minimize financial risks and thus, has **some tolerance** towards any impact that could affect the annual operating results or affect the critical assets.

- Service: Halifax Water strives to maintain the highest of professional and ethical service standards. We have a **low tolerance** towards any actions that could adversely impact our reputation and ability to fulfil our service obligations.

- Public Health: Halifax Water has **zero tolerance** for actions or behaviours that adversely impact its ability to provide safe drinking water to its customers. Halifax Water has a **low tolerance** for wastewater or stormwater discharges that could adversely impact the health of the public.

- Regulatory Compliance: Halifax Water has a **low tolerance** for actions that attract negative regulatory attention.

- Workplace Safety & Security: Halifax Water has **zero tolerance** for behaviours or operations that put our employees or members of the public at risk.

- Environment: Halifax Water has **low tolerance** for any action that could negatively impact the quality and safety of the environment as a result of uncontrolled discharges of drinking water, wastewater, and stormwater or associated delivery/storage of chemical products.

- People: Halifax Water has a **low tolerance** towards behaviours that would adversely affect its ability to provide a positive, respectful culture of accountability, where employees are engaged and working together to achieve the organization's strategic objectives.

The Board is responsible for providing oversight and strategic direction on ERM at Halifax Water. The Board may delegate certain responsibilities to Board committees and/the Chief Executive Officer/General Manager as they see fit.

The Chief Executive Officer/General Manager is accountable for implementing this Policy and establishing the processes and activities necessary to manage Halifax Water's key risks.

The Steering Committee provides guidance to employees and stakeholders charged with implementing ERM by establishing a corporate ERM program to identify, measure, mitigate, monitor, and report on potential events that may affect the business or operations of Halifax Water. The ERM Steering Committee shall provide input to the Executive Management Team regarding and recommend approval of Halifax Water's ERM plan.

The Executive Management Team is accountable for the management of risk within their executive risk registers. Providing oversight on the implementation of the ERM process, the Executive Management Team maintains the executive risk registers, prioritizes risk mitigation, identifies decision parameters, confirms the effective operation of ERM processes and provides timely and accurate updates to the Board when requested, and to employees when required.

The ERM, Program Manager maintains the corporate risk register and coordinates regular reviews and updates to the process. The ERM Program Manager provides ongoing advice and training related to ERM and this Policy and acts as a liaison to ERM external stakeholders.

Halifax Water Senior Managers, Managers and Supervisors have specific responsibilities for reporting and managing risks. All levels of management are expected to understand the risks that fall within their areas of responsibility as well as to manage and report on these risks in accordance with this Policy and the various the risk registers. Managers and Supervisors are responsible for ensuring the consistent application of the ERM Policy by their employees, and for confirming all direct reports are aware of their roles and responsibilities under this Policy.

Employees are responsible to understand and accept this Policy, report inefficient, unnecessary, or unworkable ERM controls, report risk and loss events to their supervisor, and cooperate with management on incident investigations.

Implementation Date:	Nov. 19, 2021
Updated:	Nov. 01, 2023
Recommended for Board Approval:	Nov 08, 2023
Approved by the Board:	Nov.

ENTERPRISE RISK MANAGEMENT
Policy # 1.12

Intent

To promote a risk management awareness and ownership culture across the organization. This Policy applies to all Board commissioners, employees, and other stakeholders. ~~To balance risk to the benefit of our customer and the environment. This Policy applies to all Board commissioners and employees, and outlines ERM related accountabilities and responsibilities.~~

Purpose

The Enterprise Risk Management Policy is designed to implement a consistent approach towards managing risks within Halifax Water. The ~~policy~~Policy provides all stakeholders with a clear perspective on the overall risk management strategies, it also specifies roles and responsibilities of all stakeholders towards achieving the core objectives of the ~~policy~~Policy. Halifax Water recognizes that risk is present in all business activities and that the effective management of risk is a critical success factor in attaining Halifax Water's purpose ~~mission~~ and strategic objectives. Halifax Water is committed to raising awareness of ERM by:

- Eestablishing a systematic approach to managing and reporting key business risks;
- Ffacilitating a risk-based assessment of both new and existing opportunities;
- Integrating risk management into the design of processes and business decision making activities; and
- Iimplementing initiatives, activities, and decisions intended to attain the strategic objectives of the organization.

This Policy is intended to define ERM principles and specify expectations associated with Halifax Water's risk management activities and governance.

Introduction

Risk management has continuously evolved as an integral part of sustainable systems. Organizations that have maintained quality and service despite the various internal and external adverse factors are known to have a sound risk management framework and culture.

~~The Halifax Regional Water Commission (~~Halifax Water~~)~~ has adopted Enterprise Risk Management (ERM) as a governance and operational best practice. ~~Risk is a combination of potential threat and opportunity; it is the chance of an event, action, inaction, or incident that could affect Halifax Water's ability to achieve its business and strategic objectives and regulatory obligations.~~

Commented [AA1]: The Definition is already included in the Guiding Risk Appetite, Definition and Principles section

ERM consists of risk management practices and procedures applied across the organization to identify, measure, assess, respond to, ~~monitor,~~ monitor, report on principal risks and driving factors that affect the achievement of business objectives. ERM allows Halifax Water to holistically manage its risks across the various pillars of the organization and report key focus areas to the Halifax Water Board of Commissioners (Board).~~and report on principal risks that affect the achievement of business objectives. ERM allows Halifax Water to identify, measure, and monitor key risk areas and to report on key risks to the Halifax Water Board of Commissioners (Board).~~

Guiding risk appetite, definitions and principles

Halifax Water's overall risk appetite statement is:

Halifax water seeks to accept and effectively manage the risks inherent in providing high quality water, wastewater and stormwater services including but not limited to public health, public service, workplace safety and security, asset management, environmental and regulatory compliance risks.

~~*Halifax Water's risk appetite is derived by its ability to provide world class water, wastewater and stormwater services efficiently, while minimizing impact to the environment.*~~

Commented [AA2]: Making the Risk Appetite statement more specific to our core objectives.

The following principles were used to guide Halifax Water in building its ERM process:

- Creating value and transparency
- Driving action and business planning
- Addressing uncertainty
- Tailoring organizational capability to manage risk
- Facilitating evidence-based, balanced and better decision making

The following definitions are relevant to ERM at Halifax Water:

Risk is a combination of potential threat and opportunity; it is the chance of an event, action, inaction, or incident that could affect Halifax Water's ability to achieve its business and strategic objectives and regulatory obligations.

Risk Universe identifies all of the risks identified for Halifax Water, ~~.~~ which are ranked based on likelihood and impact, grouped based on the primary directorate ownership of the risk and its corresponding mitigation with control action, sorted based on risk category ~~sorted into tiers~~ and documented ~~tracked~~ in risk registers. ~~–~~The risk universe and risk registers are highly sensitive information which must be treated confidentially.

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The c~~C~~orporate risk register is the record of the very significant risks that require input from the ERM Steering Committee, Senior Management and Board based on one or more of the following;
- Approval to implement resolution action items;
- Overall impact on occupational & public health; and
- Regulatory & environmental exposures

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The corporate risk register is updated on a regular basis, to reflect the current exposure levels that the organization holds on each risk. The corporate risk register is an excerpt of high priority exposures identified from the various executive risk registers. ~~is the record of the top risks that are reported to the Board on a regular basis, also known as tier one risks. Generally, there will be 10–12 risks treated as tier one.~~

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~~Directorate~~Executive risk registers are records of risks identified across the various business functions in the directorate and managed within the oversight of the executive in the group. An executive risk register is a combination of all business functional risk registers within the group. ~~are internal documents to record shared tier one responsibilities, and to record and track tier two and tier three risks. Other departmental strategic and tactical risks are treated as tier three.~~

~~The following principles were used to guide Halifax Water in building its ERM process:~~

- ~~Creating value and transparency~~
- ~~Driving action and business planning~~
- ~~Addressing uncertainty~~
- ~~Tailoring organizational capability to manage risk~~
- ~~Facilitating evidence-based, balanced and better decision-making~~

Commented [AA3]: The principles have been moved up. Just after the Risk Appetite Statement

Policy Statement

Halifax Water accepts that risks, and opportunities, are present in all business activities. Consequently, Halifax Water recognizes the need for ERM as a consideration in strategic and operational planning, day-to-day management, and decision-making at all levels in the organization.

This Policy recognizes and encourages the effective management of risk, promotes the attainment of Halifax Water's purposes ~~mission~~ and strategic objectives, and addresses critical risks before they materialize and negatively impact the organization.

ERM Methodology

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Halifax Water ERM framework provides the implementation guidelines for coordinating the risk management activities in order to align with our strategic objectives. The framework adopts the following methodologies:

- Risk Governance
- Objective Setting
- Event Identification
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- Risk Response
- Control Activities
- Information & Communication
- Risk Monitoring
- Risk Reporting

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An extensive detail on each methodology have been outlined in the framework document accordingly.

Procedures

Updating ERM System Components - Halifax Water commits to staying current with developments, being aware of emerging risks, and keeping pace with a changing environment.

Communication -

Risk information shall be gathered, analyzed and communicated in a structured way to ensure the relevant individuals in the Utility are aware of the risks and take their responsibility for managing the risk.

The ERM shall perform periodic local campaigns, targeted at all personnel across the ~~Business Units~~organization to spread enterprise risk management awareness.

Training - Halifax Water is committed to providing training and knowledge development in ERM. Halifax Water will ensure that all employees, particularly those with management, advisory, and decision-making responsibilities, obtain a sound understanding of ERM principles, and the requisite skills to implement ERM effectively.

Continual review and improvement - Halifax Water is committed to continuous improvement through monitoring performance and reviewing progress in ERM. Halifax Water will regularly monitor and review the progress being made in developing an appropriate ERM culture as well as the effective implementation of risk management strategies throughout the organization:

- The Board will review this Policy and the corporate risk register every two years at a minimum, and more frequently if and when a significant event occurs;
- In coordination with the ~~Risk Officer~~ERM Program Manager, the ERM Steering Committee will review this Policy and the corporate risk register regularly and provide recommendations ~~report~~ to the Executive Management Team~~Board; with any recommended changes or amendments;~~
- The Executive Management Team will review the executive ~~directorate~~ risk registers regularly and include this as an agenda item at their regularly scheduled meetings~~.~~;
- The ERM Program Manager ~~Risk Officer~~ will monitor the ERM process for any conflicts, issues or discrepancies and report to the ~~ERM~~ Board ERM Committee accordingly. ~~Steering Committee accordingly.~~
-

Roles and Responsibilities

Risk will be managed as part of Halifax Water's corporate governance and management processes. ERM is an integral part of all management and decision-making functions within Halifax Water. Identifying risk and implementing control strategies will be delegated by the Board and management as appropriate.

The risk oversight responsibilities are based on Halifax Water's seven broad risk categories, which align very closely to the Corporate Balance Scorecard key success factors:

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- Financial & Asset Management: Halifax Water seeks to minimize financial risks and thus, has **some tolerance** towards any impact that could affect the annual operating results ~~surplus~~ or affect the critical assets.
- Service: Halifax Water strives to maintain the highest of professional and ethical service standards. We have a **low tolerance** towards any actions that could adversely impact our reputation and ability to fulfil our service obligations.
- Public Health: Halifax Water has **zero tolerance** for actions or behaviours that adversely impact its ability to provide safe drinking water to its customers. Halifax Water has a **low tolerance** for wastewater or stormwater discharges that could adversely impact the health of the public.
- Regulatory Compliance: Halifax Water has a **low tolerance** for actions that attract negative regulatory attention.
- Workplace Safety & Security: Halifax Water has **zero tolerance** for behaviours or operations that put our employees or members of the public at risk.
- Environment: Halifax Water has **low tolerance** for any action that could negatively impact the quality and safety of the environment as a result of uncontrolled discharges of drinking water, wastewater, and stormwater or associated delivery/storage of chemical products.
- People: Halifax Water has a **low tolerance** towards behaviours that would adversely affect its ability to provide a positive, respectful culture of accountability, where employees are engaged and working together to achieve the organization's strategic objectives.

The Board is responsible for providing oversight and strategic direction on ERM at Halifax Water. The Board may delegate certain responsibilities to Board committees and/the Chief Executive Officer/General Manager ~~or employees~~ as they see fit.

The Chief Executive Officer/General Manager is accountable for implementing this Policy and establishing the processes and activities necessary to manage Halifax Water's key risks.

The ~~Halifax Water~~ ERM Steering Committee provides guidance to employees and stakeholders charged with implementing ERM by establishing a corporate ERM program to identify, measure, mitigate, monitor, and report on potential events that may affect the business or operations of Halifax Water. The ERM Steering Committee shall provide input to the Executive Management Team regarding and recommend approval of Halifax Water's ERM plan.

The ~~Halifax Water~~ Executive Management Team is accountable for the management of risk within their executive~~directorate~~ risk registers. Providing oversight on the implementation of the ERM process, the Executive Management Team maintains the executive~~directorate~~ risk registers, prioritizes risk

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mitigation, identifies decision parameters, confirms the effective operation of ERM processes and provides timely and accurate updates to the Board when requested, and to employees when required.

The ~~Halifax Water~~ ERM~~Enterprise Risk Management~~, Program Manager maintains the corporate risk register and coordinates regular reviews and updates to the process. The ~~Risk Officer~~ERM Program Manager provides ongoing advice and training related to ERM and this ~~Policy, and~~Policy and acts as a liaison to ERM external stakeholders.

Halifax Water Senior Managers, Managers and Supervisors ~~may~~ have specific responsibilities for reporting and managing risks. All levels of management are expected to understand the risks that fall within their areas of responsibility as well as to manage and report on these risks in accordance with this Policy and the various the risk registers. Managers and Supervisors are responsible for ensuring the consistent application of the ERM Policy by their employees, and for confirming all direct reports are aware of their roles and responsibilities under this Policy.

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Employees are responsible to understand and accept this Policy, report inefficient, unnecessary, or unworkable ERM controls, report risk and loss events to their supervisor, and cooperate with management on incident investigations.

~~Appendix A – Halifax Water's Risk Governance Structure~~

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ITEM #5
Halifax Water Board
January 25, 2024

TO: Colleen Rollings, P.Eng., PMP., Chair and Members of the Halifax Regional Water Commission Board

SUBMITTED BY: Louis de Montbrun — Digitally signed by Louis de Montbrun Date: 2024.01.18 12:00:01 -04'00'

Louis de Montbrun, CPA, CA, Director, Corporate Services/CFO

APPROVED: Tareq Al-Zabet — Digitally signed by Tareq Al-Zabet Date: 2024.01.19 10:58:10 -04'00'

Tareq Al-Zabet, Ph.D., CEO & General Manager

DATE: January 16, 2024

SUBJECT: Financial Results for the eight months ended November 30, 2023

ORIGIN

Financial information reporting.

BACKGROUND

At the January 11, 2024 meeting of the Halifax Water Audit and Finance Committee, the attached report was reviewed.

DISCUSSION

At the Audit and Finance Committee meeting, the attached financial information for the eight months ended November 30, 2023 was reviewed and discussed.

ATTACHMENTS

1. Report to the Halifax Water Audit and Finance Committee re. financial results of the Halifax Regional Water Commission for the eight months ended November 30, 2023

Report prepared by: Alicia Scallion — Digitally signed by Alicia Scallion Date: 2024.01.18 16:23:49 -04'00'

Alicia Scallion, CPA, CA
Manager of Finance (902) 497-9785

ITEM # 7

Halifax Water Audit and Finance Committee

January 11, 2024

TO: Chair and Members of the Halifax Regional Water Commission Audit and Finance Committee

SUBMITTED BY: Digitally signed by Louis de Montbrun Date: 2024.01.11 08:52:36 -04'00'

Louis de Montbrun, CPA, CA
Director, Corporate Services/CFO

APPROVED: Tareq Al-Zabet Digitally signed by Tareq Al-Zabet Date: 2024.01.11 09:29:21 -04'00'

Tareq Al-Zabet, Ph.D.
Chief Executive Officer and General Manager

DATE: January 10, 2024

SUBJECT: Financial Results for the eight months ended November 30, 2023

ORIGIN

Financial information reporting.

DISCUSSION

Attached are the operating results for Halifax Water for the eight months year ended November 30, 2023, with comparative figures for November 30, 2022.

The following discussion of the operating results reflect direct operating costs by department and allocations among water, wastewater and stormwater for common costs shared across all the services provided by Halifax Water.

Statement of Financial Position (NSUARB) – Page 3 of Attachment 1

Key indicators and balances from the Statement of Financial Position are provided in the following tables.

Table 1: Assets

November 30 (in thousands)	Notes	2023	2022	March 31 2023	From Prior Year $ Change	From Prior Year % Change
Assets						
Current						
Cash and cash equivalents	A	$ 60,786	$ 63,145	$ 44,596	$ (2,359)	(3.7%)
Receivables						
Customer charges and contractual	B	21,713	16,245	17,825	5,468	33.7%
Unbilled service revenues	C	21,006	19,838	19,265	1,168	5.9%
Inventory		2,509	2,151	3,517	358	16.6%
Prepaids		2,151	2,091	1,282	60	2.9%
		108,165	103,470	86,485	4,695	4.5%
Capital work in progress	D	131,736	100,449	79,447	31,287	31.1%
Utility plant in service	E	1,284,668	1,301,295	1,363,810	(16,627)	(1.3%)
Total assets		1,524,569	1,505,214	1,529,742	19,355	1.3%
Regulatory deferral account		2,109	2,301	2,237	(192)	(8.3%)
Total assets and regulatory deferral account		**$ 1,526,678**	**$ 1,507,515**	**$ 1,531,979**	**$ 19,163**	**1.3%**

Notes related to Table 1:

A) *Cash and cash equivalents* have decreased $2.4 million from the prior year due to increases in the payments related to an increased capital spend and repayment of long-term debt of $20.7 million in November 2023. Halifax Water also acquired new debt during the fall of this fiscal year of $50.1 million. The total balance of the Regional Development Charge (RDC) reserves is $105.3 million.

B) *Customer charges and contractual receivables* have increased $5.5 million from the prior year. The change in receivables is driven by the timing of billing cycles, higher service rates due to rate increases and a receivable for stormwater right of way charges for customers in expanded service area and the Province.

Customer charges and contractual	2023/24 '000	2022/23 '000	$ Change	% Change
Trade receivables	**$ 20,685**	$ 16,079	$ 4,606	28.6%
Other receivables	**3,909**	3,444	465	13.5%
Allowance for doubtful accounts	**(2,881)**	(3,278)	397	12.1%
	$ 21,713	$ 16,245	$ 5,468	33.7%

C) *Unbilled service revenues* have increased $1.2 million due to the timing of billing cycles and the increases in rates for services.

HRM Receivables and Payables				
	2023/24	2022/23		
	'000	'000	$ Change	% Change
Receivables	**$ 1,258**	$ 811	$ 447	55.1%
RDC	**3,310**	3,696	(386)	(10.4%)
Payables	**(5,940)**	(15,812)	9,872	(62.4%)
	$ (1,372)	$ (11,305)	$ 9,933	(87.9%)

D) The $31.3 million increase in *capital work in progress* relates to the expenditures up until November 2023 of $129.9 million compared to $101.4 million in the prior year.

E) *Utility plant in service* has decreased $16.6 million due to depreciation.

Table 2: Liabilities and Equity

November 30 (in thousands)	Notes	2023	2022	March 31 2023	From Prior Year $ Change	From Prior Year % Change
Liabilities						
Current						
Payables and accruals						
Trade	A	21,136	14,174	33,827	6,962	49.1%
Non-trade		3,596	4,159	4,717	(563)	(13.5%)
Interest on long term debt		543	1,097	2,205	(554)	(50.5%)
Halifax Regional Municipality	B	1,372	11,305	(11,305)	(9,933)	(87.9%)
Contractor and customer deposits		3,847	2,775	2,841	1,072	38.6%
Current portion of long term debt		56,933	43,154	45,962	13,779	31.9%
Unearned revenue	C	4,546	3,450	95	1,096	31.8%
		91,973	80,114	78,342	11,859	14.8%
Long term debt	D	179,446	175,227	172,489	4,219	2.4%
Deferred contributions	E	106,163	84,497	94,210	21,666	25.6%
Total liabilities		377,582	339,838	345,041	37,744	11.1%
Equity						
Accumulated capital surplus		1,103,642	1,128,985	1,153,390	(25,343)	(2.2%)
Accumulated operating surplus		28,925	29,151	28,925	(226)	(0.8%)
Operating surplus used to fund capital		12,380	12,380	12,380	0	0.0%
Deficiency of revenues over expenditures		4,149	(2,839)	(7,757)	6,988	(246.1%)
Total equity		1,149,096	1,167,677	1,186,938	(18,581)	(1.6%)
Total liabilities and equity		**$ 1,526,678**	**$ 1,507,515**	**$ 1,531,979**	**$ 19,163**	**1.3%**

Notes related to Table 2:

A) *Trade payables and accruals* have increased $7.0 million from the prior year due to increases in capital spend and challenges related to ERP implementation and an increase in accrued liabilities.

Payables and Accruals				
	2023/24	2022/23		
	'000	'000	$ Change	% Change
Trade payables	**$ 11,402**	$ 6,445	$ 4,957	76.9%
Trade accrued payables	**8,883**	6,724	2,159	32.1%
Accrued wastewater rebate	**851**	1,005	(154)	(15.3%)
	$ 21,136	$ 14,174	$ 6,962	49.1%

B) *Halifax Regional Municipality payable* has decreased from the prior year by $10.0 million. The decrease is primarily related to debt repayment. The invoices for debt were paid prior to November 30th in the current year but were outstanding at end of November in the prior year. An additional $0.7 million in payables to HRM are included with *trade payables and accruals*.

C) *Unearned revenue* has increased by $1.1 million due to the increase in deferred RDC.

D) *Long term debt* and the *current portion of long-term debt* have increased $4.2 million due to new debt acquired during the fall of this fiscal year of $50.1 million compared to the prior year of $32.9 million.

E) *Deferred contributions* have increased $21.7 million due to increases in regional development charges.

Debt servicing ratio is a function of total interest and principal payments (including accrued amounts) plus the amortization of debt issue costs divided by total operating revenue per service. Debt servicing ratio by service as of November 30, 2023, is as follows:

Debt Servicing Ratio by Service		
	2023/24	2022/23
Water	**13.04%**	14.74%
Wastewater	**18.72%**	22.72%
Stormwater	**21.90%**	25.13%
Combined	**16.83%**	19.85%

The debt servicing ratio for each service has decreased from the prior year. Debt servicing ratios have decreased from the prior year due to higher revenues, and lower debt overall. The combined debt servicing ratio of 16.83% is below the maximum 35.00% ratio allowed under the blanket guarantee agreement with Halifax.

Statement of Earnings (NSUARB) – Page 4 of Attachment 1

Table 3: Summarized Statement of Earnings (NSUARB)

Summarized Statement of Earnings								
		Budget	Actual	Actual	From Prior Year		Actual to Budget	
	Notes	2023/24 '000	2023/24 '000	2022/23 '000	$ Change	% Change	$ Change	% Change
Operating revenues		$ 168,897	$ 114,869	$ 103,799	$ 11,070	10.66%	$ (54,028)	(31.99%)
Operating expenditures		135,956	87,422	82,508	4,914	5.96%	(48,534)	(35.70%)
Earnings from operations before financial and other revenues and expenditures		32,941	27,447	21,291	6,156	28.91%	(5,494)	(16.68%)
Financial and other revenues		951	469	910	(441)	(48.46%)	(482)	(50.68%)
Financial and other expenditures		36,208	23,767	25,040	(1,273)	(5.08%)	(12,441)	(34.36%)
Earnings (loss) for the year	A	$ (2,316)	$ 4,149	$ (2,839)	$ 6,988	(246.14%)	$ 6,465	(279.15%)

Notes related to Table 3:

A) The *earnings* for the year are $4.1 million, an increase of $7.0 million over the prior year loss. The following is a discussion of factors influencing the change.

Table 4: Operating Revenues:

Operating Revenues								
		Budget	Actual	Actual	From Prior Year		Actual to Budget	
	Notes	2023/24 '000	2023/24 '000	2022/23 '000	$ Change	% Change	$ Change	% Change
Consumption revenue	B	$ 108,405	$ 75,096	$ 66,684	$ 8,412	12.61%	$ (33,309)	(30.73%)
Base charge revenue		34,356	23,048	22,713	335	1.47%	(11,308)	(32.91%)
Wastewater rebate		(1,642)	(1,137)	(1,078)	(59)	5.47%	505	(30.76%)
Metered sales total		141,119	97,007	88,319	8,688	9.84%	$ (44,112)	(31.26%)
Stormwater site generated charge		8,873	4,879	4,562	317	6.95%	(3,994)	(45.01%)
Stormwater right of way	C	6,515	4,812	3,025	1,787	59.07%	(1,703)	(26.14%)
Public fire protection		8,083	5,389	5,108	281	5.50%	(2,694)	(33.33%)
Private fire protection		1,652	1,099	886	213	24.04%	(553)	(33.47%)
Other operating revenue		2,655	1,683	1,899	(216)	(11.37%)	(972)	(36.61%)
Operating revenue total	A	$ 168,897	$ 114,869	$ 103,799	$ 11,070	10.66%	$ (54,028)	(31.99%)

Notes related to Table 4:

Operating revenues are presented above, broken down by type:

A) *Operating revenues* have increased $11.1 million as compared to the previous year.

B) *Consumption revenue* has increased $8.4 million over the prior year due to rate increases for water consumption and wastewater discharge effective December 1, 2022 and April 1, 2023. Water rates increased from $0.976 per cubic meter in the prior year to $1.017 per cubic meter effective December 1, 2022 and to $1.128 per cubic meter effective April 1, 2023. Wastewater rates increased from $2.073 per cubic meter in the prior year to $2.189 per cubic meter effective December 1, 2022 and to $2.259 per cubic meter effective April 1, 2023.

C) *Stormwater right of way charge revenue* has increased $1.8 million from the prior year due to addition of Province of Nova Scotia and Bridge Commission with an effective date of December 1, 2022.

Table 5: Operating expenditures:

Operating Expenditures									
		Budget	Forecast	Actual	Actual	From Prior Year		Actual to Budget	
	Notes	2023/24 '000	2023/24 '000	2023/24 '000	2022/23 '000	$ Change	% Change	$ Change	% Change
Water supply and treatment	B	$ 1	$ 11,246	$ 9,742	$ 7,233	$ 2,509	34.69%	$ 2,879	22.81%
Water transmission and distribution	C	3	12,441	7,643	7,263	380	5.23%	5,560	42.11%
Wastewater collection	D	4	13,096	9,420	8,820	600	6.80%	4,134	30.50%
Stormwater collection		2	5,281	3,222	3,027	195	6.44%	2,160	40.13%
Wastewater treatment		5	23,395	15,311	15,310	1	0.01%	9,754	38.91%
Engineering and technology services	E	9	13,941	8,928	9,481	(553)	(5.83%)	5,081	36.27%
Regulatory services		0	4,866	3,173	3,015	158	5.24%	1,887	37.29%
Customer services		6	4,844	2,931	2,969	(38)	(1.28%)	1,595	35.24%
Corporate services		5	3,272	2,229	2,084	145	6.96%	1,426	39.02%
Administration services		7	6,180	2,891	3,201	(310)	(9.68%)	3,306	53.35%
Depreciation and amortization	F	4	31,275	21,932	20,105	1,827	9.09%	10,752	32.90%
Total operating expenditures	A	$ 6	$ 129,837	$ 87,422	$ 82,508	$ 4,914	5.96%	$ 48,534	35.70%

Notes related to Table 5:

A) *Operating expenditures* of $87.4 million are $5.0 million higher than the prior year.

B) *Water supply and treatment* expenditures have increased $2.5 million from prior year due to an increase in Salaries and Benefits, contract services, equipment repairs & maintenance resulting from service continuity during statement of emergency as well as an increase in electricity costs, consulting services and chemical prices required for the treatment process.

C) *Water transmission and distribution* expenditures have increased $0.4M from prior year due to an increase in traffic control services and materials & supplies.

D) *Wastewater collection* expenditures have increased $0.6M from prior year due to an increase in contract services and electricity costs.

E) *Engineering and technology services* expenditures have decreased $0.6M from prior year due to an increase in costs being allocated to Wastewater and Stormwater.

F) *Depreciation and amortization* have increased $1.8 million because of additions to utility plant in service and intangibles.

Table 6: Financial and other revenues:

Financial and other revenues	Budget 2023/24 '000	Actual 2023/24 '000	Actual 2022/23 '000	From Prior Year $ Change	From Prior Year % Change	Actual to Budget $ Remaining	Actual to Budget % Remaining
Interest	**$ 324**	**$ 136**	$ 282	$ (146)	(51.77%)	$ (188)	(58.02%)
Other	**627**	**333**	628	(295)	(46.97%)	(294)	(46.89%)
Total financial and other revenues	**$ 951**	**$ 469**	$ 910	$ (441)	(48.46%)	$ (482)	(50.68%)

Notes related to Table 6:

A) *Financial and other revenues* have reduced due to less interest revenue earned on lower cash balance and a prior year one-time revenue generating wastewater treatment contract with a visiting marine vessel.

Table 7: Financial and other expenditures:

Financial and other expenditures	Budget 2023/24 '000	Actual 2023/24 '000	Actual 2022/23 '000	From Prior Year $ Change	From Prior Year % Change	Actual to Budget $ Remaining	Actual to Budget % Remaining
Interest on long term debt	**$ 7,051**	**$ 4,371**	$ 5,161	$ (790)	(15.31%)	$ (2,680)	(38.01%)
Amortization of debt discount	**202**	**145**	156	(11)	(7.05%)	(57)	(28.22%)
Repayment on long term debt	**22,191**	**14,815**	15,286	(471)	(3.08%)	(7,376)	(33.24%)
Dividend/grant in lieu of taxes	**6,589**	**4,403**	4,350	53	1.22%	(2,186)	(33.18%)
Other	**175**	**33**	87	(54)	(62.07%)	(142)	(81.14%)
Total financial and other expenditures	**$ 36,208**	**$ 23,767**	$ 25,040	$ (1,273)	(5.08%)	$ (12,441)	(34.36%)

Notes related to Table 7:

A) *Financial and other expenditures* have a reduction of $1.3 million when compared to prior year as the interest cost is likely to increase in the second half of the year after the fall debenture issued.

Table 8: Operating Results by Service:

Operating Results by Service	Budget 2023/24 '000	Actual 2023/24 '000	Actual 2022/23 '000	From Prior Year $ Change	From Prior Year % Change	Actual to Budget $ Remaining	Actual to Budget % Remaining
Water	**$ (1,715)**	$ (432)	$ (48)	$ (384)	800.00%	$ 1,283	(74.81%)
Wastewater	**70**	4,195	(1,126)	5,321	(472.56%)	4,125	5892.86%
Stormwater	**(671)**	386	(1,665)	2,051	(123.18%)	1,057	(157.53%)
Loss (earnings)	**$ (2,316)**	$ 4,149	$ (2,839)	$ 6,988	(246.14%)	$ 6,465	(279.15%)

The results in Table 8 are explained in more detail in Tables 9 to 11.

Table 9: Operating Results by Service – Water:

Operating Results by Service - Water	Budget 2023/24 '000	Actual 2023/24 '000	Actual 2022/23 '000	From Prior Year $ Change	From Prior Year % Change	Actual to Budget $ Remaining	Actual to Budget % Remaining
Operating revenues	**$ 64,252**	$ 43,662	$ 39,707	$ 3,955	9.96%	$ (20,590)	(32.05%)
Operating expenditures	**51,974**	34,985	30,613	4,372	14.28%	(16,989)	(32.69%)
Earnings from operations	**12,278**	8,677	9,094	(417)	(4.59%)	(3,601)	(29.33%)
Financial and other revenues	**724**	398	529	(131)	(24.76%)	(326)	(45.03%)
Financial and other expenditures	**14,717**	9,507	9,671	(164)	(1.70%)	(5,210)	(35.40%)
Loss for the year	**$ (1,715)**	$ (432)	$ (48)	$ (384)	800.00%	$ 1,283	(74.81%)

Water services loss has increased from the prior year loss by $0.4 million due to the following factors:

A) *Operating revenues* increase of $4.0 million attributable to the following:

i. Increase in base charges and consumption by new and existing customers.

ii. Water rates increased from $0.976 per cubic meter to $1.017 per cubic meter effective December 1, 2022 and to $1.128 per cubic meter effective April 1, 2023.

B) Increase in *operating expenditures* of $4.4 million. There was a $2.5 million increase in Water supply and treatment due to increase in salaries and benefits, equipment & maintenance from service continuity during statement of emergency as well as an increase in chemical prices.

Table 10: Operating Results by Service – Wastewater:

Operating Results by Service - Wastewater	Budget 2023/24 '000	Actual 2023/24 '000	Actual 2022/23 '000	From Prior Year $ Change	From Prior Year % Change	Actual to Budget $ Remaining	Actual to Budget % Remaining
Operating revenues	**$ 89,041**	$ 61,415	$ 56,348	$ 5,067	8.99%	$ (27,626)	(31.03%)
Operating expenditures	**71,132**	45,314	44,559	755	1.69%	(25,818)	(36.30%)
Earnings (loss) from operations	**17,909**	16,101	11,789	4,312	36.58%	(1,808)	(10.10%)
Financial and other revenues	**266**	117	416	(299)	(71.88%)	(149)	(56.02%)
Financial and other expenditures	**18,105**	12,023	13,331	(1,308)	(9.81%)	(6,082)	(33.59%)
Earnings (loss) for the year	**$ 70**	$ 4,195	$ (1,126)	$ 5,321	(472.56%)	$ 4,125	5892.86%

Wastewater services earnings of $4.2 million is higher than the prior year loss of $1.1 million due to the following factors:

A) *Operating revenues* increase of $5.1 million is attributable primarily to the increase in the wastewater discharge rate from $2.073 per cubic meter to $2.189 per cubic meter effective December 1, 2022 and to $2.259 per cubic meter effective April 1, 2023.

B) *Operating expenditures* increase of $0.8 million is due to an increase in contract services and electricity costs.

C) Decrease in *financial and other expenditures* of $1.3 million. Expect to see an increase in interest charges in the second half of the year due to the fall debenture being issued.

Table 11: Operating Results by Service – Stormwater:

Operating Results by Service - Stormwater								
	Budget 2023/24 '000	Actual 2023/24 '000	Actual 2022/23 '000	From Prior Year $ Change	From Prior Year % Change	Actual to Budget $ Remaining	Actual to Budget % Remaining
Operating revenues	**$ 15,604**	$ 9,792	$ 7,744	$ 2,048	26.45%	$ (5,812)	(37.25%)
Operating expenditures	**12,850**	7,123	7,336	(213)	(2.90%)	(5,727)	(44.57%)
Loss from operations	**2,754**	2,669	408	2,261	554.17%	(85)	(3.09%)
Financial and other revenues	**(39)**	(46)	(35)	(11)	31.43%	(7)	17.95%
Financial and other expenditures	**3,386**	2,237	2,038	199	9.76%	(1,149)	(33.93%)
Loss (earnings) for the year	**$ (671)**	$ 386	$ (1,665)	$ 2,051	(123.18%)	$ 1,057	(157.53%)

Stormwater services earnings of $0.4 million is $2.0 million higher than the prior year earnings. The following factors influenced the results:

A) Increase of $2.0 million in *operating revenues* due to rate increases effective December 1, 2022 and April 1, 2023 along with the addition of new customers due to the expansion of the stormwater boundary effective June 1, 2022.

Table 12: Operating Results by Activity:

Operating Results by Activity							
	Budget 2023/24 '000	Actual 2023/24 '000	Actual 2022/23 '000	From Prior Year $ Change	From Prior Year % Change	Actual to Budget $ Remaining	Actual to Budget % Remaining
Regulated activities	**$ (2,790)**	$ 3,613	$ (3,457)	$ 7,070	(204.51%)	$ 6,403	(229.50%)
Unregulated activities	**474**	536	617	(81)	(13.13%)	62	13.08%
Loss (earnings) for the year	**$ (2,316)**	$ 4,149	$ (2,840)	$ 6,989	(246.09%)	$ 6,465	(279.15%)

Notes related to Table 12:

A) *Regulated activities* earnings has increased from the prior year loss by $7.1 million due to the factors as previously explained including net of increases in revenues and expenditures.

B) *Unregulated activities* earnings of $0.5 million are comparable to prior year.

Results under NSUARB Handbook as compared to International Financial Reporting Standards

As a rate regulated utility, the Accounting Standards Board (AcSB) requires Halifax Water, to report financial results using IFRS. The NSUARB requires Halifax Water to report in accordance with the NSUARB Handbook. Table 9 below reconciles the results between IFRS and the NSUARB Handbook.

Table 13: Reconciliation IFRS to NSUARB:

Notes related to Table 13:

Operating revenues are the same under both IFRS and the NSUARB Handbook.

Reconcile IFRS to NSUARB			
		2023/24	2022/23
	Notes	**'000**	'000
IFRS comprehensive earnings		**$ 13,476**	$ 5,204
Add non-cash pension expense	**A**	**4,354**	6,275
Subtract debt principal payments	**B**	**(14,815)**	(15,286)
Add depreciation expense on contributed assets	**C**	**18,793**	18,592
Subtract amortization of contributed capital	**C**	**(18,793)**	(18,592)
Add various depreciation adjustments	**D**	**1,135**	968
NSUARB Earnings (loss)		**$ 4,149**	$ (2,839)

The main differences relate to reporting requirements surrounding the recognition of various expenditures as follows:

A) *Non-cash pension expense* represents the accrual of unpaid contributions to the pension plan and is not considered an expense for NSUARB Handbook reporting purposes.

B) The *principal payments* on long term debt are recognized as an expense for NSUARB Handbook reporting purposes but are not an expense under IFRS.

C) *Depreciation expense on contributed assets* is not an expense for NSUARB Handbook purposes for water and wastewater assets, however, it is offset by the removal of the amortization of contributed capital. For stormwater assets, 25% of depreciation on contributed assets is included for NSUARB reporting purposes. IFRS requires *contributed capital* to be treated as a long term liability and amortized, resulting in higher long term liabilities and lower equity on the statement of financial position.

D) The *various depreciation adjustments* include the add back of gains on the disposal of utility plant in service and IFRS requires componentization of assets and shorter useful lives resulting in higher depreciation than under NSUARB Handbook reporting.

Table 14: Statement of Earnings and Comprehensive Earnings (IFRS):

Summarized Comprehensive Earnings					
	Notes	2023/24 '000	2022/23 '000	From Prior Year $ Change	From Prior Year % Change
Operating revenues	A	$ **114,867**	$ 103,799	$ 11,068	10.66%
Operating expenditures	B	**102,672**	101,953	719	0.71%
Earnings from operations before financial and other revenues and expenditures		**12,195**	1,846	10,349	560.62%
Financial and other revenues		**10,422**	13,304	(2,882)	(21.66%)
Financial and other expenditures		**8,951**	9,753	(802)	(8.22%)
Earnings for the year before regulatory deferral account depreciation		**13,666**	5,397	8,269	153.21%
Regulatory deferral account depreciation		**(192)**	(192)	-	0.00%
Total comprehensive earnings for the year		**$ 13,474**	$ 5,205	$ 8,269	158.87%

Notes related to Table 14:

Key indicators and balances from the Statement of Earnings and Comprehensive Earnings are as follows:

A) *Operating revenues* of $114.9 million are $11.1 million higher than the prior year. Details have been discussed in preceding pages.

B) *Operating expenditures* of $102.7 million are $0.7 million higher than the prior year. This is primarily the result of the following factors:

a. Increase in water supply and treatment expenditures related to increases in salaries and benefits, equipment repairs & maintenance resulting from service continuity during statement of emergency as well as an increase in electricity costs and chemical prices.

Attachments

Attachment 1: Financial results for the eight months ended November 30, 2023.

Report prepared by: Alicia Scallion

Digitally signed by Alicia Scallion
Date: 2024.01.11 08:43:24 -04'00'

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HALIFAX WATER
UNAUDITED STATEMENT OF FINANCIAL POSITION - IFRS
November 30, 2023 (in thousands)

November 30 (in thousands)	Notes	2023	2022	March 31 2023	From Prior Year $ Change	From Prior Year % Change
Assets						
Current						
Cash and cash equivalents	A	$ 60,786	$ 63,145	$ 44,596	$ (2,359)	(3.7%)
Receivables						
Customer charges and contractual		21,713	16,245	17,824	5,468	33.7%
Unbilled service revenues		21,006	19,838	19,265	1,168	5.9%
Inventory		2,509	2,151	3,517	358	16.6%
Prepaids		2,151	2,091	1,282	60	2.9%
		108,165	103,470	86,484	4,695	4.5%
Intangible assets		21,136	19,264	22,807	1,872	9.7%
Capital work in progress		131,736	100,449	79,446	31,287	31.1%
Utility plant in service		1,272,475	1,244,841	1,302,514	27,634	2.2%
Total assets		1,533,512	1,468,024	1,491,251	65,488	4.5%
Regulatory deferral account		2,109	2,301	2,236	(192)	(8.3%)
Total assets and regulatory deferral account		**$ 1,535,621**	**$ 1,470,325**	**$ 1,493,487**	**$ 65,296**	**4.4%**
Liabilities						
Current						
Payables and accruals						
Trade	A	21,136	14,174	33,826	6,962	49.1%
Non-trade		3,596	4,159	4,717	(563)	(13.5%)
Interest on long term debt		543	1,097	2,205	(554)	(50.5%)
Halifax Regional Municipality		1,372	11,305	(11,287)	(9,933)	(87.9%)
Contractor and customer deposits		3,847	2,775	2,841	1,072	38.6%
Current portion of deferred contributed capital		18,836	14,614	18,836	4,222	28.9%
Current portion of long term debt		56,933	43,154	45,962	13,779	31.9%
Unearned revenue		4,546	3,450	76	1,096	31.8%
		110,809	94,728	97,176	16,081	17.0%
Deferred contributed capital		923,110	897,675	919,422	25,435	2.8%
Long term debt	E	179,445	175,227	172,489	4,218	2.4%
Accrued post-retirement benefits		290	310	290	(20)	(6.5%)
Accrued pre-retirement benefits		1,384	1,565	1,357	(181)	(11.6%)
Deferred pension liability		10,785	46,279	6,431	(35,494)	(76.7%)
Employee benefit obligation	F	12,458	48,154	8,078	(35,696)	(74.1%)
Total liabilities		1,225,822	1,215,784	1,197,165	10,038	0.8%
Equity						
Accumulated other comprehensive loss		51,651	11,226	51,651	40,425	360.1%
Accumulated surplus		258,148	243,315	244,671	14,833	6.1%
Total equity		309,799	254,541	296,322	55,258	21.7%
Total liabilities and equity		**$ 1,535,621**	**$ 1,470,325**	**$ 1,493,487**	**$ 65,296**	**4.4%**

HALIFAX WATER
UNAUDITED STATEMENT OF EARNINGS AND COMPREHENSIVE EARNINGS - ALL SERVICES - IFRS
APRIL 1, 2023 - NOVEMBER 30, 2023 (9 MONTHS)
ACTUAL YEAR TO DATE COMPLETE: 66.67%

	ACTUAL YEAR TO DATE		APR 1/23 MAR 31/24	ACTUAL YEAR TO DATE				
	THIS YEAR '000	LAST YEAR '000	BUDGET '000	as % of BUDGET	From Prior Year $ Change	% Change	Actual to Budget $ Remaining	% Remaining
Operating revenues								
Water	$ 36,700	$ 33,063	$ 53,669	68.38%	$ 3,637	11.00%	$ (16,969)	(31.62%)
Wastewater	60,307	55,256	87,450	68.96%	5,051	9.14%	(27,143)	(31.04%)
Stormwater	9,691	7,587	15,388	62.98%	2,104	27.73%	(5,697)	(37.02%)
Public fire protection	5,389	5,108	8,083	66.67%	281	5.50%	(2,694)	(33.33%)
Private fire protection	1,099	886	1,652	66.53%	213	24.04%	(553)	(33.47%)
Other operating revenue	1,683	1,899	2,655	63.39%	(216)	(11.37%)	(972)	(36.61%)
	114,869	**103,799**	**168,897**	**68.01%**	**11,070**	**10.66%**	**(54,028)**	**(31.99%)**
Operating expenditures								
Water supply and treatment	9,742	7,233	12,621	77.19%	2,509	34.69%	(2,879)	(22.81%)
Water transmission and distribution	7,643	7,263	13,203	57.89%	380	5.23%	(5,560)	(42.11%)
Wastewater collection	9,420	8,820	13,554	69.50%	600	6.80%	(4,134)	(30.50%)
Stormwater collection	3,222	3,027	5,382	59.87%	195	6.44%	(2,160)	(40.13%)
Wastewater treatment	15,311	15,310	25,065	61.09%	1	0.01%	(9,754)	(38.91%)
Engineering and technology services	8,928	9,481	14,009	63.73%	(553)	(5.83%)	(5,081)	(36.27%)
Regulatory compliance services	3,173	3,015	5,060	62.71%	158	5.24%	(1,887)	(37.29%)
Customer services	2,931	2,969	4,526	64.76%	(38)	(1.28%)	(1,595)	(35.24%)
Corporate services	2,229	2,084	3,655	60.98%	145	6.96%	(1,426)	(39.02%)
Administration services	2,891	3,201	6,197	46.65%	(310)	(9.68%)	(3,306)	(53.35%)
Pension services	4,354	6,275	9,415	46.25%	(1,921)	(30.61%)	(5,061)	(53.75%)
Depreciation and amortization	33,020	33,466	50,548	65.32%	(446)	(1.33%)	(17,528)	(34.68%)
	102,864	**102,144**	**163,235**	**63.02%**	**720**	**0.70%**	**(60,371)**	**(36.98%)**
Earnings (loss) from operations before financial and other revenues and expenditures	**12,005**	**1,655**	**5,662**	**212.03%**	**10,350**	**625.38%**	**6,343**	**112.03%**
Financial and other revenues								
Interest	136	282	324	41.98%	(146)	(51.77%)	(188)	(58.02%)
Amortization of contributed capital	9,953	12,392	17,864	55.72%	(2,439)	(19.68%)	(7,911)	(44.28%)
Other	333	628	627	53.11%	(295)	(46.97%)	(294)	(46.89%)
	10,422	**13,302**	**18,815**	**55.39%**	**(2,880)**	**(21.65%)**	**(8,393)**	**(44.61%)**
Financial and other expenditures								
Interest on long term debt	4,371	5,161	7,051	61.99%	(790)	(15.31%)	(2,680)	(38.01%)
Amortization of debt discount	145	156	202	71.78%	(11)	(7.05%)	(57)	(28.22%)
Dividend/grant in lieu of taxes	4,403	4,350	6,589	66.82%	53	1.22%	(2,186)	(33.18%)
Other	32	86	175	18.29%	(54)	(62.79%)	(143)	(81.71%)
	8,951	**9,753**	**14,017**	**63.86%**	**(802)**	**(8.22%)**	**(5,066)**	**(36.14%)**
Total comprehensive earnings for the year	**$ 13,476**	**$ 5,204**	**$ 10,460**	**128.83%**	**$ 8,272**	**158.95%**	**$ 3,016**	**28.83%**

HALIFAX WATER
UNAUDITED STATEMENT OF FINANCIAL POSITION - NSUARB
November 30, 2023 (in thousands)

November 30 (in thousands)	Notes	2023	2022	March 31 2023	From Prior Year $ Change	From Prior Year % Change
Assets						
Current						
Cash and cash equivalents	A	$ 60,786	$ 63,145	$ 44,596	$ (2,359)	(3.7%)
Receivables						
Customer charges and contractual	B	21,713	16,245	17,825	5,468	33.7%
Unbilled service revenues	C	21,006	19,838	19,265	1,168	5.9%
Inventory		2,509	2,151	3,517	358	16.6%
Prepaids	E	2,151	2,091	1,282	60	2.9%
		108,165	103,470	86,485	4,695	4.5%
Capital work in progress	F	131,736	100,449	79,447	31,287	31.1%
Utility plant in service		1,284,668	1,301,295	1,363,810	(16,627)	(1.3%)
Total assets		1,524,569	1,505,214	1,529,742	19,355	1.3%
Regulatory deferral account	G	2,109	2,301	2,237	(192)	(8.3%)
Total assets and regulatory deferral account		**$ 1,526,678**	**$ 1,507,515**	**$ 1,531,979**	**$ 19,163**	**1.3%**
Liabilities						
Current						
Payables and accruals						
Trade	A	21,136	14,174	33,827	6,962	49.1%
Non-trade		3,596	4,159	4,717	(563)	(13.5%)
Interest on long term debt		543	1,097	2,205	(554)	(50.5%)
Halifax Regional Municipality		1,372	11,305	(11,305)	(9,933)	(87.9%)
Contractor and customer deposits		3,847	2,775	2,841	1,072	38.6%
Current portion of long term debt		56,933	43,154	45,962	13,779	31.9%
Unearned revenue	B	4,546	3,450	95	1,096	31.8%
		91,973	80,114	78,342	11,859	14.8%
Long term debt	C	179,446	175,227	172,489	4,219	2.4%
Deferred contributions	D	106,163	84,497	94,210	21,666	25.6%
Total liabilities		377,582	339,838	345,041	37,744	11.1%
Equity						
Accumulated capital surplus		1,103,642	1,128,985	1,153,390	(25,343)	(2.2%)
Accumulated operating surplus		28,925	29,151	28,925	(226)	(0.8%)
Operating surplus used to fund capital		12,380	12,380	12,380	0	0.0%
Deficiency of revenues over expenditures		4,149	(2,839)	(7,757)	6,988	(246.1%)
Total equity		1,149,096	1,167,677	1,186,938	(18,581)	(1.6%)
Total liabilities and equity		**$ 1,526,678**	**$ 1,507,515**	**$ 1,531,979**	**$ 19,163**	**1.3%**

HALIFAX WATER
UNAUDITED STATEMENT OF EARNINGS - ALL SERVICES - NSUARB
APRIL 1, 2023 - NOVEMBER 30, 2023 (9 MONTHS)
ACTUAL YEAR TO DATE COMPLETE: 66.67%

	ACTUAL YEAR TO DATE THIS YEAR '000	ACTUAL YEAR TO DATE LAST YEAR '000	APR 1/23 MAR 31/24 BUDGET '000	ACTUAL YEAR TO DATE as % of BUDGET	From Prior Year $ Change	From Prior Year % Change	Actual to Budget $ Remaining	Actual to Budget % Remaining
Operating revenues								
Water	$ 36,700	$ 33,063	$ 53,669	68.38%	$ 3,637	11.00%	$ (16,969)	(31.62%)
Wastewater	60,307	55,256	87,450	68.96%	5,051	9.14%	(27,143)	(31.04%)
Stormwater site generated service	4,879	4,562	8,873	54.99%	317	6.95%	(3,994)	(45.01%)
Stormwater right of way service	4,812	3,025	6,515	73.86%	1,787	59.07%	(1,703)	(26.14%)
Fire protection (public and private)	6,488	5,994	9,735	66.65%	494	8.24%	(3,247)	(33.35%)
Other services and fees	1,041	1,087	1,472	70.72%	(46)	(4.23%)	(431)	(29.28%)
Late payment and other connection fees	270	376	627	43.06%	(106)	(28.19%)	(357)	(56.94%)
Miscellaneous	372	436	556	66.91%	(64)	(14.68%)	(184)	(33.09%)
	114,869	**103,799**	**168,897**	**68.01%**	**11,070**	**10.66%**	**(54,028)**	**(31.99%)**
Operating expenditures								
Water supply and treatment	9,742	7,233	12,621	77.19%	2,509	34.69%	(2,879)	(22.81%)
Water transmission and distribution	7,643	7,263	13,203	57.89%	380	5.23%	(5,560)	(42.11%)
Wastewater collection	9,420	8,820	13,554	69.50%	600	6.80%	(4,134)	(30.50%)
Stormwater collection	3,222	3,027	5,382	59.87%	195	6.44%	(2,160)	(40.13%)
Wastewater treatment	15,311	15,310	25,065	61.09%	1	0.01%	(9,754)	(38.91%)
Engineering and technology services	8,928	9,481	14,009	63.73%	(553)	(5.83%)	(5,081)	(36.27%)
Regulatory compliance services	3,173	3,015	5,060	62.71%	158	5.24%	(1,887)	(37.29%)
Customer services	2,931	2,969	4,526	64.76%	(38)	(1.28%)	(1,595)	(35.24%)
Corporate services	2,229	2,084	3,655	60.98%	145	6.96%	(1,426)	(39.02%)
Administration services	2,891	3,201	6,197	46.65%	(310)	(9.68%)	(3,306)	(53.35%)
Depreciation and amortization	21,932	20,105	32,684	67.10%	1,827	9.09%	(10,752)	(32.90%)
	87,422	**82,508**	**135,956**	**64.30%**	**4,914**	**5.96%**	**(48,534)**	**(35.70%)**
Earnings from operations before financial and other revenues and expenditures	**27,447**	**21,291**	**32,941**	**83.32%**	**6,156**	**28.91%**	**(5,494)**	**(16.68%)**
Financial and other revenues								
Interest	136	282	324	41.98%	(146)	(51.77%)	(188)	(58.02%)
Other	333	628	627	53.11%	(295)	(46.97%)	(294)	(46.89%)
	469	**910**	**951**	**49.32%**	**(441)**	**(48.46%)**	**(482)**	**(50.68%)**
Financial and other expenditures								
Interest on long term debt	4,371	5,161	7,051	61.99%	(790)	(15.31%)	(2,680)	(38.01%)
Repayment on long term debt	14,815	15,286	22,191	66.76%	(471)	(3.08%)	(7,376)	(33.24%)
Amortization of debt discount	145	156	202	71.78%	(11)	(7.05%)	(57)	(28.22%)
Dividend/grant in lieu of taxes	4,403	4,350	6,589	66.82%	53	1.22%	(2,186)	(33.18%)
Other	33	87	175	18.86%	(54)	(62.07%)	(142)	(81.14%)
	23,767	**25,040**	**36,208**	**65.64%**	**(1,273)**	**(5.08%)**	**(12,441)**	**(34.36%)**
Earnings (loss) for the year	**$ 4,149**	**$ (2,839)**	**$ (2,316)**	**(179.15%)**	**$ 6,988**	**(246.14%)**	**$ 6,465**	**(279.15%)**

HALIFAX WATER
UNAUDITED STATEMENT OF EARNINGS - WATER - NSUARB
APRIL 1, 2023 - NOVEMBER 30, 2023 (9 MONTHS)
ACTUAL YEAR TO DATE COMPLETE: 66.67%

	ACTUAL YEAR TO DATE THIS YEAR '000	ACTUAL YEAR TO DATE LAST YEAR '000	APR 1/23 MAR 31/24 BUDGET '000	ACTUAL YEAR TO DATE as % of BUDGET	From Prior Year $ Change	From Prior Year % Change	Actual to Budget $ Remaining	Actual to Budget % Remaining
Operating revenues								
Water	$ 36,700	$ 33,063	$ 53,669	68.38%	$ 3,637	11.00%	$ (16,969)	(31.62%)
Public fire protection	5,389	5,108	8,083	66.67%	281	5.50%	(2,694)	(33.33%)
Private fire protection	1,099	886	1,652	66.53%	213	24.04%	(553)	(33.47%)
Bulk water stations	171	297	338	50.59%	(126)	(42.42%)	(167)	(49.41%)
Late payment and other connection fees	90	161	252	35.71%	(71)	(44.10%)	(162)	(64.29%)
Miscellaneous	213	192	258	82.56%	21	10.94%	(45)	(17.44%)
	43,662	**39,707**	**64,252**	**67.95%**	**3,955**	**9.96%**	**(20,590)**	**(32.05%)**
Operating expenditures								
Water supply and treatment	9,742	7,233	12,621	77.19%	2,509	34.69%	$ (2,879)	(22.81%)
Water transmission and distribution	7,643	7,263	13,203	57.89%	380	5.23%	(5,560)	(42.11%)
Engineering and technology services	3,409	3,269	4,703	72.49%	140	4.28%	(1,294)	(27.51%)
Regulatory compliance services	941	894	1,521	61.87%	47	5.26%	(580)	(38.13%)
Customer services	1,617	1,514	2,308	70.06%	103	6.80%	(691)	(29.94%)
Corporate services	1,242	1,111	1,864	66.63%	131	11.79%	(622)	(33.37%)
Administration services	1,600	1,595	3,160	50.63%	5	0.31%	(1,560)	(49.37%)
Depreciation and amortization	8,791	7,734	12,594	69.80%	1,057	13.67%	(3,803)	(30.20%)
	34,985	**30,613**	**51,974**	**67.31%**	**4,372**	**14.28%**	**(16,989)**	**(32.69%)**
Earnings from operations before financial and other revenues and expenditures	**8,677**	**9,094**	**12,278**	**70.67%**	**(417)**	**(4.59%)**	**(3,601)**	**(29.33%)**
Financial and other revenues								
Interest	133	226	259	51.35%	(93)	(41.15%)	(126)	(48.65%)
Other	265	303	465	56.99%	(38)	(12.54%)	(200)	(43.01%)
	398	**529**	**724**	**54.97%**	**(131)**	**(24.76%)**	**(326)**	**(45.03%)**
Financial and other expenditures								
Interest on long term debt	1,635	1,624	2,767	59.09%	11	0.68%	(1,132)	(40.91%)
Repayment on long term debt	4,000	4,169	6,077	65.82%	(169)	(4.05%)	(2,077)	(34.18%)
Amortization of debt discount	57	59	79	72.15%	(2)	(3.39%)	(22)	(27.85%)
Dividend/grant in lieu of taxes	3,785	3,739	5,664	66.83%	46	1.23%	(1,879)	(33.17%)
Other	30	80	130	23.08%	(50)	(62.50%)	(100)	(76.92%)
	9,507	**9,671**	**14,717**	**64.60%**	**(164)**	**(1.70%)**	**(5,210)**	**(35.40%)**
Loss for the year	**$ (432)**	**$ (48)**	**$ (1,715)**	**25.19%**	**$ (384)**	**800.00%**	**$1,283,000**	**(74.81%)**

HALIFAX WATER
UNAUDITED STATEMENT OF EARNINGS - WASTEWATER - NSUARB
APRIL 1, 2023 - NOVEMBER 30, 2023 (9 MONTHS)
ACTUAL YEAR TO DATE COMPLETE: 66.67%

	ACTUAL YEAR TO DATE THIS YEAR '000	LAST YEAR '000	APR 1/23 MAR 31/24 BUDGET '000	ACTUAL YEAR TO DATE as % of BUDGET	From Prior Year $ Change	From Prior Year % Change	Actual to Budget $ Remaining	Actual to Budget % Remaining
Operating revenues								
Wastewater	$ 60,307	$ 55,256	$ 87,450	68.96%	$ 5,051	9.14%	$ (27,143)	(31.04%)
Leachate and other contract revenue	388	299	494	78.54%	89	29.77%	(106)	(21.46%)
Septage tipping fees	409	452	535	76.45%	(43)	(9.51%)	(126)	(23.55%)
Overstrength surcharge	0	0	0	0.00%	0	0.00%	0	0.00%
Airplane effluent	73	39	105	69.52%	34	87.18%	(32)	(30.48%)
Late payment and other connection fees	151	143	234	64.53%	8	5.59%	(83)	(35.47%)
Miscellaneous	87	159	223	39.01%	(72)	(45.28%)	(136)	(60.99%)
	61,415	**56,348**	**89,041**	**68.97%**	**5,067**	8.99%	(27,626)	(31.03%)
Operating expenditures								
Wastewater collection	9,420	8,820	13,554	69.50%	600	6.80%	(4,134)	(30.50%)
Wastewater treatment	15,311	15,310	25,065	61.09%	1	0.01%	(9,754)	(38.91%)
Engineering and technology services	4,570	4,811	7,096	64.40%	(241)	(5.01%)	(2,526)	(35.60%)
Regulatory compliance services	1,026	1,254	1,733	59.20%	(228)	(18.18%)	(707)	(40.80%)
Customer services	1,204	1,332	2,029	59.34%	(128)	(9.61%)	(825)	(40.66%)
Corporate services	888	876	1,612	55.09%	12	1.37%	(724)	(44.91%)
Administration services	1,165	1,445	2,733	42.63%	(280)	(19.38%)	(1,568)	(57.37%)
Depreciation and amortization	11,730	10,711	17,310	67.76%	1,019	9.51%	(5,580)	(32.24%)
	45,314	**44,559**	**71,132**	**63.70%**	**755**	**1.69%**	**(25,818)**	**(36.30%)**
Earnings from operations before financial and other revenues and expenditures	**16,101**	**11,789**	**17,909**	**89.90%**	**4,312**	**36.58%**	**(1,808)**	**(10.10%)**
Financial and other revenues								
Interest	49	91	104	47.12%	(42)	(46.15%)	(55)	(52.88%)
Other	68	325	162	41.98%	(257)	(79.08%)	(94)	(58.02%)
	117	**416**	**266**	**43.98%**	**(299)**	**(71.88%)**	**(149)**	**(56.02%)**
Financial and other expenditures								
Interest on long term debt	2,245	3,033	3,385	66.32%	(788)	(25.98%)	(1,140)	(33.68%)
Repayment on long term debt	9,178	9,691	13,790	66.56%	(513)	(5.29%)	(4,612)	(33.44%)
Amortization of debt discount	72	81	99	72.73%	(9)	(11.11%)	(27)	(27.27%)
Dividend/grant in lieu of taxes	525	519	786	66.79%	6	1.16%	(261)	(33.21%)
Other	3	7	45	6.67%	(4)	(57.14%)	(42)	(93.33%)
	12,023	**13,331**	**18,105**	**66.41%**	**(1,308)**	**(9.81%)**	**(6,082)**	**(33.59%)**
Earnings (loss) for the year	**$ 4,195**	**$ (1,126)**	**$ 70**	**5992.86%**	**$ 5,321**	**(472.56%)**	**$ 4,125**	**5892.86%**

HALIFAX WATER
UNAUDITED STATEMENT OF EARNINGS - STORMWATER - NSUARB
APRIL 1, 2023 - NOVEMBER 30, 2023 (9 MONTHS)
ACTUAL YEAR TO DATE COMPLETE: 66.67%

	ACTUAL YEAR TO DATE THIS YEAR '000	LAST YEAR '000	APR 1/23 MAR 31/24 BUDGET '000	ACTUAL YEAR TO DATE as % of BUDGET	From Prior Year $ Change	From Prior Year % Change	Actual to Budget $ Remaining	Actual to Budget % Remaining
Operating revenues								
Stormwater site generated service	4,879	$ 4,562	$ 8,873	54.99%	$ 317	6.95%	$ (3,994)	(45.01%)
Stormwater right of way service	4,812	3,025	6,515	73.86%	1,787	59.07%	(1,703)	(26.14%)
Late payment and other connection fees	29	72	141	20.57%	(43)	(59.72%)	(112)	(79.43%)
Miscellaneous	72	85	75	96.00%	(13)	(15.29%)	(3)	(4.00%)
	9,792	**7,744**	**15,604**	**62.75%**	**2,048**	**26.45%**	**(5,812)**	**(37.25%)**
Operating expenditures								
Stormwater collection	3,222	3,027	5,382	59.87%	195	6.44%	(2,160)	(40.13%)
Engineering and technology services	949	1,401	2,210	42.94%	(452)	(32.26%)	(1,261)	(57.06%)
Regulatory compliance services	1,206	867	1,806	66.78%	339	39.10%	(600)	(33.22%)
Customer services	110	123	189	58.20%	(13)	(10.57%)	(79)	(41.80%)
Corporate services	99	97	179	55.31%	2	2.06%	(80)	(44.69%)
Administration services	126	161	304	41.45%	(35)	(21.74%)	(178)	(58.55%)
Depreciation and amortization	1,411	1,660	2,780	50.76%	(249)	(15.00%)	(1,369)	(49.24%)
	7,123	**7,336**	**12,850**	**55.43%**	**(213)**	**(2.90%)**	**(5,727)**	**(44.57%)**
Earnings from operations before financial and other revenues and expenditures	**2,669**	**408**	**2,754**	**96.91%**	**2,261**	**554.17%**	**(85)**	**(3.09%)**
Financial and other revenues								
Interest	(46)	(35)	(39)	117.95%	(11)	31.43%	(7)	17.95%
Other	0	0	0	0.00%	0	0.00%	0	0.00%
	(46)	**(35)**	**(39)**	**117.95%**	**(11)**	**31.43%**	**(7)**	**17.95%**
Financial and other expenditures								
Interest on long term debt	491	504	899	54.62%	(13)	(2.58%)	(408)	(45.38%)
Repayment on long term debt	1,637	1,426	2,324	70.44%	211	14.80%	(687)	(29.56%)
Amortization of debt discount	16	16	24	66.67%	0	0.00%	(8)	(33.33%)
Dividend/grant in lieu of taxes	93	92	139	66.91%	1	1.09%	(46)	(33.09%)
	2,237	**2,038**	**3,386**	**66.07%**	**199**	**9.76%**	**(1,149)**	**(33.93%)**
Earnings (loss) for the year	**$ 386**	**$ (1,665)**	**$ (671)**	**(57.53%)**	**$ 2,051**	**(123.18%)**	**$ 1,057**	**(157.53%)**

HALIFAX WATER
UNAUDITED STATEMENT OF EARNINGS - REGULATED AND UNREGULATED ACTIVITIES - NSUARB
APRIL 1, 2023 - NOVEMBER 30, 2023 (9 MONTHS)
ACTUAL YEAR TO DATE COMPLETE: 66.67%

	ACTUAL YEAR TO DATE THIS YEAR '000	ACTUAL YEAR TO DATE LAST YEAR '000	APR 1/23 MAR 31/24 BUDGET '000	ACTUAL YEAR TO DATE as % of BUDGET	From Prior Year $ Change	From Prior Year % Change	Actual to Budget $ Remaining	Actual to Budget % Remaining
REGULATED ACTIVITIES								
Operating revenues								
Water	$ 36,700	$ 33,063	$ 53,669	68.38%	$ 3,637	11.00%	$ (16,969)	(31.62%)
Wastewater	60,307	55,256	87,450	68.96%	5,051	9.14%	(27,143)	(31.04%)
Stormwater	9,691	7,587	15,388	62.98%	2,104	27.73%	(5,697)	(37.02%)
Public fire protection	5,389	5,108	8,083	66.67%	281	5.50%	(2,694)	(33.33%)
Private fire protection	1,099	886	1,652	66.53%	213	24.04%	(553)	(33.47%)
Miscellaneous	813	1,083	1,521	53.45%	(270)	(24.93%)	(708)	(46.55%)
	113,999	**102,983**	**167,763**	**67.95%**	**11,016**	**10.70%**	**(53,764)**	**(32.05%)**
Operating expenditures								
Water supply and treatment	9,737	7,215	12,621	77.15%	2,522	34.95%	(2,884)	(22.85%)
Water transmission and distribution	7,643	7,263	13,203	57.89%	380	5.23%	(5,560)	(42.11%)
Wastewater collection	9,379	8,782	13,473	69.61%	597	6.80%	(4,094)	(30.39%)
Stormwater collection	3,222	3,027	5,382	59.87%	195	6.44%	(2,160)	(40.13%)
Wastewater treatment	14,761	14,808	24,288	60.77%	(47)	(0.32%)	(9,527)	(39.23%)
Engineering and technology services	8,928	9,481	14,009	63.73%	(553)	(5.83%)	(5,081)	(36.27%)
Regulatory compliance services	3,173	3,015	5,060	62.71%	158	5.24%	(1,887)	(37.29%)
Customer services	2,945	2,939	4,486	65.65%	6	0.20%	(1,541)	(34.35%)
Corporate services	2,225	2,072	3,642	61.09%	153	7.38%	(1,417)	(38.91%)
Administration services	2,863	3,101	6,067	47.19%	(238)	(7.67%)	(3,204)	(52.81%)
Depreciation and amortization	21,918	20,093	32,650	67.13%	1,825	9.08%	(10,732)	(32.87%)
	86,794	**81,796**	**134,881**	**64.35%**	**4,998**	**6.11%**	**(48,087)**	**(35.65%)**
Earnings from operations before financial and other revenues and expenditures	**27,205**	**21,187**	**32,882**	**82.74%**	**6,018**	**28.40%**	**(5,677)**	**(17.26%)**
Financial and other revenues								
Interest	136	282	324	41.98%	(146)	(51.77%)	(188)	(58.02%)
Other	6	27	37	16.22%	(21)	(77.78%)	(31)	(83.78%)
	142	**309**	**361**	**39.34%**	**(167)**	**(54.05%)**	**(219)**	**(60.66%)**
Financial and other expenditures								
Interest on long term debt	4,371	5,161	7,051	61.99%	(790)	(15.31%)	(2,680)	(38.01%)
Repayment on long term debt	14,815	15,286	22,191	66.76%	(471)	(3.08%)	(7,376)	(33.24%)
Amortization of debt discount	145	156	202	71.78%	(11)	(7.05%)	(57)	(28.22%)
Dividend/grant in lieu of taxes	4,403	4,350	6,589	66.82%	53	1.22%	(2,186)	(33.18%)
	23,734	**24,953**	**36,033**	**65.87%**	**(1,219)**	**(4.89%)**	**(12,299)**	**(34.13%)**
Earnings (loss) for the year - Regulated	**$ 3,613**	**$ (3,457)**	**$ (2,790)**	**(129.50%)**	**$ 7,070**	**(204.51%)**	**$ 6,403**	**(229.50%)**

HALIFAX WATER
UNAUDITED STATEMENT OF EARNINGS - REGULATED AND UNREGULATED ACTIVITIES - NSUARE
APRIL 1, 2023 - NOVEMBER 30, 2023 (9 MONTHS)
ACTUAL YEAR TO DATE COMPLETE: 66.67%

	ACTUAL YEAR TO DATE THIS YEAR '000	ACTUAL YEAR TO DATE LAST YEAR '000	APR 1/23 MAR 31/24 BUDGET '000	ACTUAL YEAR TO DATE as % of BUDGET	From Prior Year $ Change	From Prior Year % Change	Actual to Budget 33	Actual to Budget % Remaining
UNREGULATED ACTIVITIES								
Operating revenues								
Septage tipping fees	$ 409	$ 452	$ 535	76.45%	$ (43)	(9.51%)	$ (126)	(23.55%)
Leachate and other contract revenue	388	299	494	78.54%	89	29.77%	(106)	(21.46%)
Airplane effluent	73	39	105	69.52%	34	87.18%	(32)	(30.48%)
Miscellaneous	0	26	0	0.00%	(26)	(100.00%)	0	0.00%
	870	**816**	**1,134**	**76.72%**	**54**	**6.62%**	**(264)**	**(23.28%)**
Operating expenditures								
Water supply and treatment	5	18	0	0.00%	(13)	(72.22%)	5	0.00%
Wastewater treatment	550	502	777	70.79%	48	9.56%	(227)	(29.21%)
Wastewater collection	41	38	81	50.62%	3	7.89%	(40)	(49.38%)
Sponsorships and donations	(14)	57	73	(19.18%)	(71)	(124.56%)	(87)	(119.18%)
Corporate services	4	12	13	30.77%	(8)	(66.67%)	(9)	(69.23%)
Administration services	28	74	97	28.87%	(46)	(62.16%)	(69)	(71.13%)
Depreciation and amortization	14	12	34	41.18%	2	16.67%	(20)	(58.82%)
	628	**713**	**1,075**	**58.42%**	**(85)**	**(11.92%)**	**(447)**	**(41.58%)**
Earnings from operations before financial and other revenues and expenditures	**242**	**103**	**59**	**410.17%**	**139**	**134.95%**	**183**	**310.17%**
Financial and other revenues								
Other - leases and rentals	178	456	365	48.77%	(278)	(60.96%)	(187)	(51.23%)
Other - energy projects	149	145	225	66.22%	4	2.76%	(76)	(33.78%)
	327	**601**	**590**	**55.42%**	**(274)**	**(45.59%)**	**(263)**	**(44.58%)**
Financial and other expenditures								
Other	33	87	175	18.86%	(54)	(62.07%)	(142)	(81.14%)
	33	**87**	**175**	**18.86%**	**(54)**	**(62.07%)**	**(142)**	**(81.14%)**
Earnings for the year - Unregulated	**$ 536**	**$ 617**	**$ 474**	**113.08%**	**$ (81)**	**(13.13%)**	**$ 62**	**13.08%**
Total earnings (loss) for the year (Regulated and Unregulated)	**$ 4,149**	**$ (2,840)**	**$ (2,316)**	**(179.15%)**	**$ 6,989**	**(246.09%)**	**$ 6,465**	**(279.15%)**

ITEM #6
Halifax Water Board

January 25, 2024

TO: Colleen Rollings, P.Eng., PMP., Chair and Members of the Halifax Regional Water Commission Board

SUBMITTED BY: Digitally signed by Reid Campbell Date: 2024.01.19 13:59:04 -04'00'

Reid Campbell, M. Eng., P. Eng.
Director, Engineering & Technology Services

APPROVED: Tareq Al-Zabet Digitally signed by Tareq Al-Zabet Date: 2024.01.19 14:16:22 -04'00'

Tareq Al-Zabet, Ph.D. CEO & General Manager

DATE: January 18, 2024

SUBJECT: **Proposed 2024/25 Capital Budget**

ORIGIN

Staff compilation of the annual Capital Budget.

RECOMMENDATION

It is recommended that the Halifax Water Board approve the proposed 2024/25 capital budget at a total value of $152,497,000 as detailed in the attached Schedule 1.

BACKGROUND

Halifax Water's Integrated Resource Plan (IRP) identifies a 30-year capital investment plan valued at $4.05 billion ($2.69 billion net present value). With the IRP as the primary input, the capital budget program is developed to meet the utility's infrastructure requirements for the asset renewal, growth, and regulatory compliance drivers.

The capital program enables the utility to continue providing cost effective and efficient services based on long-term service sustainability.

DISCUSSION

The capital budget for the fiscal year April 1, 2024 to March 31, 2025 is attached in Schedule 1. It includes projects within the Water, Wastewater, Stormwater, and District Energy service areas with a total value of $152,497,000.

The IRP vision – a 30-year capital plan that outlines infrastructure reinvestment needs to ensure sustained service delivery from the integrity of the utility's assets – influences the 2024/25 capital budget. It is also influenced by Halifax Water's condition assessment priorities, and Operational and health and safety related considerations. The breakdown by driver shows that the 2024/25 capital budget is dominated by asset renewal at 80.9%, with growth projects representing 5.5% and compliance projects making up the remaining 13.6%.

Using the IRP average level of spend of $135M as a guide, the capital budget was developed with several improvements to the overall process including:

- Consolidating and optimizing operational line items based on previous spending history
- Reviewing previous year forecasts and understanding the magnitude of ongoing programs and projects
- Right-sizing expenditure needs based on capacity to deliver, staff availability and skills
- Review and re-prioritize unspent capital from previous budget years
- Emphasizing to Operations that candidate projects need scrutiny before submitting capital budget requests
- Rejecting candidate projects with insufficient justification and support

Comparatively, the proposed 2024/25 capital budget of $152,497,000 represents an increase from the 2023/24 budget of $146,692,000. In developing the 2024/25 capital budget, staff gave thought to what can be delivered, optimizing the current backlog, pricing factors, and recent staff additions. The proposed 2024/25 capital budget is also significantly reduced from the planned $297,068,000 expenditure identified in the previous budget for 2024/25. The reductions were achieved by:

- Moving projects out into future years to enable more planning effort prior to detailed design
- Using available funding from previous budget years (backlog)
- Taking a more realistic look at project timing in any given budget year
- Decreasing program spending based on spending history

There continues to be significant capital expenditures ahead in future years. The IRP update is commencing around the fiscal year transition. The preliminary outcomes of the next IRP update are expected to be available to inform the 2026/27 capital budget.

Efforts to increase capital delivery capabilities include:

Item	Description
Departmental realignment	Realignment in place at the beginning of fiscal 2023/24 and aimed at developing capability in asset management, project planning, and capital delivery (two groups: capital project delivery focused on delivering infrastructure projects identified from the IRP and condition assessment priorities, and strategic project delivery focused on delivering complex, multi-year capital programs and projects). Recognition of the unique needs for energy management and business development.
Ongoing recruitment of engineering personnel	5 transfers from other departments as part of the realignment or secondary recruitment and 10 new staff added in fiscal 2023/24.
Initiation of the Institutional Capacity Assessment (ICA)	Project kicked off in early January with an anticipated completion in August. The ICA will confirm the required level of staffing to deliver the IRP spend and identify impacts on groups supporting capital delivery.
Capital Project Management and Information System (CPMIS)	Ongoing implementation of the CPMIS project with anticipated go live for release 1.0 for capital planning by end of fiscal (March 31, 2024).

The 2024/25 capital budget summary by system is:

Category	Amount
TOTAL – Water	$62,625,000
TOTAL – Wastewater	$69,815,000
TOTAL – Stormwater	$19,027,000
TOTAL – District Energy	$1,030,000
TOTAL CAPITAL FUNDING	$152,497,000

The 2024/25 capital budget consists of twenty-six (26) projects over $1M totaling $103M in for 2024/25 and as outlined in the following table (costs provided in $1,000).

Project	Amount	Project	Amount
Aerotech Lagoon Rebuild	1,500	Herring Cove PS Replacement	2,900
Autoport PS	5,900	Integrated Resource Plan	1,300
Beaver Bank Reservoir Rehab	3,100	Integrated SW Program	1,200
Burnside Operations Centre	23,300	Leaman Drive Booster Station	2,100
Cathedral Lane Sewer Separation	4,400	LSL Replacement Program	2,000
Cogswell Interchange	5,600	Newton Ave. Transmission Main	3,200
Corporate Flow Monitoring Program	2,600	Silver Sands Watermain	5,900

Project	Amount	Project	Amount
Cross Culvert Replacement Program	3,200	Sullivans Pond Ph 2 Year 1	6,200
Dartmouth WWTF Fournier Press	1,200	Wastewater Fleet	2,200
Dartmouth WWTF UV Upgrade	5,000	Wastewater Integrated	1,600
Driveway Culvert Program	1,200	Wastewater Lateral Replacement	1,800
Duffus PS Elect/Mech Upgrades	1,500	Wastewater Trenchless Program	3,000
Farmers PS Rebuild	1,100	Water Dist. Renewal Program	10,400

Several large projects or programs (with planned expenditures over $15M in the next five years) are proceeding including five major strategic projects using funds identified in previous years.

Planning / Design / Construction	Funding ($1,000)					
Project	**Y1**	**Y2**	**Y3**	**Y4**	**Y5**	**Y1 to Y5**
North End Feeder Replacement	300	6,300	6,300	6,300	6,300	25,500
Pockwock Transmission Main Twinning	200	200	15,000	2,000	200	17,600
Spruce Hill Transmission Main Replacement	200	15,000	18,000			33,200
Water Supply Enhancement Program - JD Kline	800	26,169	54,577	52,066	39,469	173,081
Water Supply Enhancement Program - Lake Major	2,296	1,557	34,617	37,794	7,058	83,322
Fairview Cove Trunk Sewer *						24,000
Cogswell Interchange *	5,600	1,430				19,000
Geizer 158 New Reservoir	200	1,000	31,800	4,000		37,000
Sullivan's Pond Ph 2	6,220	17,204				23,424
Mt. Edward Reservoir Replacement	100	20,000	1,480			21,580
Mill Cove WWTF *		40,000	55,000	37,000	5,000	137,000
Biosolids Processing Facility *		1,050	21,800	50,200	33,400	106,450
Burnside Operation Centre *	23,300	48,000	10,735			82,035

* projects have funds from previous years

Projects with funding approvals over $5M, may also be subject to hearings at the Nova Scotia Utility and Review Board (NSUARB). Early identification of those projects with the NSUARB may help to expedite the approval process and better project timeline planning.

BUDGET IMPLICATIONS

The funding plan and sources for the proposed 2024/25 Capital Budget is shown below:

2024/25 Capital Budget Funding Sources					
Funding Source	**Water**	**Wastewater**	**Stormwater**	**District Energy**	**Totals**
Depreciation	$13,293,000	$17,835,000	$2,572,000	$0	**$33,700,000**
Debt	$46,138,500	$45,451,800	$16,413,700	$1,030,000	**$109,034,000**
Regional Development Charge	3,183,500	$5,206,200	$41,300	$0	**$8,431,000**
External Funding	$10,000	$1,322,000	$0	$0	**$1,332,000**
Capital Cost Contributions	$0	$0	$0	$0	**$0**
SUB-TOTAL	**$62,625,000**	**$69,815,000**	**$19,027,000**	**$1,030,000**	**$152,497,000**

1. Funding for Corporate Projects is allocated to the core asset systems (water, wastewater, stormwater).

The capital budget presented ($152.5 million) is $53 million more than the corresponding year identified in the IRP. The current capital budget considers additional resource capacity added in 2023/24, experience from construction pricing, additional cost and supply chain pressures seen in the past few years, and a gradual increase to address backlogged capital delivery.

This approach to developing the 2024/25 capital budget respects the limitations of the current operating budgets, rates to accommodate increased operating expenses such as depreciation, and debt servicing that is driven by the capital budget.

The projected annual impact of the 2024/25 Capital Budget on future years' Operating Budgets is estimated to be $7,084,000 in depreciation, $3,635,000 in debt principal payments and $5,452,000 in interest payments assuming an interest rate of 5% and 30 year term. There will be other incremental impacts to operating expenses resulting from these capital projects; however, the most material impacts are debt servicing and depreciation.

ATTACHMENTS

Attachment 1 – 2024/2025 1 Year Capital Budget
Attachment 2 – 2024/2025 Projects Over $1M

Report Prepared by:

Digitally signed by Valerie Williams
Date: 2024.01.19 14:08:31 -04'00'

Valerie Williams, P. Eng., CAMP
Senior Manager, Asset Management & Capital Planning

Financial Reviewed by:

Digitally signed by Louis de Montbrun
Date: 2024.01.19 13:51:44 -04'00'

Louis de Montbrun, CPA, CA
Director, Corporate Services/CFO

HALIFAX WATER

Capital Budget 2024/25

Summary

Asset Category	Project Costs
Water - Land -- T O T A L	$125,000
Water - Transmission -- T O T A L	$9,042,000
Water - Distribution -- T O T A L	$19,814,000
Water - Structures -- T O T A L	$7,465,000
Water - Treatment Facilities -- T O T A L	$4,197,000
Water - Energy -- T O T A L	$250,000
Water - Equipment -- T O T A L	$120,000
Water - Corporate Projects - T O T A L	$21,612,000
TOTAL - Water	**$62,625,000**
Wastewater - Collection System -- T O T A L	$16,810,000
Wastewater - Forcemains -- T O T A L	$780,000
Wastewater Structures -- T O T A L	$15,590,000
Wastewater - Treatment Facility -- T O T A L	$13,010,000
Wastewater - Energy -- T O T A L	$800,000
Wastewater - Equipment -- T O T A L	$575,000
Wastewater - Corporate Projects -- T O T A L	$22,250,000
TOTAL - Wastewater	**$69,815,000**
Stormwater - Pipes -- T O T A L	$9,752,000
Stormwater - Culverts -- T O T A L	$4,550,000
Stormwater - Equipment -- T O T A L	$25,000
Stormwater - Corporate Projects -- T O T A L	$4,700,000
TOTAL - Stormwater	**$19,027,000**
District Energy - TOTAL	$1,030,000
TOTAL - District Energy	**$1,030,000**
G R A N D T O T A L	**$152,497,000**

HALIFAX WATER

Capital Budget 2024/25

Water

Project Number	Project Name	Project Cost
	Water - Land	
3.033	Watershed Land Acquisition	$125,000
	Water - Land -- T O T A L	**$125,000**
	Water - Transmission	
3.554	North End Feeder Replacement	$300,000
3.553	Peninsula Intermediate Looping - Quinpool Rd to Young St (Newton Ave 2023)	$3,246,000
3.559	Lucasville Road Twinning Ph 2	$200,000
3.436	Pockwock Transmission Main Twinning - WSP to Hammonds Plains Rd	$200,000
3.399	Cogswell Interchange - Water Tranmission Main Realignments	$1,830,000
3.744	Lacewood Drive Looping-Geizer 158 Looping (IMP W02)	$200,000
3.743	Spruce Hill Transmission Main Replacement	$200,000
3.748	Bayers Road 27 Transmission Main Replacement Connaught Ave to Windsor	$200,000
3.752	Quinpool Road Transmission Main Upgrades-Quinn St to Beech St (W6.1 and 6.2)	$100,000
3.571	Highway 118 Crossing - Shubie Park to Dartmouth Crossing	$2,361,000
3.761	Highway 118 Crossing - Shubie Park to Dartmouth Crossing	$65,000
3.045	Highway 118 Crossing - Shubie Park to Dartmouth Crossing	$10,000
3.261	Highway 118 Crossing - Shubie Park to Dartmouth Crossing	$10,000
3.232	Highway 118 Crossing - Shubie Park to Dartmouth Crossing	$120,000
	Water - Transmission -- T O T A L	**$9,042,000**
	Water - Distribution	
3.022	Water Distribution - Main Renewal Program	$10,400,000
3.067	~ Valves Renewals	$425,000
3.068	~ Hydrants Renewals	$75,000
3.069	~ Service Lines Renewals	$75,000
3.390	Lead Service Line Replacement Program	$2,000,000
3.296	Water Sampling Station Relocation Program	$10,000
3.696	Tower Road CN Bridge - Watermain Replacement	$500,000
3.584	Silversands WSP-Linear Main Extension Cow Bay Rd	$5,859,000
3.688	Little Salmon River Bridge Watermain Replacement	$40,000
3.746	Young Avenue CN Bridge-Watermain Replacement	$100,000
3.751	Lake Major Road Culvert Replacement-Watermain Relocation	$130,000
3.686	Robie Street Upsizing	$100,000
3.555	Young Street Upsizing	$100,000
	Water - Distribution -- T O T A L	**$19,814,000**

HALIFAX WATER

Capital Budget 2024/25

Water

Project Number	Project Name	Project Cost
	Water - Structures	
3.601	Control Chamber Valve Replacement Program	$125,000
3.263	District Metered Areas (DMA) Program	$100,000
3.623	Booster Station - Building Envelope - Capital Upgrade Program	$30,000
3.709	White Hills Meter Chamber Replacement	$300,000
3.701	Leaman Dr. Emergency Booster Station	$2,130,000
3.719	Geizer 158 - New Reservoir	$200,000
3.651	Riverside Drive PRV Chamber Replacement	$40,000
3.589	Aerotech Booster Station Replacement	$500,000
3.454	Robie Street Reservoir Rehabilitation	$150,000
3.747	Aerotech Booster Station-Communication System Upgrades	$300,000
3.508	Beaver Bank Reservoir Rehabilitation	$3,100,000
3.749	Bedford South Booster Station - New Pump Control Panel	$150,000
3.750	Topsail Control Chamber - New Diesel Back-up Generator	$130,000
3.753	Waverley Road PRV CSE Retrofit	$110,000
3.712	Mount Edward Reservoir #1 Replacement	$100,000
	Water - Structures -- T O T A L	**$7,465,000**
	Water - Treatment Facilities	
	J D Kline Water Supply Plant:	
3.608	JD Kline WSP - Clearwell, reservoir and storage - WSEP JDK-800.25	$800,000
	Lake Major Water Supply Plant:	
3.162	Lake Major WSP - Butterfly Valve Replacement Program	$425,000
3.557	Lake Major WSP - Sludge Drying Beds Improvements	$350,000
3.755	Lake Major WSP - Low Lift Access Road Gate Upgrade	$70,000
3.618	Lake Major WSP - Clarification/Pretreatment - WSEP MAJ 800.15	$550,000
3.619	Lake Major WSP - Intake/low lift Pump Station - WSEP MAJ-800.20	$519,000
3.621	Lake Major WSP - Filter upgrades - WESP MAJ-800.45	$382,000
	Bennery Lake Water Supply Plant:	
3.756	Bennery Lake WSP - New High Lift Pump	$225,000
3.757	Bennery Lake WSP - Replace Process Residual Sludge Pumps	$40,000
	Non-Urban Core WSP	
3.731	Small Systems - Filter Column Replacement Program	$10,000
3-754	Water Supply Plants Asset Renewal and Emergency Repairs	$300,000
3-690	WSP Plants - Instrumentation and Controls Equipment Program	$130,000
3-691	Pump and Equipment Overhauls Program for WSPs	$250,000
3.759	Tomahawk Outlet Bridge	$64,000
3.760	Bennery Lake Road Culvert	$32,000
3.740	Receiving Environment Assessment - Bomont	$50,000
	Water - Treatment Facilities -- T O T A L	**$4,197,000**
	Water - Energy	
3.635	Energy Management Capital Program (Water)	$150,000
3.107	Chamber HVAC Retro-Commissioning Program	$100,000
	Water - Energy -- T O T A L	**$250,000**
	Water - Equipment	
3.101	Miscellaneous Equipment Replacement (Water)	$60,000
3.738	Water Quality Lab Infrastructure	$60,000
	Water - Equipment -- T O T A L	**$120,000**
	Water - Corporate Projects - T O T A L	**$21,612,000**
	GRAND TOTAL - WATER	**$62,625,000**

HALIFAX WATER

Capital Budget 2024/25

Wastewater

Project Number	Project Name	Project Cost
	Wastewater - Collection System	
2.168	Wastewater System - Trenchless Rehabilitation Program	$3,000,000
2.504	Collection System Asset Renewal Program	$150,000
2.357	Manhole Renewals WW	$60,000
2.358	Lateral Replacements WW (non-tree roots)	$1,800,000
2.563	Lateral Replacements WW (tree roots)	$600,000
2.223	Wet Weather Management Program	$400,000
2.052	Integrated Wastewater Projects - Program	$1,600,000
2.692	Cogswell Redevelopment - Sewer Relocation	$1,840,000
2.356	Auburn Avenue PS Elimination	$60,000
2.1072	Sewer Separation Program	$200,000
2.836	Wyse Road Separation Phase 1	$100,000
2.837	Wyse Road Separation Phase 2	$100,000
2.674	SSP - South Park Street - Sewer Separation	$4,400,000
2.679	College Street - Sewer Separation	$250,000
2.107	SSP - Spring Garden Road Pocket	$250,000
2.982	Young Street Pocket - Sewer Separation - Route to Harbour	$800,000
2.672	Young Street - Sewer Separation	$100,000
2.678	Robie Street - Sewer Separation	$250,000
2.942	North Preston Lateral Connection Rehabilitation	$100,000
2.830	Eastern Passage RDII Reduction Program FMZ24 - Lake Loon	$100,000
2.832	Mill Cove RDII Reduction Program FMZ07 & FMZ40 - Lower Sackville	$500,000
2.833	Mill Cove RDII Reduction Program FMZ10 - Bedford Common	$50,000
2.834	Ellenvale Area RDII Reduction Program FMZ27	$100,000
	Wastewater - Collection System -- T O T A L	**$16,810,000**
	Wastewater - Forcemains	
2.1117	ARV Replacement – Eastern Passage Gravity Pressure Sewer	$130,000
2.608	New Timberlea Pump Station Forcemain System	$600,000
2.578	Armdale Pumping Station Forcemain Replacement	$50,000
	Wastewater - Forcemains -- T O T A L	**$780,000**
	Wastewater - Structures	
2.420	Emergency Pumping Station Pump Replacements	$300,000
2.442	Wastewater Pumping Station Component Replacement Program - West Region	$200,000
2.443	Wastewater Pumping Station Component Replacement Program - East Region	$200,000
2.444	Wastewater Pumping Station Component Replacement Program - Central Region	$200,000
2.108	Pump Station Quick Connects for Generators and Bypass pumps	$320,000
2.476	Wastewater Pumping Station Asset Renewal Program	$300,000
2.1093	Fish Hatchery PS Upgrade	$815,000
2.92	Herring Cove Pumping Station - Pump Replacements	$2,900,000
2.111	Farmers PS Temporary Rebuild	$1,140,000
2.1115	Fall Protection Retro-Fit - Pumping Stations	$35,000
2.1008	Roach's Pond Pumping Station - New Screen	$200,000
2.978	Majestic Avenue PS Upgrades	$200,000
2.1030	Duffus Street Pumping Station - Mechanical & Electrical Upgrades	$1,500,000
2.740	Duffus Pumping Station Replacement and CSO Modification	$200,000
2.1032	Pier A Pumping Station - Mechanical Upgrades	$100,000
2.654	PS Control Panel / Electrical Replacement	$860,000
2.005	Autoport Pleasant Street PS Replacement	$5,900,000
2.609	New Timberlea Pumping Station	$220,000
	Wastewater Structures -- T O T A L	**$15,590,000**

HALIFAX WATER

Capital Budget 2024/25

Wastewater

Project Number	Project Name	Project Cost
	Wastewater - Treatment Facility	
2.056	Plant Optimization Program	$150,000
2.522	Emergency Wastewater Treatment Facility equipment replacements	$600,000
2.668	Wastewater Treatment Research Program Pilot Plant	$250,000
2.699	HHSPs - Outfall Inspection Program	$35,000
2.108	WWTF - Bay Door Replacements	$175,000
2.1078	HHSP WWTFs - Raw Water Pump Variable Frequency Drive (VFD's)	$230,000
2.1079	HHSP WWTFs - Polymer Batching System Replacement - Phase 1 Scoping	$60,000
2.1080	HHSP WWTFs - Air Quality Improvement Project (Internal) - Phase 1 Scoping	$60,000
2.1081	HHSPs - Critical Spares Program 2024-2028	$250,000
	Halifax WWTF	
2.506	Halifax WWTF - Asset Renewal Program	$775,000
2.765	Halifax WWTF - Raw Water Pump Refurbishment	$65,000
2.1083	Halifax WWTF - Female Locker Room	$50,000
2.1084	Halifax WWTF - Wetwell Hatch Modifications	$90,000
2.1085	Halifax WWTF - Grit Discharge Line Replacement	$100,000
2.1086	Halifax WWTF - Coarse Climber Screen Replacement & Main Gate Isolation – Phase 1 Scoping	$60,000
	Dartmouth WWTF	
2.507	Dartmouth WWTF - Asset Renewal Program	$150,000
2.790	Dartmouth WWTF - Fournier Press - Sludge Dewatering Upgrade	$1,200,000
2.8760	Dartmouth WWTF - Raw Water Pump Refurbishment Program	$65,000
2.7880	Dartmouth WWTF - UV Disinfection System - New Modules and PLC Upgrade	$5,000,000
2.1087	Dartmouth WWTF - Outfall Liner and Multiport Diffuser Repair	$150,000
2.1088	Dartmouth WWTF - Odour Control Damper Replacement	$200,000
2.1089	Dartmouth WWTF - Forklift Replacement	$60,000
	Herring Cove WWTF	
2.5080	Herring Cove WWTF - Asset Renewal Program	$150,000
2.1090	Herring Cove WWTF - Hatchway (Hoistway) Cover Replacement	$75,000
2.1091	Herring Cove WWTF - Boiler room mechanical ventilation and Basement Electrical (Phase 1 Scoping)	$25,000
	Mill Cove WWTF	
2.505	Mill Cove WWTF - Asset Renewal Program	$100,000
2.903	Mill Cove WWTF - Dewatering - Centrifuge Rebuild Program	$35,000
2.110	Mill Cove WWTF - UV AC Unit Replacements	$25,000
2.1100	Mill Cove WWTF - Replacement Gas Booster	$45,000
2.1101	Mill Cove WWTF - Wet Well Wizards (x2)	$70,000
	Eastern Passage WWTF	
2.907	Eastern Passage WWTF - Centrifuge Rebuild	$50,000
2.908	Eastern Passage WWTF - UV Bank Rebuilds	$15,000
2.1095	Eastern Passage WWTF - Primary Clarifier Refurbishment Program	$160,000
2.1096	Eastern Passage WWTF - Return Activated Sludge Pump Refurbishment Program	$50,000
2.1097	Eastern Passage WWTF - Headworks Duct Replacement	$80,000
2.1098	Eastern Passage WWTF - Scum Pump Refurbishment Program	$20,000

HALIFAX WATER

Capital Budget 2024/25

Wastewater

Project Number	Project Name	Project Cost
	Aerotech WWTF	
2.667	Aerotech WWTF - Asset Renewal Program	$75,000
2.1102	Aerotech WWTF - Caustic Tank Cleaning	$20,000
2.1103	Aerotech WWTF - Lagoon Cleaning and Rehabilitation	$1,500,000
2.1104	Aerotech WWTF - Central Hatch for Sludge Tank	$50,000
	Timberlea WWTF	
2.509	Timberlea WWTF - Asset Renewal Program	$50,000
2.1092	Timberlea WWTF - Grit Gearbox Elevated Walkway	$50,000
2.1094	Timberlea WWTF - Female Locker Room	$30,000
	Community WWTFs	
2.1107	Fall River WWTF - Replace EQ Pumps	$45,000
2.1110	Fall River WWTF - Blower Replacement	$120,000
2.1113	Fall River WWTF - Ventilation and Lighting Upgrade	$25,000
2.1108	Middle Musquodoboit WWTF – Replace WWTF LS Control Panel and SCADA Panel	$90,000
2.1109	Frame WWTF - Generator with ATS	$70,000
2.1111	North Preston WWTF - Replace Factory Talks with VTScada- Phase 1 Scoping	$15,000
	Biosolids Processing Facility	
2.126	Biosolids Processing Facility - Asset Renewal Program	$50,000
2.919	Biosolids Processing Facility - Gas Sensor Upgrade Program	$15,000
2.1105	Biosolids Processing Facility - Stairs in LBB Pit - Eliminate Confined Space	$30,000
2.111	Biosolids Processing Facility - Bio-Filter Media Replacement	$100,000
	Wastewater - Treatment Facility -- T O T A L	**$13,010,000**
	Wastewater - Energy	
2.362	Energy Management Capital Program (Wastewater)	$500,000
2.491	Pump Station HVAC Retro-Commissioning Program	$200,000
2.1075	Wastewater Heat Recovery Study	$100,000
	Wastewater - Energy -- T O T A L	**$800,000**
	Wastewater - Equipment	
2.161	I&I Reduction (SIR) Program Flow Meters and Related Equipment	$25,000
2.1038	FOG software	$50,000
2.1041	Two new fridge / sampling units	$10,000
2.451	Miscellaneous Equipment Replacement	$120,000
2.1021	Trenchless Lining Equipment	$320,000
2.1116	Odour Control Dosing Systems - Central Operations	$50,000
	Wastewater - Equipment -- T O T A L	**$575,000**
	Wastewater - Corporate Projects -- T O T A L	**$22,250,000**
	GRAND TOTAL - WASTEWATER	**$69,815,000**

HALIFAX WATER

Capital Budget 2024/25

Stormwater

Project Number	Project Name	Project Cost
	Stormwater - Pipes	
1.108	Stormwater Pipe Asset Renewal Program	$300,000
1.038	Integrated Stormwater Projects - Program	$1,200,000
1.102	Manhole Renewals SW Program	$21,000
1.103	Catchbasin Renewals SW Program	$63,000
1.135	Lateral Replacements SW Program	$18,000
1.145	Sullivan's Pond Storm Sewer System Replacement - Phase 2 Irishtown Rd to Harbour	$6,220,000
1.188	Cogswell Redevelopment - SW Sewer Relocation	$1,930,000
	Stormwater - Pipes -- T O T A L	**$9,752,000**
	Stormwater - Culverts/Ditches	
1.104	Driveway Culvert Replacement Program	$1,200,000
1.279	Cross Culvert Replacement Program - Field Investigation & Operations Replacements	$100,000
1.288	Cross Road Culvert Replacement Program - Engineering Design	$100,000
1.109	Cross Culvert Renewal Program	$200,000
1.109	154 Kaye Street	$350,000
1.109	6771 St,Margaret's bay Road	$375,000
1.109	121 Jamieson Drive	$400,000
1.109	Hammonds Plains Road (Stillwater Lake area)	$450,000
1.109	139 Ferguson's Cove Road	$200,000
1.109	26 Foster Avenue	$200,000
1.109	103 Southwood	$75,000
1.109	2884 Lawrencetown Road	$400,000
1.109	519 Old Sackville Road	$300,000
1.109	23 Old Post Road	$200,000
	Stormwater - Culverts/Ditches -- T O T A L	**$4,550,000**
	Stormwater - Equipment	
1.318	Excavator Mulching Head	$25,000
	Stormwater - Equipment -- T O T A L	**$25,000**
	Stormwater - Corporate Projects -- T O T A L	**$4,700,000**
	GRAND TOTAL - STORMWATER	**$19,027,000**

HALIFAX WATER

Capital Budget 2024/25

Corporate Projects

Project Number	Project Name	Project Cost
	Corporate - Information Technology	
4.314	Organizational PMO Strategy and Governance	$400,000
4.105	Cityworks Upgrade	$50,000
4.206	Cayenta Upgrades	$200,000
4.255	General IT System Upgrades	$500,000
4.208	DA3 – Program & Project	$800,000
4.218	EE- ITSM Process	$500,000
4.219	EE - Electrical Safety Program	$100,000
4.222	Case Management	$350,000
4.228	Enterprise Architecture	$250,000
4.231	Detection Equipment SCADA Wan Update	$150,000
4.232	Strategic Planning Business Cases	$150,000
4.239	TS Work Tracking	$150,000
4.261	Electrical Planned Maintenance Program	$450,000
4.265	EMIS Replacement Project	$50,000
4.280	CCFN version 5.5 with ISM	$350,000
4.283	Digital Twin - Virtual Facility Tours	$100,000
4.262	Enterprise Risk Management	$400,000
4.263	Business Continuity Management	$400,000
4.288	PASS Project	$500,000
4.289	E-Signature Project	$300,000
4.205	Workspaces	$960,000
4.284	IS Equipment Replacement	$700,000
4.295	CAD/BIM	$75,000
4.294	Cityworks Strategy & Governance Model	$100,000
4.309	Pollution Prevention Inspection	$400,000
4.311	Technical Services Capital Tools	$300,000
4.303	Teams Records	$960,000
4.264	Cradlepoint deployment project	$250,000
4.281	Contract Management and Vendor Performance	$250,000
4.286	Data Quality Tool and Process	$670,000
4.287	VIP- Recruitment	$500,000
4.259	Health and Safety	$50,000
4.012	Network Upgrades	$280,000
4.195	New Service Account Compliance Program	$500,000
3.602	Control Chamber - Electrical Panel Replacement Program	$60,000
4.189	Central Spread Spectrum Radio Network Replacement Program	$150,000
4.191	ICS Cyber-Security Enhancements	$100,000
4.192	PI System Enhancements	$250,000
4.193	AMI Communications Upgrade	$150,000
4.19	SCADA Equipment Renewals	$200,000
4.306	SCADA Alarm Management	$50,000
4.040	GIS Data Program	$150,000
4.105	GIS/Cityworks Upgrade Program	$50,000
4.01	Service Gap Project	$250,000
4.293	Ditch Inventory Build	$100,000
4.302	Aerial Imagery Acquisition	$250,000
4.301	CAD/Electrical Drawing	$25,000
4.297	Emergency Management Office	$50,000
4.038	GIS Hardware/Software Program	$50,000

HALIFAX WATER

Capital Budget 2024/25

Corporate Projects

Project Number	Project Name	Project Cost
4.296	Get the Lead Out Program (EI Support)	$100,000
4.299	PUCA Hot Sheet Integration	$25,000
4.300	ArcMap to ArcGIS Pro Migration	$50,000
4.313	Standardize P&ID's for Vertical Assets	$100,000
	Corporate - Information Technology -- T O T A L	**$14,305,000**

HALIFAX WATER

Capital Budget 2024/25

Corporate Projects

Project Number	Project Name	Project Cost
	Corporate - Asset Management	
4.020	Asset Management Program Development	$100,000
2.872	Wastewater Sewer Condition Assessment	$505,000
1.254	Storm Sewer Condition Assessment	$215,000
2.043	Corporate Flow Monitoring Program	$2,600,000
4.158	Condition Assessment Program	$500,000
4.163	Annual Asset Management Plan Update	$20,000
4.165	Asset Management Awareness Program	$20,000
4.113	Climate Change Management Program	$200,000
4.17	Integrated Resource Plan Update	$1,250,000
4.308	Growth Servicing Strategy	$125,000
2.1074	SSO and CSO Management Program	$257,000
3.644	Water Efficiency Strategy	$80,000
	Corporate - Asset Management -- T O T A L	**$5,872,000**
	Corporate - Facility	
4.187	Burnside Operations Centre	$23,300,000
4.077	Building Capital Improvements	$600,000
3.221	Energy Management Capital Program	$150,000
4.304	Solar PV Facility Assessment Study	$50,000
4.009	Security Upgrade Program	$240,000
	Corporate - Facility -- T O T A L	**$24,340,000**
	Corporate - SCADA & Other Equipment	
4.154	Customer Meters - New and Replacement	$400,000
	Corporate - SCADA & Other Equipment -- T O T A L	**$400,000**
	Corporate - Fleet	
4.006	Fleet Upgrade Program Stormwater	$539,000
4.006	Fleet Upgrade Program Wastewater	$2,156,000
4.007	Fleet Upgrade Program Water	$950,000
	Corporate - Fleet -- T O T A L	**$3,645,000**
	GRAND TOTAL - Corporate Projects	**$48,562,000**
	ALLOCATION BREAKDOWN:	
	Water - Corporate Projects - T O T A L	$21,612,000
	Wastewater - Corporate Projects -- T O T A L	$22,250,000
	Stormwater - Corporate Projects -- T O T A L	$4,700,000
	GRAND TOTAL - Corporate Projects	**$48,562,000**

HALIFAX WATER

Capital Budget 2024/25

District Energy

Project Number	Project Name	Project Cost
	District Energy	
4.307	Cogswell DES - Cogswell Street Extension	$1,000,000
4.312	District Energy Data Model	$30,000
	Stormwater - District Energy -- T O T A L	**$1,030,000**
	GRAND TOTAL - STORMWATER	**$1,030,000**

HALIFAX WATER

Capital Budget 2024/25

Summary of Routine Capital Expenditures included within Capital Budget

Project Number	Project Name	Project Cost	Asset Class
	Routine Capital Projects		
3.067	Valves Renewals	$425,000	Water
3.068	Hydrants Renewals	$75,000	Water
3.069	Service Lines Renewals	$75,000	Water
3.39	Lead Service Line Replacement Program	$2,000,000	Water
3.101	Miscellaneous Equipment Replacement (Water)	$60,000	Water
4.007	Fleet Upgrade Program (Water)	$950,000	Water
2.357	Manhole Renewals WW	$60,000	Wastewater
2.358	Lateral Replacements WW (non-tree roots)	$1,800,000	Wastewater
2.563	Lateral Replacements WW (tree roots)	$600,000	Wastewater
2.451	Miscellaneous Equipment Replacement (WW)	$320,000	Wastewater
4.006	Fleet Upgrade Program (WW)	$2,156,000	Wastewater
1.102	Manhole Renewals SW Program	$21,000	Stormwater
1.103	Catchbasin Renewals SW Program	$63,000	Stormwater
1.135	Lateral Replacements SW Program	$18,000	Stormwater
4.006	Fleet Upgrade Program (SW)	$539,000	Stormwater
4.154	Customer Meters - New and Replacement	$400,000	Corporate
4.012	Network Upgrades	$280,000	Corporate
	GRAND TOTAL - Routine Capital Projects	**$9,842,000**	

Attachment 2 - 2024/25 Projects Over $1M

Project ID	Project Name	Project Cost
Water		
3.553	Peninsula Intermediate Looping - Quinpool Road to Young St (Newton Ave 2024) ***	$3,246
3.399	Cogswell Interchange - Water Transmission Main Realignments	$1,830
3.571	Highway 118 Crossing - Shubie Park to Dartmouth Crossing	$2,361
3.022	Water Distribution - Main Renewal Program	$10,400
3.390	Lead Service Line Replacement Program	$2,000
3.584	Silversands WSP - Linear Main Extension Cow Bay Road	$5,859
3.701	Leaman Dr. Emergency Booster Station	$2,130
3.508	Beaver Bank Reservoir Rehabilitation	$3,100
Wastewater		
2.168	Wastewater System - Trenchless Rehabilitation Program	$3,000
2.358	Lateral Replacements WW (non-tree roots)	$1,800
2.052	Integrated Wastewater Projects - Program	$1,600
2.692	Cogswell Redevelopment - Sewer Relocation	$1,840
2.674	SSP - South Park Street - Sewer Separation	$4,400
2.920	Herring Cove Pumping Station - Pump Replacements	$2,900
2.1114	Farmers PS Temporary Rebuild	$1,140
2.1030	Duffus Street Pumping Station - Mechanical & Electrical Upgrades	$1,500
2.005	Autoport Pleasant Street PS Replacement	$5,900
2.790	Dartmouth WWTF - Fournier Press - Sludge Dewatering Upgrade	$1,200
2.788	Dartmouth WWTF - UV Disinfection System - New Modules and PLC Upgrade	$5,000
2.1103	Aerotech WWTF - Lagoon Cleaning and Rehabilitation	$1,500
Stormwater		
1.038	Integrated Stormwater Projects - Program	$1,200
1.145	Sullivan's Pond Storm Sewer System Replacement - Phase 2 Irishtown Rd to Harbour	$6,220
1.188	Cogswell Redevelopment - SW Sewer Relocation	$1,930
1.104	Driveway Culvert Replacement Program	$1,200
1.288	Cross Road Culvert Replacement Program - Engineering Design	$3,200
Corporate		
2.043	Corporate Flow Monitoring Program	$2,600
4.170	Integrated Resource Plan Update	$1,250
4.187	Burnside Operations Centre	$23,300
4.006	Fleet Upgrade Program WW	$2,156
District Energy		
4.307	Cogswell DES - Cogswell Street Extension	$1,000

ITEM #7.1
Halifax Water Board
January 25, 2024

TO: Colleen Rollings, P.Eng., PMP., Chair and Members of the Halifax Regional Water Commission Board

SUBMITTED BY: Digitally signed by Reid Campbell Date: 2024.01.17 12:58:09 -04'00'

Reid Campbell, M.Eng., P.Eng.
Director, Engineering & Technology Services

APPROVED: Tareq Al-Zabet Digitally signed by Tareq Al-Zabet Date: 2024.01.18 14:35:21 -04'00'

Tareq Al-Zabet, Ph.D., CRSP, P.Geo, CEO & General Manager

DATE: Thursday, January 25, 2024

SUBJECT: **Mill Cove WWTF Expansion & Upgrade – Detailed Design Engineering Fees**

ORIGIN

Halifax Water 2023/24 Capital Budget.

RECOMMENDATIONS

It is recommended that the Halifax Water Board approve funding in the amount of $10,000,000 for completing Phases 1 through 3 of the Mill Cove WWTF Upgrade and Expansion project.

BACKGROUND

The central wastewater collection system is a separated system that serves the Sackville and Bedford areas that discharges to the Mill Cove WWTF (MCWWTF). The facility, located at 205 Waterfront Drive, Bedford, then discharges to the west shore of Bedford Basin. The facility has an average daily flow design capacity of 28.4 MLD and is the largest secondary wastewater treatment plant owned by Halifax Water. The facility is situated on a 4.3-acre parcel of land bound on all sides by condominium complexes, a CN Rail easement, DeWolf Park, and property owned by Sobey's Inc. and a parking lot owned by Develop Nova Scotia (Figure 1).

Figure 1: MCWWTF property boundaries

The MCWWTF was constructed in the early 1970s to provide secondary treatment for the community. Two expansions have occurred increasing capacity and upgrading treatment levels with the most significant upgrade occurring in 1995 providing the removal of carbonaceous BOD (biochemical oxygen demand) and TSS (total suspended solids) before discharging to Bedford Basin. Since the 1995 upgrade, the plant's configuration has remained mostly unchanged, except for a few minor modifications in 2010, 2013, and 2018. These modifications included updates to the piping, dewatering centrifuge technology, disinfection system, odour control scrubber and installation of a new outfall.

The current plant is designed to achieve effluent concentrations of Carbonaceous Biochemical Oxygen Demand – ($CBOD_5$) and TSS of 25 milligrams per litre (mg/L). In 2017, Nova Scotia Environment (NSE) required an Escherichia coliform (*E. coli*) limit of 200 count /100 millilitres

(ml) as well as a requirement for the effluent to be non-acutely lethal (as defined by the Fisheries Act) which now is included in the requirements outlined in the current Approval to Operate.

The federal Fisheries Act established requirements in the Wastewater Systems Effluent Regulations (WSER SOR/2012-139) setting minimal municipal effluent quality standards nationwide for suspended solids (SS), carbonaceous biochemical oxygen-demanding material (cBOD), total residual chlorine, and un-ionized ammonia ($NH_{3,\,aq}$). Nova Scotia Environment and Climate Change have endorsed these regulations for applicable facilities and are aligning operational approvals to ensure facilities meet or exceed these regulations based on Environmental Risk Assessment (ERA) filed when requesting approvals for expansions or upgrades.

In 2019, a site-specific Environmental Risk Assessment (ERA) was undertaken for the MCWWTF by Dillion Consulting. The ERA was based on the Canadian Council of Ministers of the Environment (CCME), 2009 Canada-wide strategy for the Management of Municipal Wastewater Effluent (the Canada-wide strategy). The ERA evaluated effluent discharge requirements associated with the design capacity of existing facility. The ERA process is part of a risk management approach that focused on defining WWTF allowable effluent concentrations which are protective of the receiving environment and human health. Components of the Canada-wide strategy included an initial characterization of effluent, determination of Environmental Quality Objectives (EQOs) required in supporting sensitive designated use of the water, determination of corresponding Effluent Discharge Objectives (EDOs), and identification of compliance monitoring requirements. This report was finalized in 2020 and is used as the basis of design requirements for the future facility upgrades as the recommended EDO were more stringent than those listed on current operational permits and those listed under the federal WSER regulations, trigging the need to address current and future environmental regulations moving forward.

The Infrastructure Master Plan (IMP) completed in 2019 highlighted the need for further expansion of the treatment facility to accommodate the ongoing growth in the sewershed area to meet the service strategy for the Central Region. IMP analysis results pertaining to the MCWWTF indicated that the facility was operating at approximately 90% of its rated capacity of 28.4MLD. However, projections for the average daily flow (ADF) in 2046 suggested a future estimated rate of 37.1 MLD would be required.

Considering the projected growth rates and the impact on the receiving water and sewershed boundaries, as well as the site-specific effluent discharge objectives that were established from the ERA it was determined that it was necessary to proceed with a capital upgrade project that would address growth, asset renewal, and regulatory compliance objectives identified in the Environmental Risk Assessment (ERA), WSER regulations and IMP initiatives to the year 2046. Planning for the expansion began immediately with internal efforts focused on data collection, development of design parameters, and process selection.

DISCUSSION

As indicated in the discussion section above, the need to accommodate growth, to address the site-specific needs identified in the ERA and to comply with the 2046 requirement of the WSER regulations, necessitated that the plant be upgraded. In 2019, Halifax Water evaluated alternatives to meet the project's specific needs and developed a Conceptual Design Report (CDR) for the upgrade and expansion project. Through an extensive process evaluation effort, a preferred strategy was identified. The report included a high-level analysis of the design flows and loading, process modeling simulations, and process sizing to allow spatial arrangement/integration with existing processes on site. Opinions of probable costs of the five (5) treatment technologies reviewed were established along with operation and maintenance costs. Finally, a preferred design concept was proposed recommending the implementation of a membrane bioreactor retrofit concept. The CDR was filed with the Nova Scotia Utility and Review Board (NSUARB) and subsequent discussions, presentations and correspondences were exchanged with the NSUARB Counsel Consultants (BCC) related to the report. The result was that the BCC's requested a third-party validation of the CDR to ensure the outcomes and recommendations were sound.

A consecutive negotiation, public procurement process was initiated to select a prime consultant for the project. The consecutive negotiation process allowed Halifax Water to obtain firm pricing for the first two phases and establish a basis for negotiation for future phases. The Request for Proposals was structured to allow for firms to provide a comprehensive design team and expertise capable of undertaking engineering services through the four phases of the project that included:

Phase 1: Concept Validation
Phase 2: Preliminary Design & Equipment Pre-selection
Phase 3: Detailed Design
Phase 4: Construction and & Engineering Services

CBCL-Stantec team was successful in this procurement process and were subsequently contracted for this project in June 2023 at a cost of $ 694,317 plus HST for the first two phases.

The Phase 1 Validation of the Conceptual Design draft was finalized in November 2023. The key report findings indicated that the technology and approach outlined in the CDR was the preferred upgrade/expansion option for Mill Cove and was reasonable considering the objectives and site constraints. Additional refinement of several key aspects will be finalized in the predesign report due in February 2024. The report was filed with the BCC's ahead of a December 4th, 2023, meeting to discuss the validation report as well as the next phase of the project. The BCC's agreed with the assessment of the findings and appropriateness of the MBR treatment concept recommendation in the CDR allowing the project to advance to Phase 2 provided some outstanding concerns identified by the Board Consultants would be addressed as part of the preliminary design currently underway.

Halifax Water staff has established a stage gating committee, comprised of some members of the executive to provide governance and oversight to projects executed by the Strategic Projects

business unit. The committee met for the first time on January 8, 2024, to review the project. The project was approved to proceed through gate 2 to the Plan & Design stage.

A proposed fee and time task matrix outlining the estimated detailed engineering (Phase 3) fees was provided by the consultant team at a cost of $6,500,000 plus HST. This value based on the project definition to date and is subject to further negotiation as scope is developed. through preliminary design and equipment preselection. Should the negotiated fee for Phase 3 be less than the $6,500,000 cost, the balance will be used to offset the cost of Phase 4 – Constructions and Engineering Construction Services in future budgets. Once detailed design is nearing completion, and the construction cost is better defined, Halifax Water staff will return to the Halifax Water Board seeking approval of funding for Phase 4. Table 1 includes a breakdown of the anticipated project costs for engineering services to produce tender ready package with a project timeline associated with engineering design is provided in Figure 2.

Table 1: Breakdown of Engineering Design Project Fees

Item	Description	Cost
1	Phase 1 & 2: CDR Validation, Pre-selection and Preliminary Design	$ 694,317
2	Phase 3: Detailed Design Engineering (Opinion of probable cost)	$ 6,500,000
3	Design Development Contingency (30%)	$ 2,158,295
4	HW Staff and Project Management (1%)	$ 93,526
5	Overheads (1%)	$ 93,526
6	Net HST (4.286 % on Items 1, 2 and 3)	$ 400,853
	TOTAL	$ 9,940,517
	Rounded TOTAL	$ 10,000,000

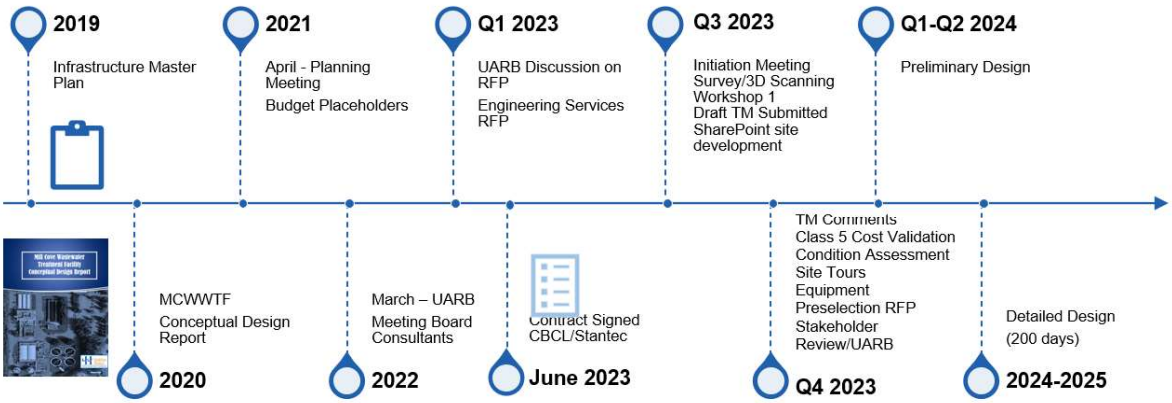

Figure 2: MCWWTF Project Timeline

BUDGET IMPLICATIONS

Funding in the amount of $1,000,000 was available within the 2023/24 Capital Budget under *Wastewater - Treatment Facilities – 2.817 - Mill Cove WWTF – Process Upgrades – Preliminary Engineering.*

Funding in the amount of $9,000,000 is available within the 2023/24 Capital Budget under *Wastewater - Treatment Facilities – 2.1055 Mill Cove WWTF Plant Upgrade – Design and Contract Admin.*

The proposed expenditure meets the "NO REGRETS - UNAVOIDABLE NEEDS" approach of the 2012 Integrated Resource Plan. The proposed work meets the NR-UN criteria of "Firm regulatory requirement", "Required to ensure infrastructure system safety and integrity" and "Directly supports the implementation of the Asset Management program".

RISKS

The project team is working with the ERM Program Manager to develop a risk register and risk management plan for this project. Current projects risk identified include the overall capital project costs, project procurement strategies, challenging project site constraints, operational risks during construction, limited contractors, competing projects within the capital budget and community stakeholder support.

ALTERNATIVES

Deferring the project to future years.

The existing infrastructure is exceeding current ADF design capacity, does not meet proposed environmental risks identified in the ERA, is required to meet the needs of growth identified in the IMP and several assets are exceeding their useful life expectancy. Deferral is not recommended.

Report Prepared by: Digitally signed by Chris Fahie Date: 2024.01.17 11:35:27 -04'00'

Chris Fahie, P.Eng., MASc
Manager of Process Engineering, Strategic Projects

Financial Reviewed by: Digitally signed by Louis de Montbrun Date: 2024.01.17 15:20:53 -04'00'

Louis de Montbrun, CPA, CA
Director, Corporate Services/CFO

Halifax Water

ITEM #7.2

Halifax Water Board
January 25, 2024

TO: Colleen Rollings, P.Eng., PMP., Chair and Members of the Halifax Regional Water Commission Board

SUBMITTED BY: Digitally signed by Reid Campbell Date: 2024.01.17 17:00:31 -04'00'

Reid Campbell, M.Eng., P.Eng.
Director, Engineering & Technology Services

APPROVED: Tareq Al-Zabet Digitally signed by Tareq Al-Zabet Date: 2024.01.18 14:40:40 -04'00'

Tareq Al-Zabet, Ph.D., CEO & General Manager

DATE: January 17, 2024

SUBJECT: **Harbour Solutions WWTFs – UV Disinfection System Upgrades & Replacements**

ORIGIN

Halifax Water 2021/22, 2023/24 and 2024/25 Capital Budgets.

RECOMMENDATIONS

It is recommended that the Halifax Regional Water Commission Board approve funding in the amount of $7,275,000 for the Harbour Solutions WWTFs – UV Disinfection System Upgrades & Replacements project.

BACKGROUND

The effectiveness of UV disinfection is dependent on the characteristics of the wastewater effluent [measured as % UV Transmittance (%UVT) and total suspended solids (TSS)], the intensity of the UV radiation being emitted, the amount of time the microorganisms are exposed to the radiation (measured as flow rate) and the UV reactor configuration. When the factors of UV radiation and flow rate through the UV reactor are combined, the calculated product is known as UV dosage.

The Dartmouth and Halifax WWTFs face challenges with achieving consistent disinfection compliance results can be attributed to two conditions: 1) dry summers with low flows; and 2) high flows during wet weather events. Low flows lead to high colour and dissolved solids in the effluent which results in low UV transmittance, thus reducing the disinfection efficiency. The low flows also result in poor heat transfer from the UV lamps and sleeves; which causes excessive

scaling on the UV sleeves; reducing the UV radiation being emitted to the effluent. At the other extreme, the high flows experienced in wet weather events results in floc carryover from the clarification system that on occasion reduces the %UV transmittance below the minimum 40% design condition. Figure 1 below depicts the disinfection compliance data for both the Dartmouth & Halifax WWTFs since 2016.

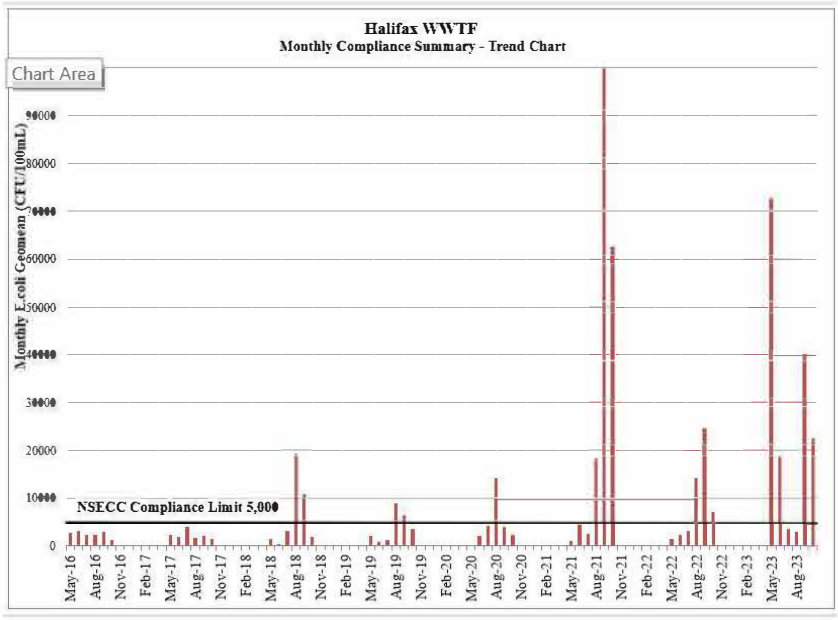

Figure 1A – Halifax WWTF Monthly Disinfection Compliance Summary

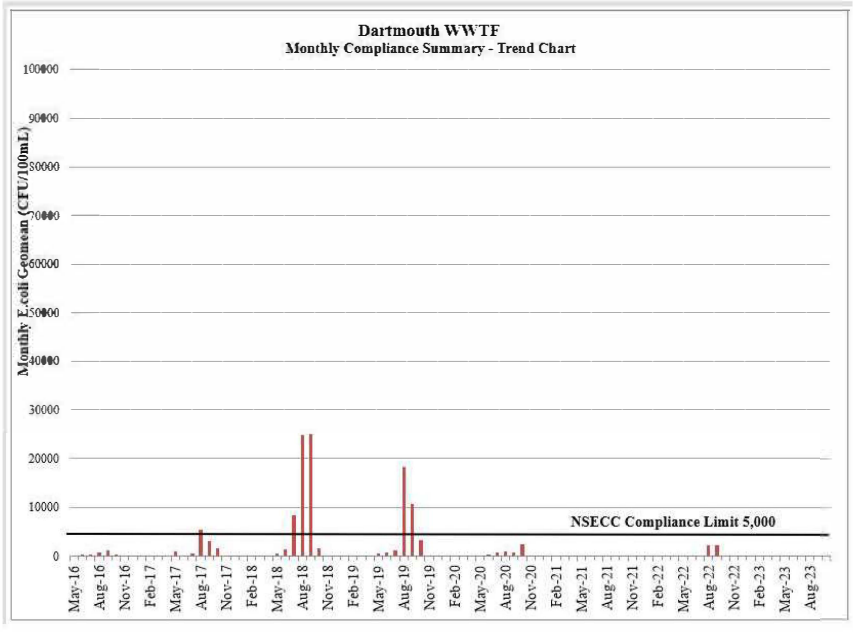

Figure 1B – Dartmouth WWTF Monthly Disinfection Compliance Summary

To understand the limitations of the existing UV systems, Halifax Water engaged Dalhousie University, in 2016, to undertake collimated beam testing of the wastewater effluent at the Dartmouth WWTF. Collimated beam testing was initiated to determine how the design UV dosage compared with the actual UV dosage required to meet the effluent disinfection target of ≤5,000 *E. coli*/100 mL sample (based on a 30-day geometric mean and samples taken three (3) times per week). The results of this testing showed that the treated wastewater effluent requires a higher dosage than the existing UV system can deliver.

Laboratory data collected at the Dartmouth WWTF since 2016 also shows that the minimum UVT during the seasonal disinfection period is frequently below the 40% design which dramatically increases the likelihood of non-compliance. Based on these historical records, a 30% minimum UVT is being used in future dosage calculations. The effluent wastewater quality is similar at the Halifax WWTF and experiences the same trends.

The manufacturer of the existing UV systems, Trojan Technologies, prepared various disinfection ability scenarios based on Dalhousie University's collimated beam testing; see Table 1 below from the Compliance Plan (2019). The scenarios confirm that the existing UV systems are undersized and unable meet disinfection under all scenarios which aligns with Halifax Water's compliance data.

Table 1: Harbour Solutions WWTF UV Disinfection System Performance Scenarios at Peak Wet Weather Flow

	EXISTING DISINFECTION ABILITY			FUTURE DISINFECTION ABILITY WITH FULL EXPANSION OF EXISTING SYSTEMS						EFFLUENT DISCHARGE OBJECTIVES – *E-COLI* CFU/100mL (Info from ERA Reports completed by Dillon Consulting)
WWTF FACILITY	UV DOSE (MS2) mJ/cm2	@ UVT %	EST. *E-COLI* CFU / 100mL	UV DOSE (MS2) mJ/cm2	@ UVT %	EST. *E-COLI* CFU / 100mL	UV DOSE (MS2) mJ/cm2	@ UVT %	EST. *E-COLI* CFU / 100mL	
Halifax	13.2	30	20,000	16.3	30	5,200	23.1	40	2,700	3,800
Dartmouth	13.4	30	20,000	17.5	30	5,200	24.9	40	2,700	2,200
Herring Cove	No Data collected as facility performance meets targets with lower flows than design.									3,600

To improve compliance, the 2019 Compliance Plan identified several UV system upgrade requirements for each of the Harbour Solutions WWTFs. The upgrades also included asset renewal projects to replace obsolete equipment. These projects were included in the Capital Budget for the years 2021/22, 2022/23 and 2023/24 and are as below:

- Purchase and install new System Control Centres (UV Control Panels) for Dartmouth
- Purchase and install additional UV modules & accessories to complete expansion capabilities of existing UV systems at Dartmouth & Halifax WWTFs

- Purchase and install new Automatic Level Controllers in the form of motorized weir gates for improved UV disinfection channel water level control performance at the Halifax, Dartmouth & Herring Cove WWTFs

DISCUSSION

In March of 2023, Halifax Water Staff obtained equipment costing information for the projects discussed above from Trojan Technologies. Alternatively, Halifax Water Staff also requested the cost for a completely new fully expanded UV system replacement at Dartmouth (which would mean that the current equipment at Dartmouth plant can be re-purposed at Halifax WWTF). This alternative approach is more cost effective than replacing individual components at each facility as originally intended in the 2019 Compliance Plan. See Table 2 below for the equipment cost comparison.

Table 2: Comparison of UV Disinfection Equipment Purchasing Options

Capital Work Description	Facility (2023 Equipment Pricing Only)					Sub-Totals
	Dartmouth WWTF	# of Modules	Halifax WWTF	# of Modules	Herring Cove WWTF	
System Control Centre Replacement	$ 135,230					
Motorized Weir Gates w/ Actuators	$ 282,530		$ 353,700		$ 297,570	
PDC Expansion for Full Set of Modules	$ 82,020		$ 82,300			
Module Expansion – Full Complement	$ 1,802,640	64 Additional	$ 2,027,970	72 Additional		
Total Work Planned	**$ 2,302,420**		**$ 2,463,970**		**$ 297,570**	**$5,063,960**
Alternative Equipment Purchase Plan						
New UV System Full	$ 2,824,450	184 New Total	120 existing modules at Dartmouth will be available for use at Halifax WWTF & Herring Cove WWTF			
System Control Centre Replacement						
Motorized Weir Gates w/ Actuators			$ 353,700		$ 297,570	
Total Work Planned Alternative	**$ 2,824,450**		**$ 353,700**		**$ 297,570**	**$3,475,720**
Potential Savings						**$1,588, 240**

The recommended project execution strategy involves the removal of the existing 120 UV Modules, Power Distribution Centre (PDC) parts and accessories from the Dartmouth WWTF. The removed equipment will then be installed at the Halifax WWTF to fully expand their UV disinfection system to a total of 256 modules. Any remaining components at the Dartmouth WWTF that can be utilized for spares or parts will be salvaged for use at either the Halifax WWTF or the Herring Cove WWTF. A new UV disinfection system from Trojan Technologies will be purchased and installed at the Dartmouth WWTF including new automatic water level controllers (i.e., motorized weir gates). New water level controllers will also be purchased for the Halifax and Herring Cove WWTFs per the 2021/22 annual capital plan. This plan is shown in Table 3.

Table 3: Proposed Capital Project Plan for UV Disinfection Upgrades and Replacements at Harbour Solutions WWTFs

Fiscal Year	Description
SCOPE OF WORK	
2023/24 & 2024/25	Purchase and install a new UV System for the Dartmouth WWTF with a full complement of modules to fill each channel.
	Utilize the modules and PDC accessories removed from Dartmouth to expand the UV systems at Halifax WWTF and, if desired, at Herring Cove WWTF.
	Purchase new motorized weir gates and actuators to improve the level control at the Halifax and Herring Cove WWTFs
SCHEDULE	
Q3 2023/24	Procurement – Consultants and Equipment Pre-Selection & Purchase
Q1 2024/25	Design and Stakeholder Engagement
Q2 2024/25	UARB Approval, Construction Tender & Dartmouth WWTF UV System Purchase
Q3 & Q4 2024/25	Project Execution
Q1 2025/26	Project Completion

BUDGET IMPLICATIONS

The UV system purchase, design, and installation cost of a new UV system for the Dartmouth WWTF and the repurposing of the existing system at Dartmouth WWTF to expand the UV system at the Halifax WWTF, complete with replacement of the water level control mechanisms at each Harbour Solutions WWTF is estimated at a total project cost of $7,275,000 as detailed below in Table 4.

Table 4: Opinion of Probable Cost UV System Upgrades

Halifax WWTF	
Cost Description	**Cost Opinion**
Material and Equipment	$354,000
Contractor Installation Cost Allowance	$531,000
Subtotal	**$885,000**
Dartmouth WWTF	
Material and Equipment	$2,850,000
Contractor Installation Cost Allowance	$2,137,500
Subtotal	**$4,987,500**

Herring Cove WWTF	
Material and Equipment	$298,000
Contractor Installation Cost Allowance	$149,000
Subtotal	**$447,000**
All WWTFs	
Contingency (10%)	$631,950
Engineering & Halifax Water Staff Time	$315,975
Overheads	$63,195
net HST	$270,854
Subtotal	**$947,925**
Total	**$7,267,425**
Rounded Total	**$7,275,000**

Following are the source of funding for this project that are identified in the capital budget:

1. Funding in the amount of $775,000 and $5,000,000 are identified in Capital Project Line Item "*2.788 – Dartmouth WWTF UV Disinfection System – New Modules & PLC Upgrade"* for 2023/24 and 2024/25 budget years respectively.

2. Funding in the amount of $1,000,000 is identified in the Capital Project Line Item: "2.775 - *Halifax WWTF – UV Disinfection System – New Modules and PLC Upgrade" for the 2023/24 budget year.*

3. Funding in the amount of $275,00 is available from the underspent on the Capital Project Line Item: "2.774 - *Halifax WWTF – UV Disinfection System – New Automatic Level Controls" for the 2021/22 budget year.*

4. Funding in the amount of $225,00 is available from the underspent on the Capital Project Line Item: "2.802 – *Herring Cove WWTF – UV Disinfection System – New Automatic Level Controls" for the 2021/22 budget year.*

The proposed expenditure meets the "NO REGRETS - UNAVOIDABLE NEEDS" approach of the 2012 Integrated Resource Plan. The proposed work meets the NR-UN criteria of "Firm regulatory requirement", "Required to ensure infrastructure system safety and integrity" and "Directly supports the implementation of the Asset Management program". The project meets this criterion based on the following:

- The upgrades are required to meet WWTF compliance requirements.
- The renewal at Dartmouth WWTF and the rehabilitation of the UV system at Halifax WWTF are necessary as the existing systems are in a condition that impacts facility performance.
- The projects are a part of the on-going asset management program.

PROJECT SCHEDULE

Please see Table 3 above for project schedule.

RISKS

SCOPE:

- The project has been developed carefully with detailed scope. However, since there is movement of equipment from one plant to the other, there is a risk of scope creep. Detailed project management, design and procurement efforts will mitigate this risk.

COST:

- The construction market has seen significant cost increases in recent times. Appropriate procurement efforts and locking in a contractor as early as possible with a fixed fee will help control this risk.

SCHEDULE:

- Targeting installation, testing, and commissioning work during the non-disinfection period at each facility between November 1st, 2024 and April 30th, 2025.
- Equipment manufacturing period after shop drawing approval is 26-28 weeks for the UV equipment and 40 weeks for the motorized weir gates and actuators.
- Delays in the approval process, manufacturing time, installation and startup may extend the work for all or part of it, which may impact the facilities' ability to meet disinfection targets when the disinfection season starts in May 2025.

ALTERNATIVES

The Halifax Water Board could direct staff to not proceed with the new system purchase for the Dartmouth WWTF and continue with the component purchase plan identified in the 2019 Compliance Plan. If this direction is desired, additional funding of an estimated $1,600,000 to this request will be required.

Deciding to not proceed with any UV system upgrades is inadvisable as treated effluent disinfection NSECC non-compliance will continue from both the Halifax and Dartmouth WWTFs until the facilities are upgraded to secondary treatment by 2040.

Report Prepared by: Robert Gillis Digitally signed by Robert Gillis Date: 2024.01.17 14:50:46 -04'00'

Robert Gillis, P.Eng., PMP, CAMP
Manager, Structures and Special Projects

Financial Reviewed by: Digitally signed by Louis de Montbrun Date: 2024.01.17 15:06:13 -04'00'

Louis de Montbrun, CPA, CA
Director, Corporate Services/CFO

ITEM #8
Halifax Water Board
January 25, 2024

TO: Colleen Rollings, P.Eng., PMP., Chair; and
Members of the Halifax Regional Water Commission Board

SUBMITTED BY: Digitally signed by Kenda Signature Date: 2024.01.19 14:31:06 -04'00'

Kenda MacKenzie, P.Eng., Director, Regulatory Compliance Services

APPROVED:

Tareq Al-Zabet, Ph.D., General Manager and CEO

DATE: January 25, 2024

SUBJECT: **Port Wallace Capital Cost Contribution Charges**

ORIGIN

June 21, 2018	Halifax Water Board Report, Port Wallace Capital Cost Contribution
March 27, 2018	Halifax Regional Municipality Council Report, Port Wallace Master Infrastructure Study, Urban Service Area Expansion, and Plan Amendment Request (Case 21601)

RECOMMENDATION

It is recommended that the Halifax Water Board approve:

1. The proposed Capital Cost Contribution initial base rate for Port Wallace at an estimated value of $3,164 / acre for water and $12,367 / acre for wastewater with density adjustments as detailed within Table 1 of the report.

2. Preparation and submission of application for necessary Nova Scotia Utility and Review Board approvals and amendments.

BACKGROUND

The Halifax Regional Municipality (HRM) 2014 Regional Plan identifies Port Wallace, located on the northeastern edge of Dartmouth, as a potential future growth area due to the proximity to the existing Urban Service Area boundary. It is one of three potential new communities located inside the Urban Settlement Designation that, within the life of the Regional Plan (2031), could be serviced with municipal water and wastewater services, subject to a secondary planning process and Regional Council approval. Port Wallace was also one of several greenfield development areas identified in the 2006 version of the Regional Plan for development prior to 2026 based primarily on the potential low cost of providing municipal services.

To consider allowing new growth in the area, the Regional Plan requires that the Urban Service Area boundary be expanded. Prior to any expansion Regional Council must consider various criteria including, completion of a watershed study, adoption of a secondary planning strategy and establishment of potential charges by the appropriate approval bodies including Regional Council, the Halifax Water Board and the Nova Scotia Utility and Review Board (NSUARB).

In 2014, Regional Council established an Interim Port Wallace Secondary Plan study area and directed that a secondary planning strategy be undertaken to design the community and determine servicing needs. The Port Wallace Secondary Plan study area was finalized in 2016. Consideration of site design, densities, open space and other community amenities will be presented in secondary plan policies and land use by-laws for consideration by Regional Council.

The land holdings within the Port Wallace are principally owned by three developers, they are: Conrad Brothers Limited, Port Wallace Holdings Limited (Clayton Development Limited and Cresco partnership), and W. Eric Whebby Limited. Their land holdings are summarized in Table 1.

Table 1 – Port Wallace Developer Land Holdings

Developer	Residential (acres)	Commercial (acres)	Industrial (acres)
Conrad Brothers Limited	55		242
Port Wallace Holdings Limited	453	10	
W. Eric Whebby Limited	25		
Total Acreage	533	10	242

On January 26, 2023, the provincial government approved amendments to the Regional Municipal Planning Strategy, the Municipal Planning Strategy for Dartmouth and Cole Harbour/Westphal, and the Land Use Bylaw for Dartmouth and Cole Harbour/Westphal. Subsequently, on January 31, 2023, the Minister approved the development agreement between the Halifax Regional Municipality and applicable landowners to enable residential development to proceed within the Port Wallace Special Planning Area. The development agreement is applicable to all Port Wallace lands with exception to the Industrial zoned lands. The supporting Port Wallace master concept plan can be found in **Appendix A**.

In developing secondary plan land use policies and by-laws, both Halifax Water and HRM considered their financial ability to absorb and manage related costs. Halifax Water and HRM studied the capacity of the existing infrastructure to determine if and how it can accommodate the proposed development. This included analyzing different infrastructure scenarios based on different conceptual designs for the site. The Port Wallace Capital Cost Contribution Analysis Baseline Study (CBCL, 2018), can be found in **Attachment B**, was conducted to aid Halifax Water and HRM consider different scenarios for upgrading infrastructure, and to establish baseline costs.

Halifax Water and HRM have policies that allow for consideration of cost sharing with a developer in building new oversized infrastructure that is being established for a growth area. Cost sharing recognizes new oversized infrastructure being developed benefits existing residents and businesses located outside of the growth area. Financial models have been prepared to establish how the infrastructure investments are funded among the parties.

DISCUSSION

Port Wallace Capital Cost Contribution Analysis Baseline Study

Following the public input to the community design concepts, the Port Wallace Capital Cost Contribution Analysis Baseline Study was commissioned to evaluate the cost of providing municipal services to the Port Wallace Secondary Plan study area. The study included a review of available background information (Watershed and Land Suitability Analysis studies, the predesign baseline reports), design concepts and various stakeholder development plans, reports, and preliminary water and wastewater servicing system designs.

The Port Wallace Capital Cost Contribution Analysis Baseline Study is a design brief which addresses issues at a broad conceptual level, illustrating land use and infrastructure components with cost estimates, and identifies opportunities and constraints relating to capacity allocations, development sequence, and conflicts between systems. The estimated costs presented in this report have been shared with developers and will be subject to further discussion through the capital cost contribution process.

Using the submitted design concepts, the consultant (CBCL) conducted a detailed analysis of the water, wastewater, storm, and transportation systems. The key findings of the report from a water, wastewater and stormwater perspective are as follows:

Water Master Plan

1. The existing water transmission system has sufficient capacity to service the Port Wallace area.

2. There are servicing restrictions within the higher elevations of the Port Wallace development area, specifically the Conrad Lands north of the Forest Hills Extension.

The maximum gravity fed water service on the Conrad lands is 70 metres elevation. Lands above this elevation would require either the developer to install a water booster station, to be transferred to Halifax Water upon construction, to bring the water distribution system to minimum service levels or require each water service connection to install a booster pump within their private plumbing arrangement. The ultimate servicing details will be developed in the future design stages.

The water master plan was refined in 2023 due to an increased residential density being proposed in the Avenue du Portage area. Through that exercise, fire flow testing was done which provided new insight into the operating water conditions that were not considered in the CBCL report. It was determined a 400mm water main throughout the Port Wallace development would provide adequate domestic service and fire flow. **Attachment C** contains the DesignPoint Port Wallace Water Service Report. **Attachment D** is a visual representation of the Port Wallace Water Master Plan.

The oversizing of the water main throughout the Port Wallace development is of benefit to all of the developers, benefits existing Halifax Water customers and HRM for fire protection. For these reasons the oversizing of the water main from 300 mm to 400 mm supports the creation of a water capital cost contribution charge.

Attachment E summarizes the oversized infrastructure contained within the water capital cost contribution charge.

Wastewater Master Plan

1. Capacity within the Waverley Road wastewater system does not currently exist to accommodate the Port Wallace development. Upgrades are required prior to any development occurring.

The North Dartmouth Trunk Sewer (downstream of these lands) has been sized to accommodate the wastewater generated from the Port Wallace development. This requires a new wastewater pumping station on Waverley Road, and wastewater force mains crossing Shubenacadie Canal and connected to the North Dartmouth Trunk Sewer on Wright Avenue.

2. A new wastewater force main connection is required through Shubie Park and under the Shubenacadie Canal.

This is an environmentally and culturally sensitive area with significant construction constraints. The connection requires a crossing of Highway 118. These lands are owned by Nova Scotia Department of Natural Resources and Renewables (NSNRR) and Nova Scotia Department of Transportation (NST). As such, this connection is subject to NSNRR and NST approval, this process is underway and nearing completion. The Shubenacadie Canal Commission is also a significant stakeholder and has been consulted through the process.

The proposed force main connection provides the opportunity for other utilities to cross at the same location and share the costs. One such opportunity is the twinning of regional water transmission main from Breeze Drive to Dartmouth Crossing. The Port Wallace Water Transmission Main project was approved by the Halifax Water Board and the Nova Scotia Utility and Review Board in 2023.

Attachment F summarizes the oversized infrastructure contained within the wastewater capital cost contribution charge.

Stormwater Master Plan

1. No stormwater elements have been identified which would be considered to warrant capital cost contribution or shared developer cost.

CCC Charge Determination

Halifax Water's CCC policy section 17, as noted below, provides the criteria for developing the cost of oversized infrastructure within a charge area.

Section 17: Oversized Infrastructure Criteria

a) Oversizing Criteria

The cost of providing oversized water, Wastewater and Stormwater Infrastructure will be funded through the WWS CCCs levied in a charge area.

The cost of providing oversized water, Wastewater and Stormwater Infrastructure may also include discrete upgrades of, or new connections to, existing systems outside of the charge area.

There are several methods of calculating the oversize cost, which generally fall into one of the following categories:

i. Incremental basis:

Where the oversize cost would be calculated by determining the incremental or marginal cost of up-sizing to the required oversized water, Wastewater and Stormwater Infrastructure defined in the Master Plan. This method is most fairly applied if there is a base value or benefit associated with providing the minimum service requirements without considering oversizing. For the purpose of oversizing, minimum service requirements would be those necessary to provide service to an area being developed and may be based on minimum pipe sizes and local road standards.

ii. Flow Proportioning:

The incremental costs of the oversized component(s) in a Master Plan Area may be distributed amongst the landowners on a flow proportionate basis as determined by their allowable densities noted in the Municipal Planning Strategies or land use in the Land Use Bylaws.

iii. Capacity basis:

Where the oversize cost is determined on the basis of capacity allocated to the charge area. The cost to be recovered through a WWS CCC would be calculated by pro-rating total cost on the basis of capacity. This method is most fairly applied for a discrete upgrade of an existing system outside of the charge area.

b) Water, Wastewater and Stormwater Systems within a Charge Area

The oversized costs to provide Water, Wastewater and Stormwater Systems within a charge area will be determined on an incremental basis. There are various methods for calculating incremental costs of piped systems:

i. Dual Design Method:

Where the oversize cost is determined by deducting the total cost of the minimum required pipe size from the total cost of the oversized pipe.

ii. Cost Ratio Method:

This method assumes a direct relationship between the cost of providing a service and the size of the pipe. A cost factor can be determined and applied similar to the Cost Sharing Policy of the former City of Halifax, or a simple percentage based on nominal dimensions may be applied.

c) Infrastructure Exterior to a Charge Area

The portion of the cost of an upgrade, expansion, or provision of a discrete component of water, Wastewater and Stormwater infrastructure to be recovered through a WWS CCC will be determined on the basis of capacity allocated to the charge area.

In accordance with Halifax Water's CCC Policy 17, the incremental amount of oversizing to benefit the charge area was determined for each component. The oversized water infrastructure that benefits existing customers is based on area, specifically the Burnside High Pressure Zone, as indicated in Table 2.

Table 2 – Benefit to Existing Customer - Water Infrastructure

	Acres
Andrea Lynn Drive	4.692
Applewood Lane	3.458
Burnhope Drive	18.154
Cayton Court	1.871
Charles Keating Drive	6.863
Craigburn Drive	23.801
Garden Court	1.653
Gleave Walk	1.098
Hazelnut Court	2.661
Lake Charles Drive	9.186
Lakewater Court	1.147
Lakewood Court	2.115
Lochburn Lane	3.707
Lynnwood Drive	4.202
Marjorie Ann Drive	2.427
Meadow Walk	1.612
Montague Road	16.862
Mount Portobello Road	3.562
Rocklin Road	1.950
Spider Lake Road	21.746
Sunset Drive	2.590
Twilight Lane	7.353
Waverley Road	186.552
Wilcot Lane	5.176
Total Benefitting Existing Customers	**334.438**
Total Port Wallace Developer Area	785.274
Total Benefitting Existing Customers	334.438
Total Serviced Acreage	**1,119.712**
Benefit to Existing Water	**29.9%**

Determination of the benefit to existing infrastructure that benefits existing customers is flow proportioned allocated. The DesignPoint memo supplied in 2017 and based on wastewater investigations conducted in previous years is supplied in **Appendix G**. That memo indicated a peak existing wastewater flow of 54.7 litres/sec recorded in December 2014. A pre-design brief supplied in 2023 in support of the new wastewater pumping, found in **Appendix H**, summarized the station design flows in in Table 3.

Table 3 – New 390 Waverley Road Wastewater Pumping Station – Design Flows

ADWF (Domestic)	150	L/P/D
ADWF (Industrial)	35	m3/D/Ha
PF (Domestic)	2.5	
PF (Industrial)	2	
I&I	15	m3/D/Ha
Peak Wet Weather Flow (PWWF) – Port Wallace Domestic	65	L/s
PWWF – Port Wallace Industrial	81	L/S
PWWF – Existing Serviced Area	41	L/S
TOTAL DESIGN PWWF	**187**	**L/S**

Table 4 – Benefit to Existing Customer - Wastewater Infrastructure

	Flow (L/s)
Existing Peak Flow December 10, 2014	54.7
Total Design PWWF (includes existing)	187.0
Benefit to Existing Wastewater	**29.3%**

Then the estimated oversizing costs were apportioned based on allowable densities to the benefitting sub areas to determine the required charges across the charge areas. A financial model was prepared utilizing the developers' phasing plans and oversizing infrastructure components proposed to be installed. This resulted in estimated CCC (2024 base year) charges as follows:

Water Infrastructure CCC Charge: $ 3,164.48/acre (estimated)

Wastewater Infrastructure CCC Charge: $ 12,366.89/acre (estimated)

The estimated water and wastewater CCC charge summaries can be found in **Appendix I** and **J** for water and wastewater, respectively.

Within Port Wallace, the allowable density varies by subarea and thus the CCC charge will be adjusted according to allowable density. This results in fairness amongst the stakeholders in each respective subarea and is in keeping with each density allocation in each subarea. The density factors and corresponding CCC charges are shown in Table 5 below.

Table 5 – Sub-Area Specific CCC Charges (2024 Base Year) based on Density

Subarea	Density Factor	Water Charge/acre	Wastewater/acre
1	0.6397	$2,024.32	$ 7,911.10
2	1.3895	$4,397.05	$17,183.79
3	0.5442	$1,722.11	$ 6,730.06
4	0.9846	$3,115.75	$12,176.44
5	1.0269	$3,249.61	$12,699.56
6	0.4096	$1,296.17	$ 5,065.48
7	0.7462	$2,361.34	$ 9,228.17
8	0.3876	$1,226.55	$ 4,793.41
9	0.9396	$2,973.35	$11,619.93
10	0.8888	$2,812.59	$10,991.69
11	1.1294	$3,573.97	$13,967.16
12	0.6565	$2,077.48	$ 8,118.86
13 Industrial Park	1.3951	$4,414.77	$17,253.04

Stakeholder Consultation

The developers of Port Wallace, Conrad Brothers, Port Wallace Holdings Limited and Whebby and development had regular meetings with HRM and the utilities beginning in 2018. In January of that year Halifax Water participated in a stakeholder and public information meeting led by HRM as part of their transportation CCC process. Discussions of the base information and how the CCC charges were determined occurred.

Since 2018, the developers, utilities and HRM have been working on the Port Wallace Utility Corridor. The project required provincial approval for the highway crossing and Shubie canal crossing which took considerable time and effort. Beginning in the fall on 2023 as the design and approvals had fleshed out, cost sharing discussions with the developers, HRM, Eastward Energy and Halifax Water began.

BUDGET IMPLICATIONS

Halifax Water intends to tender the Port Wallace Utility Corridor which includes water transmission, wastewater pumping station and force mains, gas mains, multi-use pathways and road reinstatement. Halifax Water, HRM, Eastward Energy and the developers began cost sharing negotiations in Fall of 2023 which were concluded in January 2024.

Halifax Water intends to use tender results to calculate the water and wastewater CCC charges. HRM is required to obtain Regional Council approval for HRM's share of the Port Wallace Utility Corridor related to multi-use pathways and transportation enhancements. Eastward Energy will also be required to obtain approval. Once all parties have obtained budget approval, Halifax Water

will then make application to the NSUARB to create the charges. Should the tender results be greater than 10% from the estimated costs, Halifax Water will return to the Halifax Water Board to seek approval prior to NSUARB application.

Water

The oversized water infrastructure cost estimate can be viewed in **Attachment E**. The financial risk associated with water CCC is low. The water oversized infrastructure contained within the water CCC is installed evenly as the development progresses. Meaning, the timing of expenditures of the CCC are fairly equal to the timing of collections. The water CCC carries a positive balance for much of the projected development timeline and is never in debt more than $700,000 at any given time up to 2042.

The portion of oversized water infrastructure to the benefit of existing Halifax Water customers is 29.9% and the portion to the benefit of fire protection, paid by HRM, is 29.0%. The remaining expenditures will be recovered through as development proceeds through collection of the CCC acreage charge.

Wastewater

The oversized wastewater infrastructure cost estimate can be viewed in **Attachment F**. The benefit to the existing Halifax Water wastewater customer was calculated to be 29.3%. The financial risk associated with wastewater CCC is moderate given that all wastewater CCC expenditures occur in the first two years of the financial model.

Risk Mitigation

Halifax Water has factored in a set payment schedule ($5.6 million of guaranteed payments between 2024 and 2029) to the calculation of the wastewater CCC charge to be paid by Port Wallace Holdings Limited and Conrad Brothers. The payment amounts reflect the size of the land holdings, the density of those lands, proposed development phasing and Halifax Water's ability to pay back the debt on a scheduled timeline.

The proposed expenditure meets the "No Regrets – Unavoidable Needs" approach of the 2012 Integrated Resource Plan. The proposed work meets the NR-UN criteria, required to ensure infrastructure system integrity and growth-related infrastructure supported by pre-design level master plan.

ALTERNATIVES

The Halifax Water Board may choose not to create a Port Wallace capital cost contribution. This would require the developer to finance the infrastructure on their own.

The Halifax Water Board may determine the risk too high and consider an upfront payment, by the developer, for the oversized water and wastewater infrastructure is warranted as per section 18 (d) of the Attachment 3 of the Halifax Water Regulations.

ATTACHMENT

Attachment A	Port Wallace Concept DA Lands
Attachment B	Port Wallace Capital Cost Contribution Analysis Baseline Study
Attachment C	Port Wallace Water Servicing Report
Attachment D	Port Wallace Water Master Plan
Attachment E	Port Wallace Oversized Water Infrastructure Phase Costs
Attachment F	Port Wallace Oversized Wastewater Infrastructure Phase Costs
Attachment G	390 Waverley Road Wastewater Pumping Station Memo 2017
Attachment H	390 Waverley Road Wastewater Pumping Station Pre-Design Brief
Attachment I	Port Wallace Water CCC Charge Summary
Attachment H	Port Wallace Wastewater CCC Charge Summary

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THE PARKS
OF LAKE CHARLES

PORT WALLACE

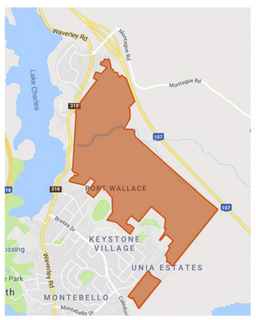
PORT WALLACE, NOVA SCOTIA
JANUARY 2023

MASTER CONCEPT PLAN

LEGEND

- Low Rise (Up to 11m)
- Mid Rise (Up to 20m)
- Tall Mid Rise (Up to 32m)
- High Rise (Up to 50m)
- Mixed Use/ Commercial (Up to 20m)
- Institutional (Up to 20m)
- Parkland
- PWHL Boundary
- Conrad Boundary
- KDL Boundary
- Whebby Boundary
- Trail/ Walkway
- Existing/ Planted Vegetation
- Wetland
- Signalized Intersection

KEY PLAN



NOTE: This conceptual plan is used for Illustrative purposes and is intended to convey the concept and vision for the development/ buildings. Site details are subject to change.

PORT WALLACE CAPITAL COST CONTRIBUTION ANALYSIS BASELINE STUDY

Final Report

CBCL LIMITED
Consulting Engineers

ISO 9001
Registered Company

UPLAND

Prepared for

HALIFAX

171013.00 • Final Report • January 2018

Contents

Appendices

Executive Summary

The Port Wallace Study area is comprised of approximately 285 hectares and is located to the north and south of Highway 107 at the Montague Road intersection. The site is largely undeveloped, and plans are in place to construct over 3,700 residential units as well as some commercial, industrial and institutional development. The area was previously identified under the Regional Municipal Planning Strategy (RMPS, 2006) to be serviced with water, wastewater, and stormwater systems. There are a number of land owners involved in the development of this site who have presented proposed development layout and phasing plans for their lands. The developers are Port Wallace Holdings Limited, Conrad, Unia, and Whebby.

This capital cost contribution analysis establishes long-term infrastructure requirements necessary to service the development of Port Wallace. The infrastructure considered in this study includes transportation, wastewater, stormwater, potable and fire suppression water systems, and suggests how the community can fulfill a role within the regional context. The primary purpose of this study is to develop a basis for Halifax Regional Municipality (HRM) Regional Council and Halifax Water (HW) to assess and validate costs and risks associated with infrastructure requirements necessary to service the Port Wallace site growth area.

To facilitate the development of Port Wallace, this study identified the following required infrastructure upgrades:

Transportation:
Upgrades to existing intersections are required on Montague Road, Waverley Road, Caledonia Road and Main Street/Forest Hills Extension. These upgrades can be constructed successively at a rate which parallels buildout of the Port Wallace area.

Estimated cost borne by HRM: $16,000,000
Estimated cost borne by the developers: $5,100,000

Wastewater:
The existing municipal wastewater system does not have any additional capacity and cannot support any additional development. The existing pump station at 390 Waverley Road should be upgraded/replaced, and a new forcemain constructed to tie into the North Dartmouth Trunk Sewer which runs parallel to Highway 118. The sanitary system needs to be upgraded prior to any development in Port Wallace.

Estimated cost born by HRM/HW: $4,000,000.
Estimated cost born by the developers: $9,400,000.

Stormwater:
No stormwater elements have been identified which are considered to warrant capital cost contribution or shared developer cost.

Potable Water and Fire Suppression:
To service Port Wallace, some internal upsizing is required and has been identified in the water section of the report. The pipe upsizing should be constructed in conjunction with road construction.

Estimated cost born by the developers: $2,000,000.

Transportation

CBCL Limited completed an assessment of the existing and future road network as it relates to the Port Wallace development. The existing road network and intersections were examined under current operating conditions (2017), 50% buildout (2031) and full buildout (2047). A background growth rate of 1% was applied between 2017 and 2031, with a background growth rate of 0.75% being applied from 2031 and beyond. A number of potential road network layouts were established based on various potential road configurations within the study area, connections to the existing road network and future road upgrades outside the study area. AM and PM analysis were completed for these layouts. Both 10% and 20% non–auto mode shares were subsequently assessed for each of the road network layouts.

The 2017 models indicate that the majority of existing modeled intersections currently provide a satisfactory level of service, with the exception of Main Street/Forest Hills Extension signalised intersection which HRM is aware of. The 2031 models identified key intersections which have a poor operational performance. The 2047 model shows a further decrease in the level of service at the key intersections.

This development represents a substantial increase in trip generation for the immediate area. To facilitate the Port Wallace development, it is recommended that the intersections identified with poor levels of service be upgraded, and the potential to reduce trip generation be pursued to the greatest extent possible. Further modeling and preliminary engineering design would be required to determine the extent of intersection upgrades required to achieve an acceptable level of service at the 2031 and 2047 horizons; however, for the purposes of this report possible suitable upgrades have been established based on engineering judgement. A preliminary summary of recommended intersection upgrades based on percentage of overall buildout is given within the body of this report, in section 2.11.

Transit services are seen as the primary method of reducing trip generation and should be implemented in the initial stages of the development. We believe that non-auto modes in particular, transit and active transportation, should be widely supported and encouraged for the Port Wallace development given the level of trips generated during the buildout period.

Wastewater

Wastewater from the study area will be discharged to the existing municipal sewer system on Waverley Road. Flow is directed towards Dartmouth center via a series of gravity sewers and pump stations. This study assessed the wastewater system from Montague Road to the pump station at civic 200 Waverley Road.

There are portions of the gravity system which have limited capacity and will require upgrades due to this development. There is currently no available additional capacity at the 390 Waverley Road pumping station or at the 200 Waverley Road pumping station. Port Wallace Holdings Limited (PWHL) has forwarded a proposal to temporarily increase the capacity of the pump station at 390 Waverley Road which would increase flow to the 200 Waverley Road pump station which has no available capacity.

The pumping station at 390 Waverley Road should be upgraded/replaced and a force main should be rerouted west, across the Shubenacadie Canal to the North Dartmouth Trunk Sewer on the west side of Highway 118. The North Dartmouth Trunk Sewer has capacity for the Port Wallace development.

Planned capital works for capacity upgrades should be reviewed in the event of modifications to the development areas and characteristics.

Stormwater

There are a number of pipes and/or drainage courses which enter the study area from lands upstream. It is the responsibility of each land owner to manage the stormwater on their property. If the mechanism for stormwater conveyance is altered the developer is responsible to insure that pre and post flows are maintained. For example if stormwater currently flows over land or in a ditch and the developer requests to change to a hard pipe sewer system some form of detention facility would likely be required to offset the reduced time of concentration.

The Port Wallace study area is within the Lake Charles watershed. Lake Charles is a headwater lake which flows in two directions with a number of significant water bodies downstream. The proposed Port Wallace development area contains several small watercourses, marshes, swamps and bogs as well as a major watercourse, Barry's Run, which discharges to a fen wetland.

Areas of environmental contamination and cultural significance have been identified within Port Wallace. It is vital that potential contamination is fully investigated and appropriate action taken for the protection of public health and safety. One of the areas of environmental and cultural significance is the aforementioned Barry's Run. It has been proposed to utilize Barry's Run as a stormwater management mechanism. For environmental, ecological and cultural reasons, Barry's Run should not be considered for stormwater management for the Port Wallace development. Other areas of potential concern are discussed in detail in the main body of the report.

Stormwater management is required to maintain peak pre-development runoff rates for the 1 in 2, 5, 10, 25, 50 and 100-year storm events to meet Halifax Water and Nova Scotia Environment requirements. Within HRM, and throughout Atlantic Canada, these requirements have traditionally been achieved by constructing centralised stormwater management facilities such as large detention ponds, which are ultimately owned by the stormwater management utility.

Centralized stormwater management infrastructure based solely on rate control represents a simplified ownership, maintenance and liability model, however they do not mimic the natural environment, can often increase the risk of downstream flooding and degrade water quality. Throughout North America and Europe the goals of stormwater management have been adjusted to account for this. Quantity and quality control are more prevalent in much of today's stormwater management guidelines and are becoming a more central requirement in stormwater management in many municipalities.

Source control is generally considered the most favourable way to achieve this. Traditional stormwater systems collect rainwater where it falls and directs runoff downstream through pipes, roadways, ditches, creeks, etc. Source control is the process of infiltrating rain water where it falls, much like the undeveloped, natural environment. Water which does not infiltrate is then routed downstream through pipes, roadways, ditches, creeks, etc. Source control reduces the total amount of water in the municipal storm system, reduces risk of flooding, improves water quality, promotes ground water recharge and offers many more benefits.

Previous reports completed by others have recommended that source control be implemented within the Port Wallace study area and the landowners have demonstrated their intent to implement source control by proposing Low Impact Development (LID) measures. LIDs include; rain gardens, bio swales, infiltration trenches, permeable pavement, infiltration galleries, absorbent landscape, etc. LIDs are ideally installed on public as well as private property. Due to the current Nova Scotia Environment and Halifax Water mandate for stormwater management, the developers may have some difficulty pursuing the LID approach on private property however, Halifax Regional Municipality Council passed a motion on March 4, 2014 pertaining to stormwater management which noted that the design of Port Wallace should include stormwater management facilities on private property.

It is recommended that this motion be built upon by HRM to facilitate the implementation of source control techniques on both public and private lands. This practice is becoming common across Canada. Not following this approach will likely lead to increased flooding risk, degraded water quality, and thereby not meet the project requirements.

Potable & Fire Suppression Water

This study is intended to establish the minimum water and fire flow service requirements necessary to achieve the Halifax Water design guidelines within the Port Wallace Development. The addition of Port Wallace to the water system will increase water demands and an analysis of the existing infrastructure has been carried out to understand the impacts of the additional demand.

For the purposes of the study, Halifax Water provided a copy of the water model understood to be representative of the system to 2017. WaterCAD V8i (SELECTSeries 6) was used to model current conditions, future background growth and the addition of Port Wallace. Meetings between Halifax Water and CBCL were held to develop an understanding of current system operation. The outcome from the meetings helped to establish the design constraints for evaluating the impact of future growth within the Port Wallace study area and background growth to the existing system.

The system should be capable of achieving the desired fire flow for the given land use while maintaining a minimum of 22 psi throughout the system. A 400 mm waterline along Avenue du Portage Extension and to the Conrad Lands is recommended to provide service to the full study area. Areas within the study area where 300mm watermains are recommended have been identified in the main body of the report.

Crossing the Shubenacadie Park and Highway 118

This development will very likely require a new forcemain to run from an upgraded pump station at 390 Waverley Road to the North Dartmouth Trunk Sewer. This forcemain would cross through Shubie Park, including the Shubenacadie canal, and cross Highway 118. This is an environmentally and culturally sensitive area with significant construction constraints. The lands are owned by the Department of Natural Resources (DNR) and Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR). As such, the sanitary servicing concept recommended in this report is subject to DNR and NSTIR approval. The Shubenacadie canal commission are also a significant stakeholder.

Future regional growth will require a transmission watermain to make a similar crossing. Other utilities have also have expressed an interest in a crossing including gas, power and communications. It would likely be financially and environmentally beneficial to complete these crossings concurrently. This potential for a common utility corridor should be incrementally investigated with all utilities. Cost contribution discussions should be held in parallel with the design development.

This study will identify order of magnitude costing for the crossing as it relates to Port Wallace developments. A number of potential crossing mechanisms have been discussed including tunneling and pipe/pedestrian bridges. Subsequent to this study it is recommended that a crossing design be agreed upon with all interested stakeholders which would subsequently be submitted to the DNR, the canal commission and NSTIR for review.

The critical path for the development of Port Wallace is the sanitary service. Crossing the canal and Highway 118 will take significant coordination, design and approval effort. It is recommended this process begin as soon as possible.

Costs

This report identifies infrastructure upgrades required to service the Port Wallace Study area and future growth within HRM. The benefactors for each upgrade have been recognised and costs should be apportioned between benefactors. It is suggested to allocate costs related to transportation upgrades based on trip generation and that sanitary and water upgrades are allocated based on gross development area. The costs for internal site development and connections to existing infrastructure at a property owner's boundary should be borne by the individual developer. Internal upsizing required to service the full study area should be shared between each developer based on trips generated or contribution area as outlined above. Following this report a more detailed design and cost estimate should be completed to establish capitol cost contribution charges.

Chapter 1 Introduction

1.1 Background

The Port Wallace Secondary Planning Study Area was identified as one of six areas under the Regional Municipal Planning Strategy (RMPS, 2006) to be serviced with water, wastewater, and stormwater systems. Prior to servicing, an evaluation of cost to provide municipal services and transportation links to the study area was required. A Watershed Study was also required.

On March 4, 2014, following the completion of the aforementioned studies – the Cost of Servicing Study, (COS, CBCL Limited., 2009); and the Shubenacadie Lakes Subwatershed Study – Final Report, (SWS, AECOM, 2013), respectively – Regional Council passed a motion to proceed with the Port Wallace Secondary Planning Process.

Subsequently, a Land Suitability Analysis (LSA) was completed by WSP in 2016 (WSP LSA, 2016) to determine areas of environmental and cultural importance based on physical attributes inherent to the study area. This process included an assessment and mapping of natural systems and critical areas, the purpose of which was to identify, map and assess natural environmental features, cultural landscape features, and engineered structures critical to maintain natural ecological functions.

This master infrastructure study represents the next stage in the secondary planning process by conducting a detailed assessment of the regional and local infrastructure required to support the proposed development. The intent of this study is to establish the long term infrastructure requirements necessary to service this proposed growth area. The infrastructure to be considered in this study includes water, wastewater, and stormwater and transportation systems. The primary purpose of this study is to develop a basis for HRM Regional Council and Halifax Water (HW) to assess and validate costs and risks associated with infrastructure requirements necessary to service this proposed growth area. The general location of the study area is shown in Figure 1: General Location of Study Area and Key Intersections.

1.2 Report Structure

This is a broad report covering a range of disciplines and includes an introduction with five main chapters. Each chapter discusses a particular infrastructure system as follows:

1. Introduction;
2. Transportation;
3. Wastewater;
4. Stormwater; and
5. Potable water and fire suppression.

It is anticipated that most readers of this report will be interested in the chapter which discusses their particular area of expertise rather than reviewing the report as a whole. To accommodate a discipline based review each chapter has been written as a standalone section which can be reviewed independently of the other chapters.

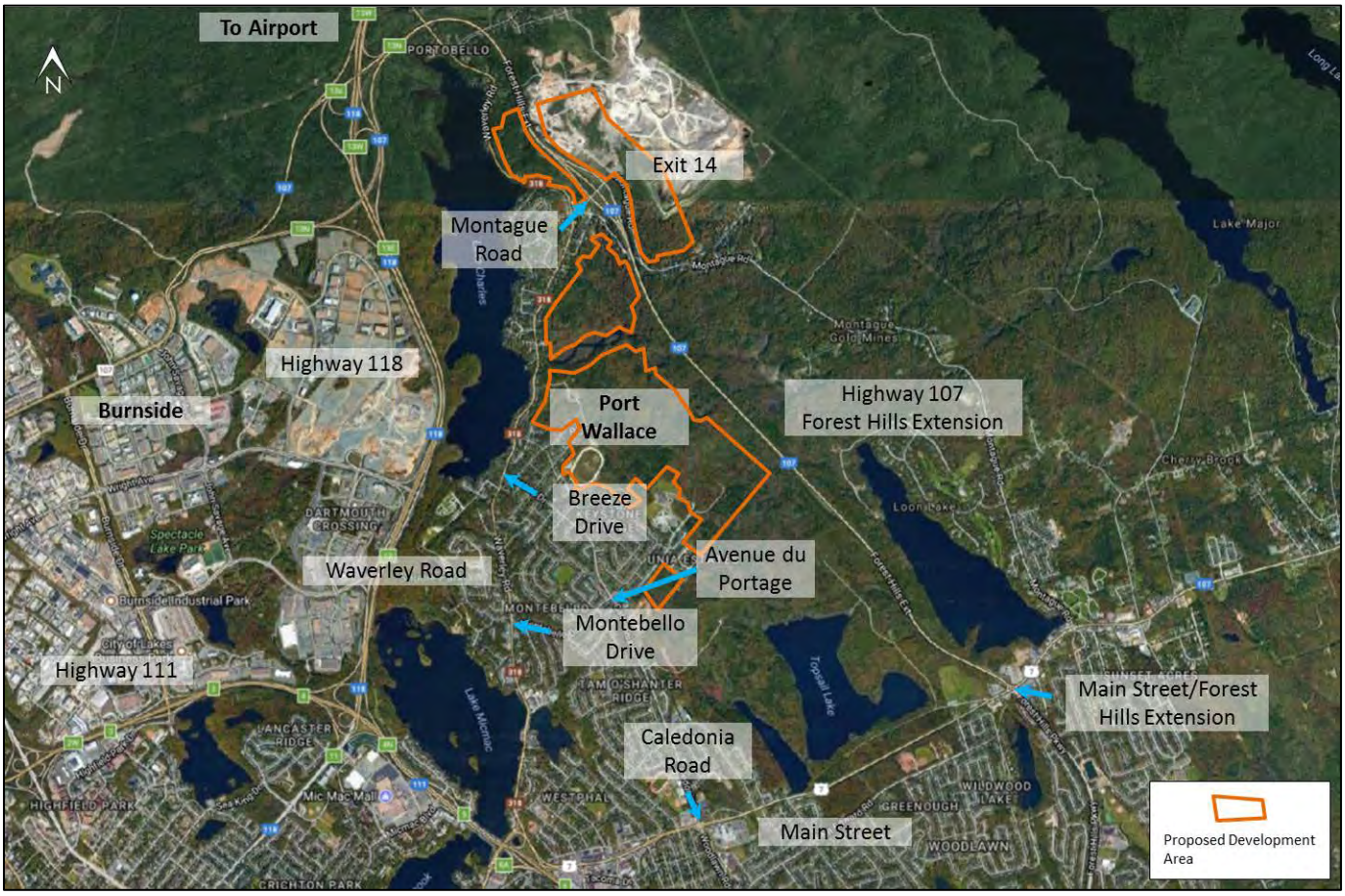


Figure 1: General Location of Study Area and Key Intersections

1.3 Land Ownership and Stakeholder Engagement

Error! Reference source not found. outlines the current property owners as well as the study area. The land owners engaged as part of this study were:

→ Conrad Brothers;
→ Port Wallace Holdings Limited;
→ Frank/Eric Whebby; and
→ Unia.

Three meetings were held with the stakeholders and/or their representatives. During our first meeting, each stakeholder provided their development plans, outlined their work to date and discussed their phasing intent. A follow-up meeting was conducted for stakeholders to offer their input to this study. At a third meeting, CBCL provided initial feedback on the preliminary findings of the report.

The southern portion of the Unia lands, PID 41254822, has poor development potential due to an environmental encumbrance. The land owner has requested that this portion of land be removed from the study area they have indicated as they intend to develop this portion of land in accordance with its existing zoning. There are no known issues with this proposal at this time. For the purposes of this report, these lands have been kept within the study area, however, they can be removed from consideration at a later stage if deemed appropriate by HRM.

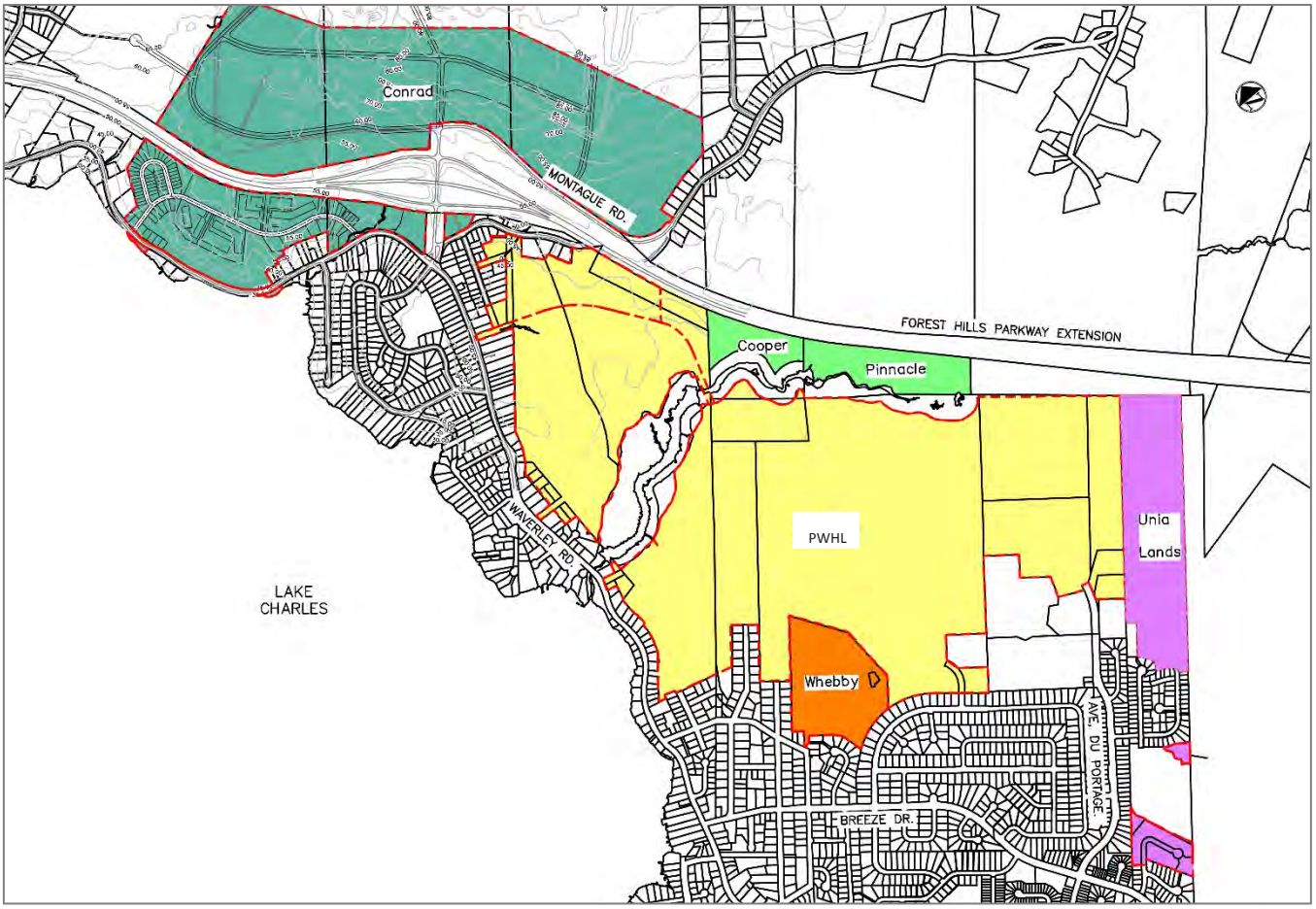


Figure 2: Land Owners

There were two land owners within the study area who could not be contacted by HRM PID 41365180. The property owner is noted on property online as George Anthony Cooper of Dartmouth, and PID 41025321 is owned by Pinnacle Properties. These properties were shown to have significant constraints to development in the land suitability assessment, which indicates there may be very limited financial benefit to be gained from development of these parcels and therefore, at present, future development of these properties is considered unlikely. Through the course of this development, the land owners should be contacted to confirm they do not intend to develop these parcels in the future, or the development layout be configured to offer access to these lots. Alternatively, HRM may decide that the constraints on the lands are such that they would not permit the area to be developed, and they may implement a non-development zone on those lots.

1.4 Population Projections and Project Buildout

Development of Port Wallace will be a joint effort from a number of developers and public agencies. Each developer has presented their proposed development layout, phasing plans and buildout timeline. The development layouts and phases integrate well to create an overall area plan which demonstrates a homogenous style and pattern. The developers have submitted a cumulative unit count of 3,744 residential units. Commercial, institutional and industrial development is also proposed.

Port Wallace Holdings Limited and Conrad Developments have expressed the strongest desire to begin development in the near future; Unia and Whebby have indicated they intend to commence development further down the road. A holistic review of the buildout timelines put forward by each developer shows a buildout overlap between developments. This overlap identifies a potential overall buildout scenario of over 300 units per year. This could equate to a full project buildout timeline as short as 12 years. This is considered very aggressive for Port Wallace.

This study does not aim to agree or disagree with the development timelines presented by any developer, but to review the development as a whole in terms of risk to HRM and Halifax Water. Project buildout timeline has been a significant issue for HRM and Halifax Water in the past where they have made capital investments in infrastructure to support large developments. In some cases, the rate of buildout, which was initially presented by the developers, was not achieved by all landowners. This delayed the generation of the tax revenue required by HRM and Halifax Water to recoup the initial capital investment, meaning that HRM and Halifax Water would be financing this infrastructure over longer than expected time frames at a higher cost to them.

A full buildout timeline for the study area of 30 years has been estimated. This equates to an average of 125 new residential units per year. While 125 units per year represents a significant portion of the annual average HRM new building permit applications and a substantial construction effort, it is considered to represent an acceptable timeline for the development, based on the information provided by the developers and overall growth in HRM.

In the infrastructure sections in this report, we have outlined upgrades based on buildout rate where possible. For example, road intersection upgrades are triggered at 10, 30, 50 & 70% buildout. This is in an effort to promote a distributed rate of capital cost investment for HRM, Halifax Water and the developers. Should development proceed at a faster rate and full development be achieved in say 12 years, the upgrades will still be constructed as required. Should development proceed at a slower rate full buildout may be achieved in say 60 years, the capital costs would be deferred in line with the rate of development. Populations and occupancy rates are taken from HRM and Halifax Water design guidelines. These are considered to be accurate representations of current and future occupancy rates. Potential occupancy rates outside the existing guidelines were not considered herein as they would represent a significant deviation from the established acceptable standard of practice in this jurisdiction and would require significant, detailed study and analysis to offer appropriate justification. Population and population equivalents for each sub area within Port Wallace are given in Table 1, with the sub areas being shown in Figure 3.

Table 1: Population Equivalents

Port Wallace Area	Population Equivalent
PW 1	1,147
PW 2	4,163
PW 3	1,477
PW 4	1,047
PW 5	2,096
PW 6	1,513
PW 7	633
PW 8	1,247
PW 9	906
PW 10	586
PW 11	106
Total:	14,921

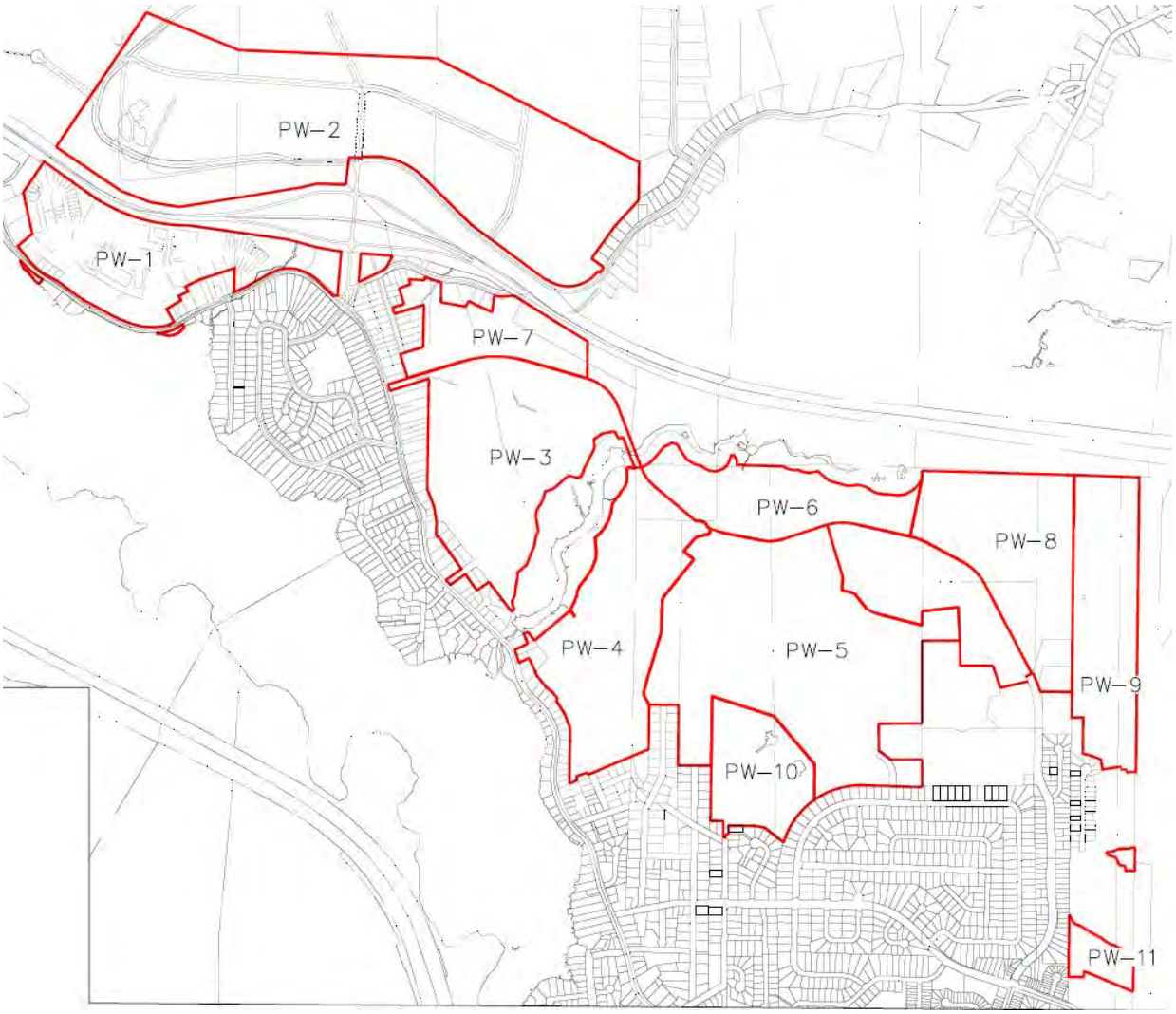


Figure 3: Port Wallace Sub Areas

Chapter 2 Transportation

2.1 Transportation Objectives

CBCL Limited completed an assessment of the existing and future road network as it relates to the Port Wallace study area. There are a number of potential road network layouts proposed by the developers within Port Wallace, with each layout representing a different potential road connection to the existing network. CBCL reviewed each of the proposed layouts considering the existing road network as well as assessing a number of potential future offsite upgrades. Each scenario was assessed under varying background growth conditions and with varying non-auto mode share.

Analysis of possible development layouts with different access options and potential future offsite infrastructure upgrades was completed. Varying levels of background growth and percentages of non-auto mode share (transit, walking, bicycling, taxi, rideshare, etc.) were adopted, to determine the level of service, queues and delays at major intersections within the study area.

This section provides an overview of the trip generation and suggested transportation infrastructure improvements associated with the Port Wallace study area. There are a number of landowners affected including Port Wallace Holdings Limited, Conrad Brothers Ltd, J&W Whebby Enterprises and Unia Estates. It is understood that the site could be available for development as soon as 2018. WSP has completed a review and analysis of the Port Wallace Holdings Limited proposals on behalf of Port Wallace Holdings Limited. HRM has also undertaken a comprehensive analysis of the baseline conditions within the area, as well as the proposed development and its impact on the surrounding road network using the VISUM model. CBCL completed a number of tasks as part of the infrastructure study, including:

- → Review of previously completed reports;
- → Review, assess, validate and modify the VISUM model outputs;
- → Conduct peak hour turning movement counts at key intersections;
- → Modify modelled trip distribution;
- → Assignment and mode choice assumptions;
- → Validate delays at key intersections; and
- → Conduct intersection modelling analysis using Synchro.

2.2 Site Description

The Port Wallace study area is currently largely undeveloped lands and owned by various developers. A portion of the land, owned by Conrad Brothers, is currently in operation as a quarry with trucks accessing Highway 107 (Forest Hills Extension) at Exit 14, Montague Road on the east side of the highway. There is also a secondary access on the west via local residential streets. It is understood that quarry vehicles do not typically utilise this access. We understand that operations at this site are expected to continue in the future, but also that these operations are seasonally dependent. The quarry vehicles mainly access the Forest Hills Extension to travel north and south away from the quarry. The site is bordered by Highway 107 Forest Hills Extension to the east, and Waverley Road to the west. The Port Wallace Study Area is bisected by Highway 107, which is accessible from Exit 14 at Montague Road.

Access to Highway 107 Exit 14 is currently along Waverley Road and Montague Road to the north of the site. Access to Main Street is currently via Avenue du Portage and Caledonia Road. The general location of the study area and existing access points are previously shown in Figure 1.

2.3 Initial Review

CBCL Limited reviewed background information provided from a number of sources, we also reviewed analysis undertaken by WSP and HRM, on behalf of various developers. The review included consideration of the anticipated numbers of residents or number of residential units as part of the development, a comparison of traffic count data obtained during different months and over different years, the estimated trip generation, distribution and non-auto mode share, and also the proposed access points, both existing and new.

2.3.1 Port Wallace Pre-Design Baseline Study (HRM 2014)

The HRM Baseline Report included an analysis of pre-designed baseline conditions for transportation services and forms an essential part of the secondary planning process undertaken by HRM. In this report, there were two main tasks: to determine the capacity constraints in the road, active transportation, and transit network systems; and to identify critical infrastructure deficiencies.

The key points to be noted from the study include:

- → The southern section of Waverley Road/Braemar Drive is at capacity and the signals at Montebello Road are also near capacity;
- → The remaining roads and intersections have spare capacity to accommodate new development;
- → Main constraints to active transportation in the area are street layout, grades, and the lack of infrastructure; and
- → The transit system in the area is underutilized. Transit accounts for 7.5% of commuting trips. The contributing factors are population density, street layout, lack of active transportation connections, and limited service to areas other than the Regional Centre.

2.3.2 Port Wallace Development Access Review (WSP May 2017)

This analysis was undertaken by WSP on behalf of Port Wallace Holdings Limited, and included a total number of 3,189 residential units (single family and multi-unit buildings) for the development. The Access Review considered a number of options for access from the development including:

- → All traffic loading on to Waverley Road;
- → Traffic being split between Waverley Road and a one-way only intersection on the Highway 107 Forest Hills Extension; and
- → Traffic split between Waverley Road and a new full intersection on the Highway 107 Forest Hills Extension.

The Access Review also included a bridge across Barry's Run between the two parts of Port Wallace Holdings Limited's proposed development.

The inclusion of a bridge to connect both parts of the development would allow for a continuous spine road through the development, and would also allow for a more efficient transit service.

In terms of phasing, WSP assumed a 10 year buildout timeline for full buildout of the Port Wallace Holdings Limited development. They also assumed that traffic from the development would be heading towards Waverley Road to the north and south, but would also use a right-in/right-out connection from the Highway 107 Forest Hills Extension to the Port Wallace development. In terms of typical build rates by developers, constructing 3,189 residential units in 10 years appears to be very ambitious given the number of anticipated trips generated by the development and current limitations on the road infrastructure.

WSP assumed a 20% non-auto mode choice, which is higher than HRM's assumption. If we are taking the long-term view of the proposed development, then a 20% share should be encouraged to help to reduce and to mitigate the number of peak hour trips generated by the Port Wallace development.

The key points to be noted from the study include:

→ It did not include the Conrad Residential and Industrial Lands;

→ Improvements are required for the Montague Road corridor, and intersection upgrades are required at the Waverley/Montebello, Waverley/Breeze, Caledonia/Montebello intersections; and

→ Planning should continue to preserve a road reserve for a future connection to the Forest Hills Extension.

2.3.1 Port Wallace Travel Demand Modelling Report (HRM 2017)

The information included in the Baseline Report was used as the basis for the work undertaken to create the Travel Demand Modelling Report. An estimate of 3,500 residential units were included as part of the development. The analysis considered that full buildout of the development would be in 2031 which coincides with the regional plan travel demand model developed by HRM. The baseline VISUM model looked at the wider study area as well as a sub-area model using PM peak hour travel demand. The model looked at five key intersections within the sub-area which surround the Port Wallace development and would be most directly affected by the generated trips. Background traffic growth was considered and compared with WSP's baseline traffic volumes as shown later in this section. In terms of trip generation, the VISUM model includes a 10% non-auto mode choice, half of the 20% assumed by WSP.

The key points to be noted from the study include:

→ The critical peak hour period is the PM peak hour;

→ At full buildout, the proposed development will generate 2,900 PM peak hour external trips;

→ The forecast demand with and without development will exceed the capacity of Forest Hills Extension, from Montague Road to Highway 118;

→ The forecast demand for Braemar Drive, just south of Montebello, is 1,100 vehicles per hour (vph) in the peak hour direction.

2.3.2 Summary

The Port Wallace Pre-Design baseline Study, Travel Demand Modelling Report, and the Access Review studies are consistent in their approach. Based on the analysis undertaken by CBCL, which is outlined in Section 2.9 below, CBCL generally agrees with the results of the HRM and WSP studies.

2.4 Access

2.4.1 Existing Access

There are two undeveloped portions of the study area, a portion of lands to the west of Montague Road, south of the highway owned by Conrad and the remainder of the study area to the east of Montague Road/Waverley Road. The Conrad lands front on Waverley Road. The lands to the east front on Waverley Road and have a number of dead end roads which will be used for future site access, these include Avenue du Portage, Rosecroft Drive, Lethbridge Avenue, Belvedere Drive and Lynwood Drive.

There are three existing Halifax Transit bus services, routes 10, 54 and 55 that serve the area surrounding Port Wallace. Routes 10 and 54 travel into the residential areas close to Avenue du Portage, and route 55 travels along Waverley Road.

There are also multiple active transportation trails in the area that encourage active transportation with connections to Waverley Road and Main Street, as well as an existing bicycle lane along Waverley Road/Braemar Drive.

2.4.2 Access Routes - Option Review

Proposed access to the site in the future will still include Waverley Road and Main Street/Caledonia Road. Waverley Road provides access both north to Exit 14 on Highway 107 towards Burnside Industrial Park, and to the Airport, and south towards Main Street, downtown Dartmouth and Halifax, as well as the Eastern Shore. These will continue to be the main access routes during the initial phase of the development as residential areas are constructed. The direct access point into Port Wallace will be via a continuation of Avenue du Portage which would become a spine road through the development. Routes to and from the site were determined in terms of route direction, trips were generated going North, South, East and West. There are a number of route options being discussed at the moment to accommodate the anticipated level of new traffic coming from the development. The route options are described in the following text and are shown in corresponding figures.

2.4.3 Option 1 (Baseline)

Option 1 is shown in Figure 4: Access Option 1 below. New traffic to access Waverley Road at the existing Montebello Drive and Breeze Drive intersections, plus via seven new access points A, B, C, D, E, F and G; Access to Main Street is via the Forest Hills Extension and Caledonia Road intersections. Access to Forest Hills Extension is via the Montague Road interchange. Option 1 includes a bridge connection across Barry's Run.

- → Access A - New intersection with Waverley Road via a vacant lot and an extension of Lynwood Drive (Primary access point);
- → Access B – New intersection with Waverley Road opposite Applewood Lane (Secondary access point); and
- → Access C – New Intersection with Waverley Road opposite Meadow Walk (Secondary access point);
- → Access D – New Intersection with Waverley Road for the Conrad Residential lands. (Location to be determined);
- → Access E – New Intersection with Waverley Road for the Conrad Residential lands. (Location to be determined);
- → Access F – New Intersection with Cono Drive for the Conrad Industrial lands. (Location to be determined); and
- → Access G – New Intersection with Montague Road for the Conrad Industrial lands. (Location to be determined).

Figure 4: Access Option 1

2.4.4 Option 1A

This option consists of Option 1 plus construction of right-in/right-out access from the Forest Hills Extension to the proposed Port Wallace development.

The above details are shown in Figure 5: Access Option 1A.

Figure 5: Access Option 1A

2.4.5 Option 2

This option consists of Option 1 plus construction of a full access (possibly a roundabout) on the Forest Hills Extension to the proposed development. Option 2 does not include a bridge connection across Barry's Run.

The above details are shown in Figure 6: Access Option 2.

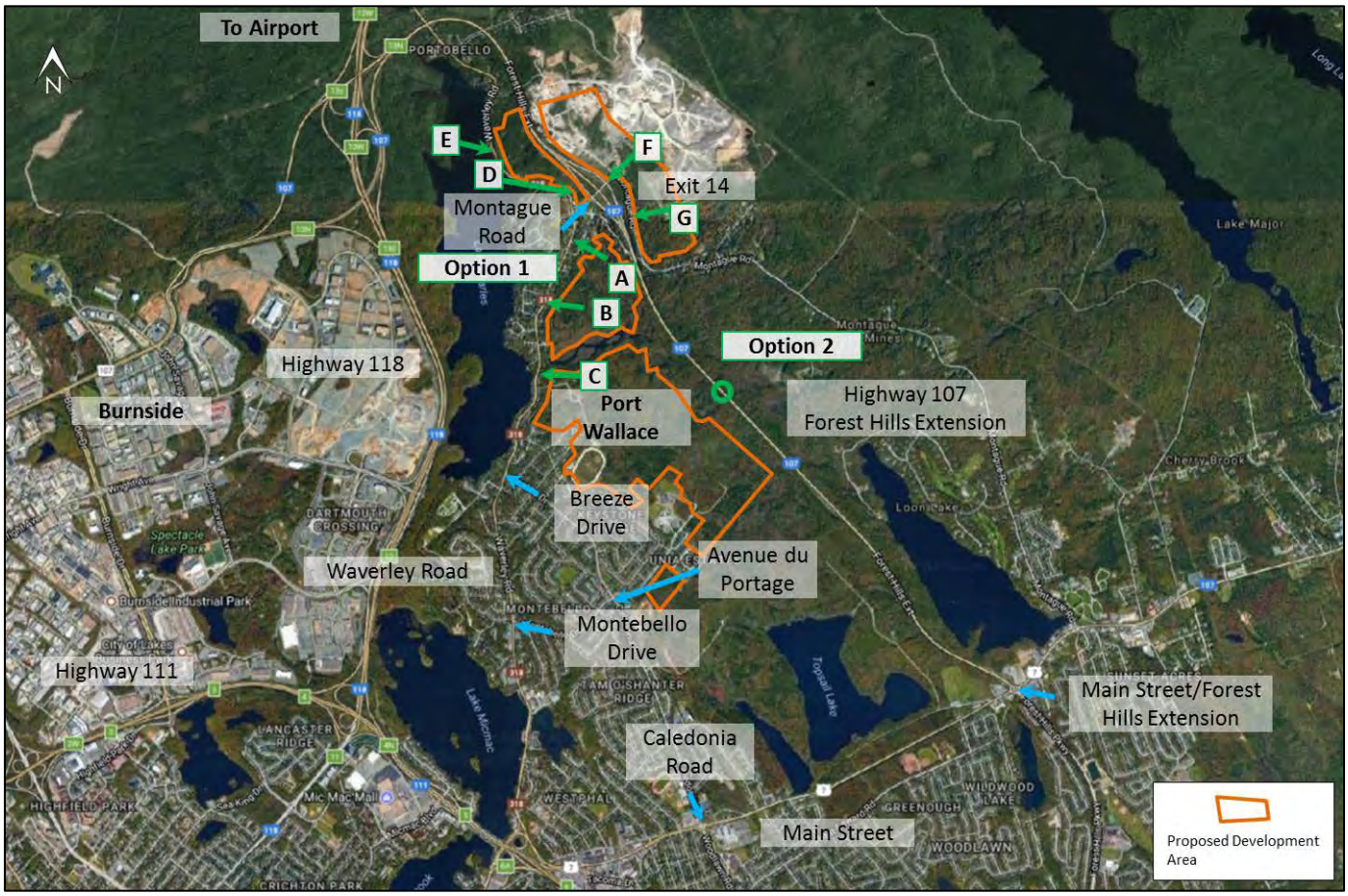


Figure 6: Access Option 2

2.5 Baseline Traffic Volume and Background Growth

2.5.1 CBCL Limited Data Collection

To provide an updated baseline, and to allow us to make a comparison with previous analysis, CBCL Limited undertook traffic turning movement counts over three days in May 2017. The traffic counts were undertaken to establish a new baseline and to provide confirmation of the VISUM modelling and analysis already undertaken by HRM. The counts were made on either Tuesday, May 9; Wednesday, May 10; or Thursday, May 11, 2017 at the following intersections:

→ Waverley Road/Montague Road;
→ Waverley Road/Montebello Drive;
→ Waverley Road/Breeze Drive;
→ Breeze Drive/Montebello Drive/Caledonia Road;
→ Main Street/Caledonia Road/Woodlawn Road;
→ Main Street/Forest Hills Extension/Forest Hills Parkway; and
→ Highway 107/Montague Road ramp terminals.

The hours of data collection included peak hours from 7:00 am to 9:00 am and 4:00 pm to 6:00 pm during the weekdays mentioned above. Traffic counts were conducted for one day at each intersection. The traffic counts were conducted using "Miovision" video traffic data collection technology and were undertaken over as short a time period as possible to minimize the risk of daily or weekly variations. To provide sufficient information by vehicle type, the following classifications were adopted:

→ Passenger vehicles;
→ Medium trucks;
→ Heavy trucks and buses;
→ Pedestrians; and
→ Cyclists.

From the May 2017 traffic counts, we have established the turning movements at key intersections within the study area, creating a baseline traffic conditions. The results of the turning movement counts have been used as the basis of the Synchro modelling work being undertaken.

2.5.2 Trip Patterns

The traffic count data indicates that the distribution of trips to and from the study area show a similar pattern of outbound and inbound trips. For example, traffic volumes using the northbound ramp at the Montague Road interchange during the AM peak hour are similar to the traffic volumes using the southbound ramp during the PM peak hour. This would indicate that commuters are using the same routes during both the morning and evening rush hour periods.

A comparison of the intersection traffic count data obtained by HRM and CBCL Limited shows that although HRM's data were collected between 2009 and 2013 (generally May, September, October), accounting for growth and allowing for variations due to the recording days/times of the year they are very similar to the data collected by CBCL in May 2017. However, CBCL's counts are a little higher as would be expected given 4 to 8 years' worth of background growth within the area. The comparison would also appear to indicate that traffic patterns and volumes have changed very little over an eight year period due to the existing residential neighbourhoods being well established.

2.5.3 Background Growth

We compared the 2031 traffic volumes generated by HRM VISUM, WSP and CBCL without any future development, only background growth, for the key intersections within the study area. Background growth was assumed to be 1% per year for the period from 2017 to 2031. Background growth beyond 2031 was assumed to be 0.75% per year. The results of the comparison show that, including the reported rounding differences, all three sources of data are generally within 200 vehicles plus or minus of each other. Some larger differences appear at various locations within the study area road network, generally CBCL's values are greater than either HRM or WSP's values. This is due to our methodology of adopting a "worst case scenario" for background traffic growth and applying a 1% increase to 2031 across the board. A lower background growth rate would make the corresponding differences smaller. All three sources of data are within reasonable limits accounting for various time periods and rounding differences.

2.5.4 Forest Hills Extension

While comparing the VISUM model with our own 2031 baseline analysis, it became apparent that traffic using the Forest Hills Extension in the northbound direction was much higher in VISUM than in CBCL's analyses.

Through investigating individual turning movements and zone to zone volumes, the volume of traffic coming from the Porter's Lake direction to the Forest Hills Extension northbound showed an increase of over 400 vehicles which were attributed to an unrelated proposed development in the Porter's Lake area. In the VISUM model, these ~400 vehicles are using the Exit 14 northbound ramp to bypass Highway 107 to avoid the congestion on Highway 107, which would not likely occur in reality. Therefore, to represent the worst case scenario, these ~400 vehicles were reallocated from the ramp to the Highway 107 in the Synchro analysis. By removing these ~ 400 trips from the ramp and adding them back on to the main Forest Hills Extension, the traffic volumes at the ramp from the VISUM model and CBCL's analysis on this section were more comparable.

2.6 Trip Generation and Mode Choice

2.6.1 Number of Residential Units, Commercial, and Industrial Areas

Based on the information provided by the land owners, the estimated number of residential units anticipated for the Port Wallace development is 3,744. The analysis also includes 184 acres of light industrial and 152,000 square feet of commercial area. While it is anticipated that the Port Wallace development may have institutional land uses, these land uses typically do not generate or attract trips from outside of the immediate surrounding area.

2.6.2 Trip Generation

The trip generation analysis undertaken by CBCL has been based on standard trip rates from the Institute of Transportation Engineers (ITE) Trip Generation Handbook (9th edition). Note that a comparison of the ITE trip generation rates adopted by CBCL indicates that they are similar to the rates and land use codes used by HRM and WSP in their analysis. At full buildout, the Port Wallace development is expected to generate 3,400 trips during the AM peak hour, and 4,200 trips during the PM peak hour.

2.6.3 Trip Reductions

An estimated buildout timeline of 30 years has been assumed for this development. As we are considering long term future planning for trip generation, there are a number of significant possibilities relating to transportation that we must include in our analysis. For the purposes of this analysis, we have examined AM and PM peak hours as they generally have more trips than any other time of the day.

Trip generation considerations included:

- → The number of jobs within Burnside Industrial Park and at the Halifax International Airport are likely to increase given the level of expansion being proposed at both locations;
- → Based on the rate of advances in vehicle technology, autonomous vehicles are potentially going to be on our roads within the 30 year buildout. Autonomous vehicles have the potential to reduce car ownership as they may provide an on-demand transportation service without the need for private ownership. It is anticipated that this would operate in a similar way to a taxi service, so trips will be made to a specific destination. This could also reduce the requirement for parking space provision currently accommodated in new developments;
- → We also anticipate that a small percentage of people living within the site will also work at some of the shops and schools proposed as part of the multi-use development. These trips are classed as internal trips, and would not impact the surrounding existing road connections during peak hours;

→ We also considered trips by active transportation (AT) instead of by private vehicle. The proposed development includes AT trails, with connections to existing AT facilities around the site for walking and bicycling;
→ There are also opportunities to reduce the number of private vehicle trips by people choosing to use transit services to and from the site. The existing transit services routes 10, 54 and 55 that travel close to the Port Wallace development could potentially be altered to include a loop through the new development, or perhaps a new transit service could be offered based on sufficient demand. One way of helping to reduce private-and particularly single occupancy vehicle trips, would be to encourage the introduction of sustainable, reliable transit services to Burnside Industrial Park and Halifax International Airport. If demand was sufficient, perhaps consideration of a transit hub within the development could also be considered; and
→ We anticipate that some of the residents of the proposed development will be retired. The anticipation is that most residents will be families, and therefore are more likely to be making vehicle trips during the peak hours. However, another shift in traditional working and travel patterns could be that more people will be working from home in the future, or indeed able to work flexible hours to avoid travelling in peak hour traffic.

Assumed trip reduction rates were chosen based on the likelihood of trips not being made during peak hours. The reductions adopted are the same for both AM and PM peak hours due to this being a high level analysis.

Trip reduction rates include non-auto mode share (transit and AT trips) and internal trips. Residential trips were reduced by 27%. Commercial trips were reduced by 75% to account for site synergies. Industrial trips were not reduced.

From a comparison of the HRM and WSP reports, HRM's Port Wallace Master Plan Area Travel Demand Modelling Report (2017) used 10% reduction for non-auto mode choice, and 75% reduction for neighborhood shopping and on site synergies. WSP's Access Review on Proposed Residential Development - Port Wallace (2014) used 20% reduction for non-auto mode choice and 75% reduction for neighborhood shopping and on site synergies.

At full buildout, the Port Wallace development is expected to generate 2,450 net external vehicle trips during the AM peak hour, and 3,050 net external vehicle trips during the PM peak hour.

Based on our analysis, we found that after the trip reductions and non-auto mode choice factors were applied, the adjusted external trips are similar to the HRM and WSP estimates of adjusted trip generation.

2.7 Trip Distribution

We have assumed that there will be five main access routes to the residential developments via the existing access on Avenue du Portage, and Waverley Road. This will be the case until the sites are more developed. Avenue du Portage should be extended through the site as a primary/spine road in the future. The existing access routes are as follows:
→ From Waverley Road via Breeze Drive;
→ From Waverley Road via Montebello Road; and
→ From Main Street via Caledonia Road.

Access to the Conrad residential lands would be directly from Waverley Road at two new access points. Access to the Conrad industrial lands would be from two new access points with Montague Road, and one at the Cono Drive/Montague Road intersection. Access to the Whebby and Unia lands will be via adjacent existing development or through the study area.

2.7.1 Initial Review

In terms of residential trip distribution assumptions, HRM initially adopted the trip distribution percentages from the 2031 PM peak VISUM Regional Travel Demand Model. These percentages were then compared to the trip distribution percentages shown in WSP's Access Review which are as follows:

→ North - 10%;
→ East - 5%;
→ South - 35%; and
→ West - 50%.

Following this, the Origin Destination (OD) tables were adjusted by HRM and the final residential trip distribution assumptions adopted in the VISUM model are as follows:

→ North - 7%;
→ East - 5%;
→ South - 30%; and
→ West - 58%.

2.7.2 Recommended

Each of these general directions of distribution was allocated a percentage of trips to and from the site at 50% (2031) and full buildout (2047). Note that the trip distribution percentages were based on a combination of CBCL's own estimation and the trip distribution percentages used by HRM and WSP, and are as follows:

→ North - 7%;
→ East - 6%;
→ South - 38%; and
→ West - 49%.

Development traffic has been assigned to the available routes based on the CBCL trip assignment assumptions which differed depending on the route option being analysed.

Considering future roadway connections, it is proposed that there be five new access points (A, B, C, D, and E) from the proposed developments on to Waverley Road, as described in section 2.4 above. Other options for access include the construction of a right-in/right-out access only on to the Forest Hills Extension, or a full access on the Forest Hills Extension which we have modelled as a roundabout for the purposes of this study.

2.8 Analysis Assumptions and Constrains

Several assumptions have been incorporated into the concept plan and have been adopted for the transportation analysis. These assumptions and constraints are as follows:

→ Background growth rates applied to our baseline 2017 traffic volumes were 1% per year to 2031, and 0.75% per year from 2031 to 2047;

→ Development is anticipated to commence in 2018. We have assumed a 30 year buildout for this study area, therefore the buildout year is assumed to be 2048. For the purposes of this analysis, a full buildout year of 2047 has been used to accommodate existing models and data. For the purposes of this assessment, it is anticipated that there will be a negligible change in traffic patterns between 2047 and 2048;
→ 2031 is the limit of HRM's VISUM model;
→ We have assumed 50% of the total development area is to be constructed by 2031;
→ An estimate of trip distribution from the entire development at full buildout (2047) has been made using existing and future access points;
→ The residential area would include approximately 3,744 units, split between single-family detached housing, apartments and condos/townhouses;
→ Significant traffic (including private vehicle trips, walking, cycling, transit trips) will be generated by a development of this size and the types of land use anticipated;
→ Assumptions have been made to reduce the number of private vehicle trips from the entire development during peak hours. This is based on percentages of people making internal trips, working from home, using active transportation or transit, amongst other modes or travel patterns;
→ Active transportation, and transit services and use needs form a large part of travel to and from the site, including connections to existing active transportation facilities;
→ Non-auto mode choice was assumed at 10%;
→ Waverley Road is the most likely point of access to the site to/from the Highways 107 and 111, Main Street, and downtown Dartmouth and Halifax, at least initially;
→ The Forest Hills Extension (Highway 107) offers a potential future connection point as the site is developed; and
→ Forest Hills Extension (Highway 107) will be widened by 2031.

2.9 Baseline and Scenario Results

In discussion with HRM, several scenarios were developed for modelling in Synchro based on the access options discussed above, in conjunction with the two horizon years (2031 and 2047), 50% and 100% buildout, and modelled for both AM and PM peak hours. Each modelled intersection was examined in terms of level of service (LoS), and queues and delays, which are the key indicators for intersection analysis.

In summary, the majority of the intersections examined do not have any operational issues under existing 2017 AM and PM peak hour conditions, with the exception of the Main Street/Forest Hills Extension signalized intersection which HRM are aware of. Looking at 2031 AM peak hour conditions and a 50% buildout of Port Wallace, the following intersections show signs of poor operational performance including lower level of service, longer queues and delays for vehicles passing through the intersections:
→ Highway 107 ramp northbound;
→ Waverley Road/Montague Road;
→ Waverley Road/Option 1 Access A; and
→ Breeze Drive/Avenue du Portage/Caledonia Road.

As for the 2031 PM conditions, more intersections display poor operational performance, namely;
→ Highway 107 ramp southbound;
→ Waverley Road/Montague Road;
→ Waverley Road/Option 1 Access A;
→ Waverley Road/Option 1 Access B;

→ Waverley Road/Option 1 Access C;
→ Waverley Road/Montebello Road; and
→ Breeze Drive/Avenue du Portage/Caledonia Road.

Note that our Level of Service (LoS) analyses for 2031 agree with HRM and WSP's recommendation on upgrading Montebello Road at Waverley Road with an additional northbound right turn lane.

Figure 7: Intersections Displaying Poor Operational Performance During the 2031 Peak Hour illustrates

Figure 7: Intersections Displaying Poor Operational Performance During the 2031 Peak Hour

intersections displaying poor performance during the 2031 peak hour.

Although the proposed access points A, B and C show poor level of service at 2031, we assume that the developer will be implementing mitigation measures so that they operate satisfactorily.

Similarly by 2047, using a 0.75% background growth rate beyond 2031, plus the inclusion of a 10% non-auto mode choice, the following intersections show poor level of service during the AM peak hour in addition to the intersections mentioned above for 2031 AM peak hour:

→ Main Street/Caledonia Road;
→ Waverley Road/Access Road B; and
→ Waverley Road/Access Road C.

The following intersections also show poor level of service during the 2047 PM peak hour in addition to the intersections mentioned above for 2031 PM peak hour:

→ Main Street/Caledonia Road; and

→ Highway 107 Exit 14 ramp northbound.

Figure 8: Intersections Displaying Poor Operational Performance During the 2047 Peak Hour illustrates intersections displaying poor performance during the 2047 peak hour.

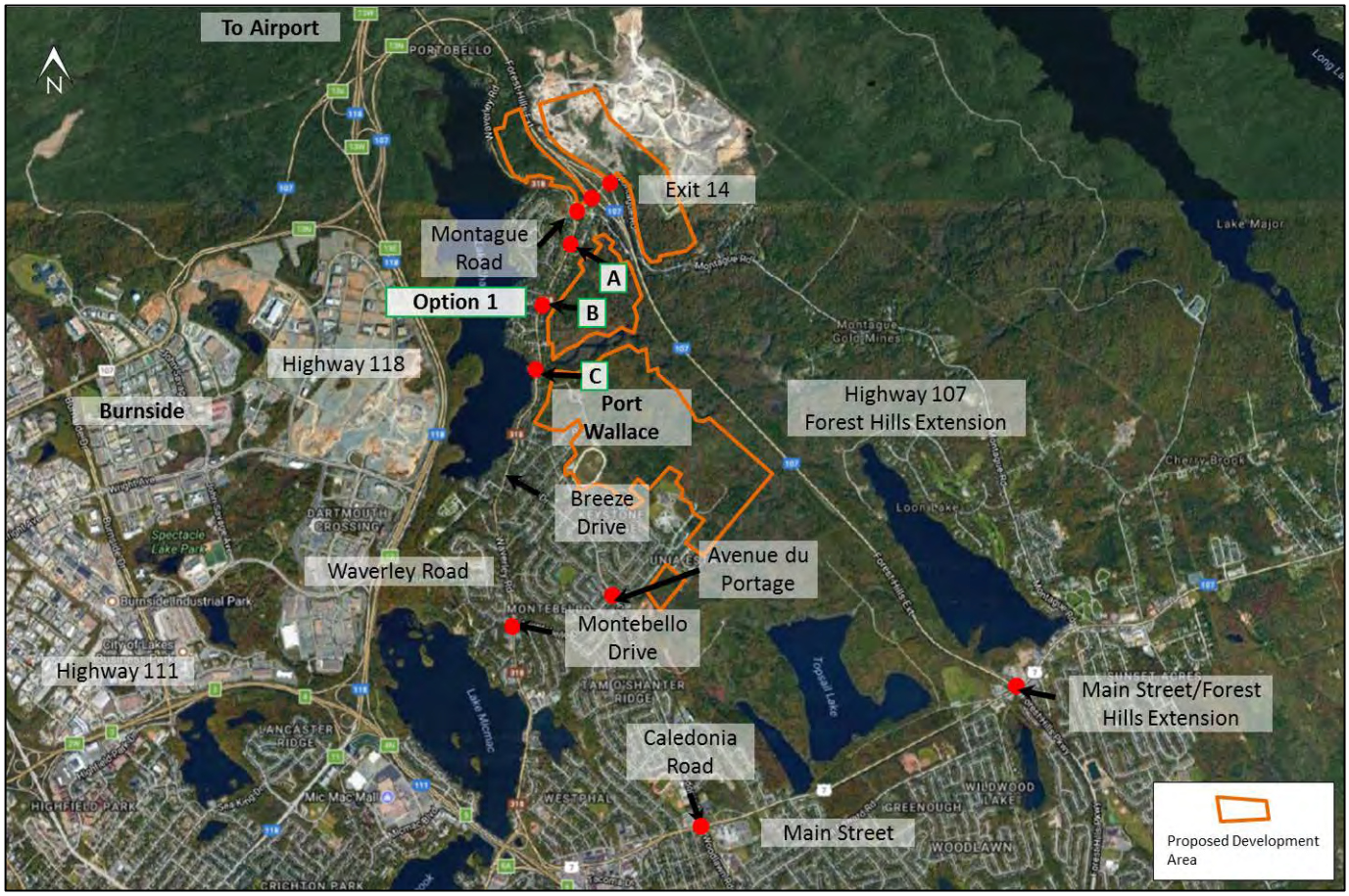


Figure 8: Intersections Displaying Poor Operational Performance During the 2047 Peak Hour

We note that Waverley Road/Braemar Drive south of Montebello, a two-lane arterial road, currently carries approximately 930 vehicles per hour (vph) in the peak direction during the peak period. This is expected to increase to 1,250 vph by 2031 at 50% buildout. For comparison, sections of St Margaret's Bay Road, another two-lane arterial road, currently carry traffic volumes exceeding 1,200 vph in the peak direction during the peak hour. This would suggest that Waverley Road/Braemar Drive could carry similar traffic volumes without the need to widen the roadway before 2031.

Including future Port Wallace development, traffic heading to and from Highway 107 at Exit 14 will use up any spare capacity on the Montague Road overpass which is currently two lanes wide, one lane in each direction. Improvements at each ramp terminal intersection may mitigate the need to widen the structure. Further detailed analysis of future traffic volumes and queue lengths will be required to confirm this.

2.10 Sensitivity Analysis

HRM requested that we run a few sensitivity tests using the VISUM model to examine the impacts of additional scenarios on the surrounding road network.

2.10.1 New Connection to Forest Hills Extension

Firstly, we compared Option 1 and Option 1A. Option 1A offers a right in/right out access from Highway 107. The analysis showed that there is no appreciable difference in overall LOS at the surrounding intersections between Option 1 and Option 1A. However, the results of the analysis did show that the 95th percentile queue length, V/C ratio, and average delay in seconds by intersection approaches improve slightly with Option 1A compared to Option 1.

Therefore, there would appear to be little difference in the impact at the intersections by including a right in/right out access to the Forest Hills Extension.

Similarly, Option 2 (Option 1 plus full access on to the Forest Hills Extension) improves the 95th percentile queue length, V/C ratio, and average delay in seconds by intersection approaches at the Caledonia/Montebello intersection. However, there is no appreciable difference in overall LOS in between Option 1 and Option 2.

Therefore, Option 2 does not eliminate the need to upgrade the Caledonia/Montebello intersection.

2.10.2 Non-Auto Mode Choice

Secondly, we examined the effect of using a 20% non-auto mode choice mode choice in 2047 for full buildout of the development. In reviewing the non-auto mode share percentages used in HRM and WSP's analysis, the VISUM model, which used a 10% value, was adjusted to include a 20% value.

The results of this analysis showed that conditions at both northbound and southbound ramps on the Highway 107 Forest Hills Extension improved such that there was no operational issue at these locations during the AM peak period. However, during the PM peak period, conditions at all intersection location were the same as with the 10% non-auto mode choice.

There was very little difference in overall traffic volumes based on the two values, therefore, there would appear to be little benefit in the impact to the surrounding intersections from a 20% non-auto mode choice. However, we believe that non-auto modes, in particular, transit and active transportation should be widely supported and encouraged for the Port Wallace development given the level of trips generated during the buildout period.

2.10.3 Forest Hills Extension Twinning

Lastly, we examined the impact of twinning the Highway 107 Forest Hills Extension from Exit 14 to the interchange with Highway 118. Using the VISUM model, we examined the forecast travel demand on this section of highway with and without the Port Wallace development. Currently, peak hour traffic volumes in the peak direction are estimated at 1,400 to 1,600 vehicles per hour (vph). This is at or near the capacity of this two-lane highway section. Without the Port Wallace development, 2031 peak hour travel demand on this section is expected to exceed 1,900 vph in the peak direction. With the Port Wallace development, peak hour travel demand is expected to exceed 2,300 vph in the peak direction.

Using the VISUM model and adjusting the links which represent this section of highway, we changed the link type from one lane in each direction to two lanes in each direction which simulates a twinned highway. From the analysis, it was found that 170 additional vehicles are heading to the north via the new twinned highway during the AM peak period. Moreover, there is an extra 40 vehicles using the twinned highway to come south during the AM peak period. Similarly, during the PM peak period, there are additional 255 vehicles coming to the south via the twinned highway. The results of this analysis show that there is a significant difference in the volumes of directional traffic, specifically traffic heading to the north and south via the Highway 107 ramps. The twinned highway attracts significantly more vehicles than the existing two lane highway. In addition, should an intersection on the Forest Hills Extension from the Port Wallace development be constructed and the highway twinned from this intersection, this would alleviate traffic issues at the Waverley Road and Exit 14 ramp terminals.

While the Port Wallace development will add traffic to the section of Highway 107, from the Exit 14 interchange to the interchange with Highway 118, improvements to this section of highway will be needed with or without the development.

2.11 Infrastructure Plan

The surrounding road network has been assessed under a number of different scenarios. Each potential development layout or infrastructure configuration will generate a different trip distribution. This affects the level of service at each intersection and therefore the potential required infrastructure upgrades. Detailed analysis will be required at the time of preliminary/detailed design to determine the appropriate upgrade for each intersection.

For the purpose of the costing discussion given herein, we have compared two scenarios: 2031 without Port Wallace vs 2031 with Port Wallace, as most of the upgrades are triggered by 2031, with the remaining being required before 2047. Both scenarios show intersections with poor levels of service. Preliminary estimated upgrade timelines have been developed for this study and are provided below.

As indicated above, the way the development will connect to existing infrastructure is undefined at this point. For the purposes of this study we have reviewed Infrastructure configuration Option 1 at full buildout. Intersections have been reviewed to determine the trigger point where level of service is no longer acceptable based on the anticipated increased traffic volumes. This trigger point was established on an individual basis for each intersection based on the total number of vehicles, the total wait time and an overall level of service for all turning movements within the intersection. The cost of the transportation upgrades is shown in Table 2 below.

The recommended infrastructure improvements shown above are described in more detail in the section below, and have been grouped by specific geographic corridors**.** Figure 9: Infrastructure Improvement Corridor shows the infrastructure improvement corridors recommended to be upgraded based on our analysis.

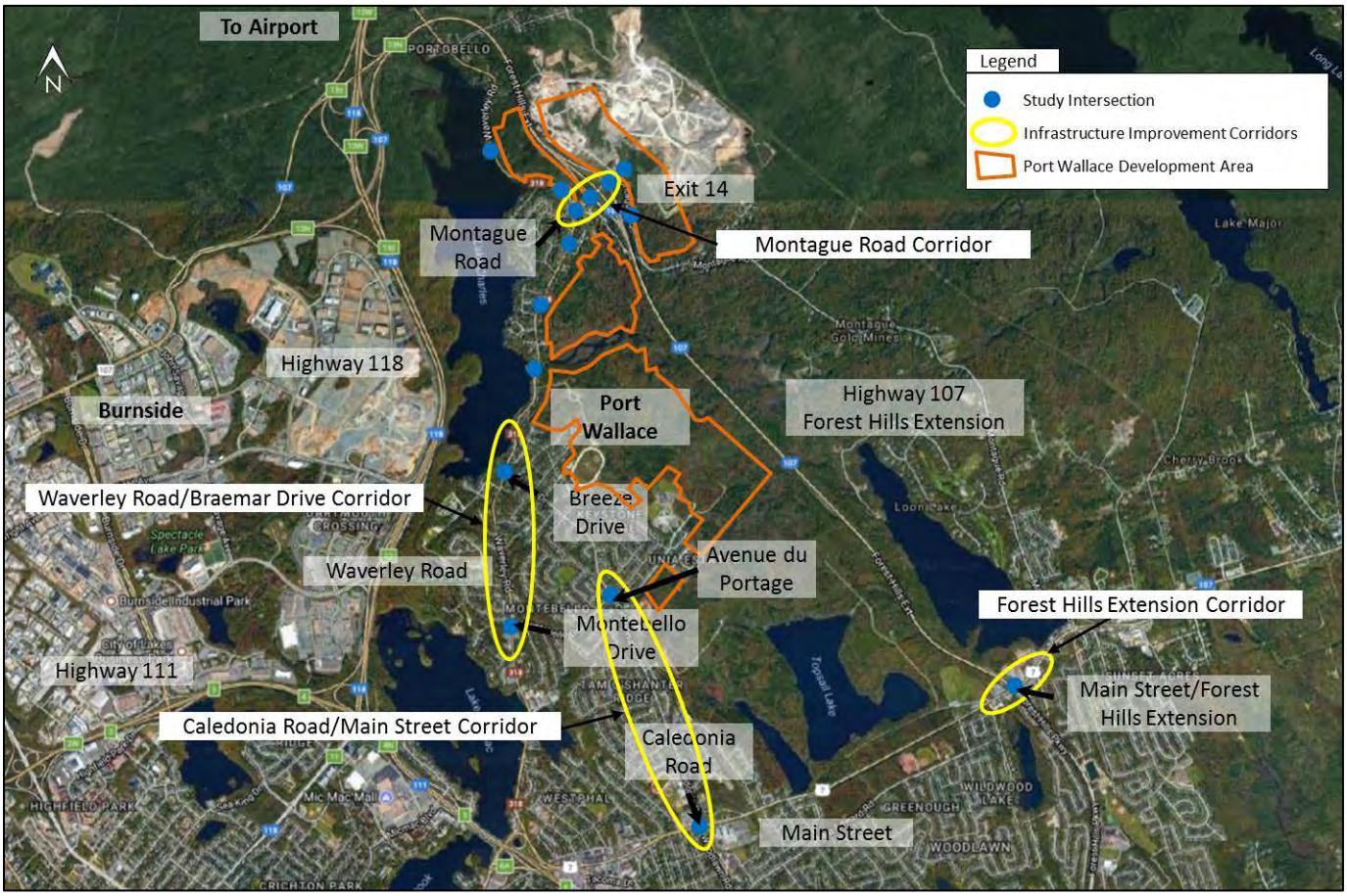


Figure 9: Infrastructure Improvement Corridor

2.11.1 Montague Road Corridor

Looking at the analysis completed and at some of the individual intersections and upgrades required based on Option 1, and for a 50% buildout at 2031, the following points should be noted:

→ Montague Road and Ramp Terminal (South) – The Highway 107 Exit 14 south ramp terminal will also require a roundabout to accommodate development traffic coming from Port Wallace heading towards the highway.

This roundabout would need to be 50 metre diameter with a single circulating lane and a southbound right turn lane to remove this movement from the traffic passing through the roundabout, in particular the left turn movement.

Trigger Point: 10% buildout (400 residential units)

→ Montague / Charles Keating / Waverley – The existing Montague Road / Waverley Road stop controlled intersection will require a single lane roundabout, while maintaining the right turn slip lane from Montague Road.

Trigger Point: Construction of the Montague/Ramp Terminal South Roundabout.

→ Montague Road and Ramp Terminal (North) – The Highway 107 Exit 14 north ramp terminal will require a roundabout to accommodate development traffic coming from Port Wallace heading towards the highway.

This roundabout would need to be 50 metre diameter with a single circulating lane. In addition, this intersection should also include a westbound right turn slip lane on the approach to the roundabout to remove this movement from the through traffic. An eastbound through traffic bypass lane could also be included to remove the conflict between through traffic and left turn traffic.

Trigger Point: Development of the Conrad Industrial Lands and/or 30% residential development (1100 residential units).

→ Montague Road at Cono Drive (Access F) – Improvements to this intersection will be needed to accommodate the development of the Conrad Industrial lands. This plan assumes that a single lane roundabout will be required, however given its proximity to the Montague Road/Ramp Terminal North intersection, a single five-leg roundabout may be required. Further analysis will be required. Access G/Montague Road – additional access from Conrad Industrial Lands.

Trigger Point: Development of the Conrad Industrial Lands or construction of the Montague/Ramp Terminal North roundabout.

→ Montague Road Overpass – Including future Port Wallace development, traffic heading to and from Highway 107 at Exit 14 will use up any spare capacity on the Montague Road overpass which is currently two lanes wide, one lane in each direction. Based on the inclusion of a roundabout at each ramp terminal, and through providing bypass and slip lanes, any peak hour queuing across the bridge should be accommodated within the existing cross section of one lane in each direction. This would mitigate the need to widen the structure at this time, however further more detailed analysis of future traffic volumes and queue lengths would be required to determine if the structure would need to be widened at a later date.

Trigger Point: TBD.

2.11.2 Waverley Road/Braemar Drive Corridor

→ Access A / Waverley – Assume two lane westbound approach as Access A. Install a southbound left turning lane on Waverley Road. Install traffic signals.

Trigger Point: 0% buildout. Southbound left turn lane on Waverley Road and traffic signal civil works will be needed when Access Road A is constructed. It is assumed that Access Road A will be one of the first roads constructed. Traffic signals (electrical) will be constructed by the local developer when signals are warranted.

→ Access B / Applewood Lane and Waverley Road – Install a southbound left turning lane on Waverley Road. Traffic signals if required will be the responsibility of the local developer.

Trigger Point: TBD by the local developer.

→ Access C / Meadow Walk & Waverley – Install a southbound left turning lane on Waverley Road. Traffic signals if required will be the responsibility of the local developer.

Trigger Point: TBD by the local developer.

→ Access D / Waverley Road – Install a northbound left turning lane on Waverley Road. Traffic signals if required will be the responsibility of the local developer.

Trigger Point: TBD by the local developer.

→ Access E / Waverley Road – Install a northbound left turning lane on Waverley Road. Traffic signals if required will be the responsibility of the local developer.

Trigger Point: TBD by the local developer.

→ Breeze / Waverley – Install additional westbound lane on Breeze Drive, and install traffic signals.

Trigger Point: 70% buildout (2,600 residential units).

→ Montebello / Waverley – Install northbound right turn lane on Waverley Road.

Trigger Point: 50% buildout (1,900 residential units).

2.11.3 Breeze Drive/Caledonia Road Corridor

→ Montebello / Avenue du Portage / Caledonia / Breeze – Install traffic signals.

Trigger Point: 10% buildout (400 residential units) and/or the extension of Avenue du Portage (Access A) to Waverley Road.

2.11.4 Forest Hills Extension

→ Forest Hills Extension Twinning – The requirement for twinning of Highway 107 from Exit 14 to Highway 118 at Burnside will need to be monitored as time goes by. This upgrade would need to be instigated in conjunction with NSTIR. This study assumes that twinning will occur by 2031.

Trigger Point: TBD

→ New connection to Forest Hills Extension – Option 1A considers a right in / right turn out connection on Highway 107. Option 2 considers a full access to Highway 107 (Roundabout or Interchange). While a new connection to Highway 107 would improve operations on Waverley Road and the Montague Road interchange, it has not been costed as part of this Infrastructure Plan.

Trigger Point: Not Considered.

2.11.5 Main Street

→ Main / Caledonia / Woodlawn – Traffic signal optimization.

Trigger Point: 70% buildout (2600 residential units).

→ Main / Forest Hills – This intersection is at or near capacity during the peak hour. Upgrades to this intersection will be required if the Cherrybrook Bypass is not constructed. For the purposes of this study, it is assumed that this intersection would be converted to a multi-lane roundabout.

Trigger Point: TBD.

2.11.6 Cost Estimates, Timing, and Cost Sharing

Class D cost estimates are presented in Table 2 and include a 45% contingency, and 12% engineering fees. The cost estimates are in 2017 dollars and do not include land acquisition. For upgrades where the trigger point has not been determined, the timing of these projects for cost estimating purposes were established as noted below.

For upgrades that will be funded 100% by the local developer Access points A, B, C, D, E, and G, these projects have not been included in Table 2. Access point F (Cono Drive) has been included in Table 2 as it would be a cost shared project between HRM and local developer. The Forest Hills Extension twinning project has not been included since it will be needed with or without the Port Wallace development.

Improvements to the Main at Forest Hills Extension were assumed to occur at 50% buildout for costing purposes. Looking at the Main Street/Forest Hills Extension intersection, HRM is aware that there is a significant volume of traffic using this intersection even before the Port Wallace development goes ahead. Our analysis shows that less than 5% of the total trips (including residential, industrial, commercial and institutional) generated by the development would use the Main Street/Forest Hills Extension intersection. This in turn represents a smaller percentage of the cost sharing by the local developers at this location.

Many of these existing intersections are currently at a satisfactory level of service, and therefore have additional available capacity. The capacity of a few intersections is exceeded over the timeline of this development due to increased road use, triggering upgrade requirements. Increased road use originates from a combination of the Port Wallace development and background growth. Cost sharing has been allocated based on HRM Capital Cost Contribution policy with background growth included as an HRM responsibility.

Should Port Wallace not proceed, some existing intersections within the study area are shown to require upgrades over the next 30 years based on background growth alone. These intersections are: Montague Rd / Ramp Terminal (South), Main / Forest Hills, and Montebello / Avenue du Portage / Caledonia / Breeze. It is anticipated that the costs for upgrading these intersections would be shared between the developers and HRM.

Cost sharing has been typically allocated based on the % share of total traffic approaching (or exiting) an intersection. When using the model (as opposed to a manual trip distribution and assignment) to estimate cost sharing, there is induced traffic. This is traffic that shifts from one facility to another when road system capacity is changed. Spare capacity is equally allocated to background and site generated traffic.

The HRM CCC policy states that: *"… In cases where existing traffic has been shifted from an existing facility, thereby releasing capacity for use by traffic generation in the charge area, no direct benefit will be attributed to the Municipality…"*

To factor this in, % traffic share has been allocated by comparing the 2031 PM Peak model run without Port Wallace to the 2031 PM peak model run with Port Wallace. The 2031 model with and without Port Wallace includes background growth.

The model results are given below in Table 2**.**

Table 2: Cost Sharing Between Developers and HRM

Project	Cost ($M)	Baseline Volume Without Development	Baseline Volume With Development	Volume Difference	Developer Share	Developer Share (Rounding Adjustment)	Developer Cost ($M)	HRM Cost ($M)
Cono Drive (Access F)	2.40	830	1,500	670	44.7%	45%	1.1	1.3
Ramp Terminal (North)	2.40	1,000	1,750	750	42.9%	45%	1.1	1.3
Ramp Terminal (South)	2.40	1,500	2,300	800	34.8%	35%	0.8	1.6
Charles Keating	2.40	1,200	2,000	800	40.0%	40%	1.0	1.4
Waverley at Breeze	0.70	650	1,300	650	50.0%	50%	0.4	0.4
Waverley at Montebello	0.35	1,300	1,900	600	31.6%	30%	0.1	0.2
Main at Forest Hills	10.00	4,250	4,700	450	9.6%	5%	0.5	9.5
Main at Caledonia	0.00	3,250	4,300	1050	24.4%	25%	0.0	0.0
Caledonia at Avenue du Portage	0.40	700	1,300	600	46.2%	45%	0.2	0.2
Total Cost (with Main at Forest Hills)	**21.05**						**5.1**	**16.0**
Total Cost (without Forest Hills)	**11.05**						**4.6**	**6.5**
Total Developer Share (with Main at Forest Hills)	**24%**							
Total Developer Share (without Main at Forest Hills)	**42%**							

Chapter 3 Wastewater

3.1 Introduction

3.1.1 Objectives

This analysis has the objective of evaluating the existing sanitary system capacity downstream of the planned Port Wallace Development, and identifies potential upgrades in order to service this development's wastewater flows. The existing sewer system and planned Port Wallace development are shown in Figure 10: Existing Sanitary Sewershed in Relation to Proposed Development Area. Letters A and B Denote the Start and End of the Profile in Figure 11.

The limiting sections of the existing sanitary system have been identified by comparing the available capacity of the existing system with the projected flows of the proposed development. If, for a given phase of development, the projected flows exceed the available capacity, updates are required prior to that phase of development. Upgrades of the downstream system have been designed to meet the ultimate service requirements of the development at full buildout.

This chapter presents calculations of future design flows and an assessment of existing system capacity. The results show, for each section, at which phase of development upgrades will need to be completed.

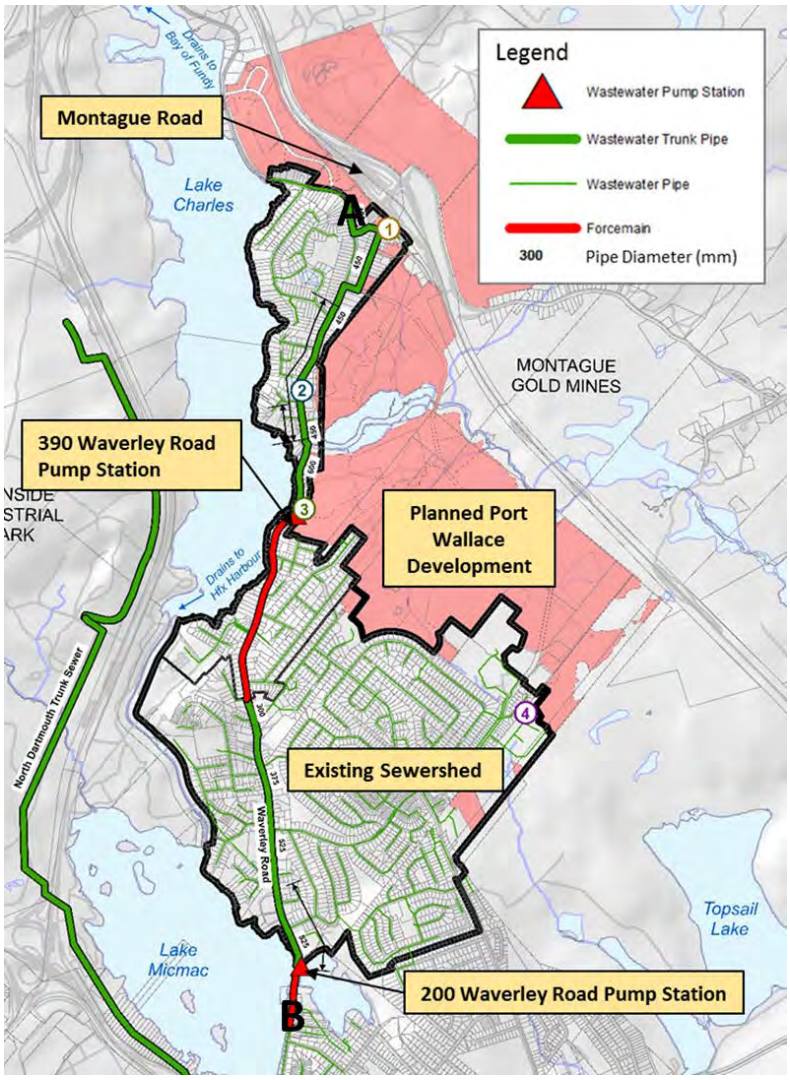


Figure 10: Existing Sanitary Sewershed in Relation to Proposed Development Area. Letters A and B Denote the Start and End of the Profile in Figure 11

3.1.2 Existing System

The existing gravity system is depicted in plan view in Figure 10: Existing Sanitary Sewershed in Relation to Proposed Development Area. Letters A and B Denote the Start and End of the Profile in Figure 11 and in profile in Figure 11: Profile of Existing Sanitary Sewer System. The existing sewer originates at the intersection of Montague Road and Waverley Road and continues south along Waverley Road to a pumping station (PS) at 390 Waverley Road. Flow is then pumped further south on Waverley Road into another gravity sewer system. This gravity system discharges to the pumping station at 200 Waverley Road, which pumps to the Dartmouth Trunk Sewer. The topography in the area explains the need for two pumping stations in the area. A complete gravity system could only be constructed with excavations in the order of 20m of depth.

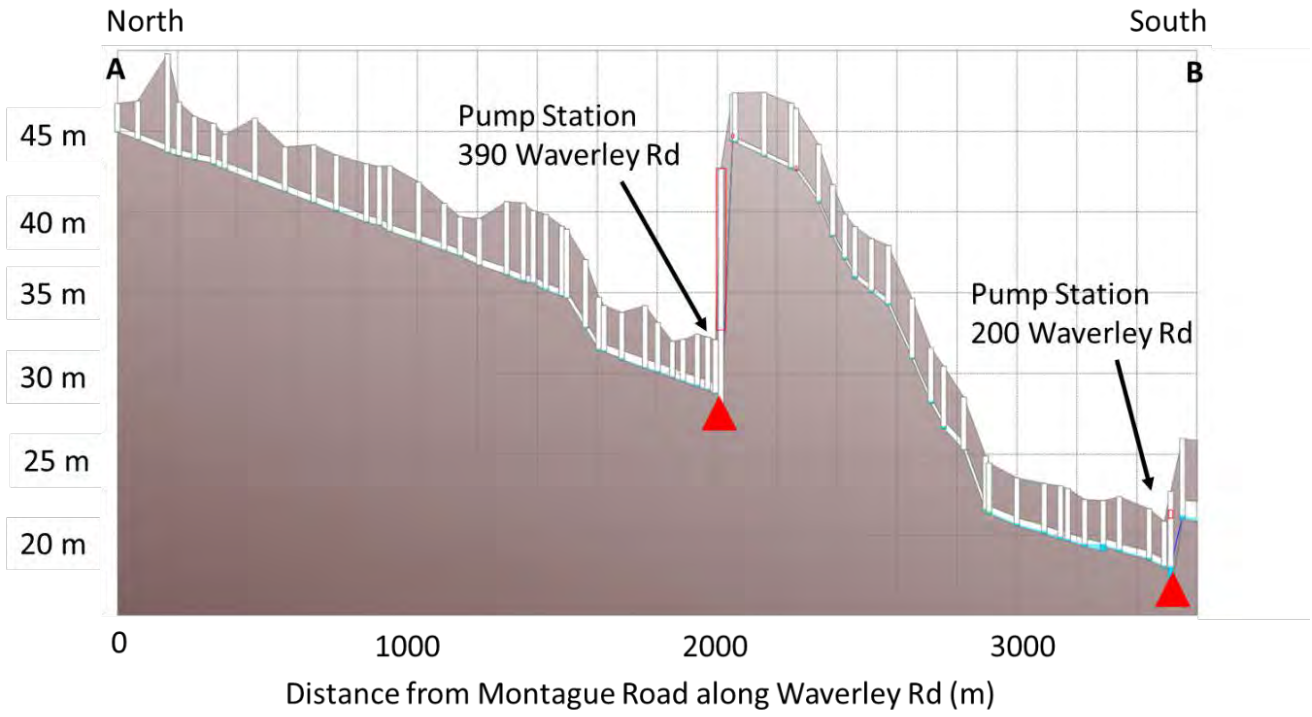


Figure 11: Profile of Existing Sanitary Sewer System

The gravity system upstream of the 390 Waverley Road PS is comprised of concrete pipes with diameters in the order of 400mm to 600mm (according to the Halifax Water GIS). Downstream, between the 390 Waverley Road PS and the 200 Waverley Road PS, the gravity system has similar slopes, but is comprised of smaller diameter pipes, that range from 375mm to 525mm. This section of gravity sewer therefore has a lower overall capacity compared to the gravity system upstream of the 390 Waverley Road PS.

3.1.3 Proposed Changes

The proposed Port Wallace development area is shown in Figure 10: Existing Sanitary Sewershed in Relation to Proposed Development Area. Letters A and B Denote the Start and End of the Profile in Figure 11**.** The proposed area is composed of varied land ownership and land uses (as shown in Figures 1, 2 and 3 respectively in previous chapters). The new wastewater system will connect to the existing wastewater system at distinct connections points. Four connection points have been identified based on: (1) pre-development grading (i.e., LIDAR flow paths), (2) the conceptual layout of the proposed development (provided by the developers), and (3) spatial arrangement of existing parcels.

Therefore, the location of the connection points are subject to change:

→ Connection Point 1 is at the intersection of Wilcot Lane and Lynwood Drive;

→ Connection Points 2 and 3 are along Waverley Road, at Applewood Lane and at the 390 Waverley Road Pump Station respectively; and

→ The fourth connection point, at Stanfield Avenue, is off of the main trunk sewer, at the fringe of the existing sewer system.

The connection points and associated contribution areas are shown in Figure 12: Connection Points Where the Proposed Wastewater System will Connect into the Existing System, and Associated Contribution Areas.

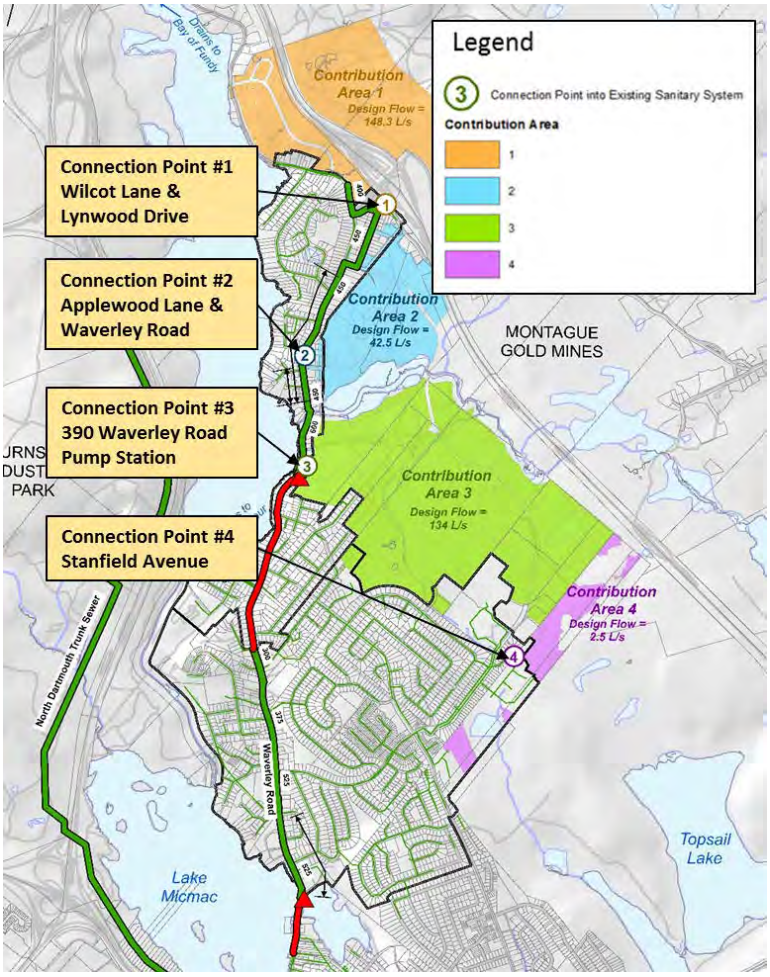


Figure 12: Connection Points Where the Proposed Wastewater System will Connect into the Existing System, and Associated Contribution Areas

3.1.4 Previous Studies

Several studies have previously been completed and contribute to the understanding of the existing sanitary system:

→ The Dartmouth Cove Wastewater Management Study (CBCL Limited, 2007) analysed possible routing paths for the future wastewater flows from the Port Wallace development, recommending the option of routing the flows to the North Dartmouth Trunk Sewer;

→ The Halifax Water Cost of Servicing Plan (CBCL Limited, 2009) noted that the 390 Waverley Road Pump Station will need to be upgraded to receive wastewater flows from the Port Wallace development;
→ The Regional Wastewater Functional Plan (CBCL Limited, 2012) provided a capacity analysis of the North Dartmouth Trunk Sewer (NDTS) and its downstream system. The impacts of future flows from the Port Wallace development to the NDTS was also evaluated, and confirmed the NDTS had adequate capacity to handle flow from this development; and
→ A drawdown test of the 390 Waverley Road Pump Station was carried out by DesignPoint on January 29, 2015.

3.1.5 Scope

The following analyses were included as part of the wastewater component of this study:
→ Capacity analyses of the 390 Waverley Road Pump Station, the 200 Waverley Road Pump Station and their respective upstream wastewater systems were completed to assess future partial development conditions for Port Wallace. These analyses were not previously carried out as part of the Regional Wastewater Functional Plan (CBCL Limited, 2012); this was confirmed by CBCL Limited and Halifax Water during the May 31, 2017 meeting;
→ A wastewater capacity analysis of the North Dartmouth Trunk Sewer with respect to the Port Wallace development was not completed, because this analysis was done as part of the Regional Wastewater Functional Plan (CBCL Limited, 2012); this was confirmed by CBCL Limited and Halifax Water during the May 31, 2017 meeting; and
→ Since the intent of this masterplan is to establish long term infrastructure requirements, detailed design of the sanitary system was not included.

3.2 Methodology

3.2.1 Specifications

The sanitary system analysis presented here follows the most up-to-date version of the Halifax Water Design Specification for water, wastewater & Stormwater systems 2017. In addition to this, all assumptions for non-residential properties (industrial and commercial) were based on the Atlantic Canada Wastewater Guidelines Manual (Environment Canada, 2006).

3.2.2 Approach

The following steps were undertaken as part of this analysis:
1. Calculation of design flows into the existing sanitary system based on the existing sewershed areas and land uses (Section 4.2.3);
2. Calculation of design flows for the proposed Port Wallace development into each of the four connection points (Section 4.2.3);
3. Drawdown analysis for the 200 Waverley Road Pump Station (Section 4.2.4);
4. Hydraulic modelling of the existing sanitary system (pipes and pump stations) (Section 4.2.5);
5. Calculation of the remaining capacity of the existing system based on the existing flows (Section 4.2.6); and
6. Comparison of the remaining capacity of the existing system with the future development design flows (Section 4.2.7).

3.2.3 Design Flow Calculations

Design flows were calculated for both for the proposed Port Wallace development and for the existing sanitary system using the equations in the specifications described above.

→ For the existing system, flows were calculated based on the types and numbers of establishments within the existing sewershed;

→ For the proposed development, flows were calculated to the four connections points detailed above. The proposed development areas and number and type of units for the proposed development were based on information provided by the developers; and

→ It is noted that these design flows were calculated based on the equations in the specifications described above, and therefore not calibrated based on flow gauges.

The following assumptions were made based on the specifications described above. Assumed flow allowances, operational periods and peaking factors for various types of establishments are presented in Table 3.

→ Safety Factor 1.25;

→ I/I Allowance: 0.28 L/ha/s;

→ Single Unit Dwelling: 3.35 people/unit;

→ Townhouse: 3.35 people/unit; and

→ Multi-Unit Dwelling: 2.25 people/unit.

Table 3: Flow Allowance Assumptions for Various Types of Establishments

Type of Establishment	Daily Flow Allowance	Operational Period	Peaking Factor
Light Industrial/Commercial Area	35,000 L/ha	12 hours	1.0
Residential	300 L/person/day	24 hours	(Harmon)
School	105 L/person/day	8 hours	1.5
Restaurant	225 L/seat/day + 100 L/employee/day	16 hours	2.0
Carwash	340 L/car/day	16 hours	4.0
Gas Station	20 L/car/day	24 hours	4.0
Industrial/Commercial Building	45 L/person/day	12 hours	2.0

3.2.4 Pump Station Drawdown Analyses

A drawdown test of the 390 Waverley Road Pump Station had previously been carried out by DesignPoint on January 29, 2015. To close the information gap on the capacity of the 200 Waverley Road Pump Station, CBCL Limited and Halifax Water completed a drawdown test at that location on June 19, 2017.

3.2.5 Hydraulic Modelling

The EPA-SWMM5 modelling engine was used in combination with the PCSWMM interface to assess the capacity of the existing sanitary system. The hydraulic model uses the characteristics of the existing sanitary system's pipes (e.g., sizes, slopes, material, spatial arrangement) and pump stations (e.g., information from drawdown analyses) to assess how much flow the system is able to transmit downstream.

3.2.6 Remaining Capacity of Existing System

Next, the hydraulic model was used to evaluate the remaining capacity of the existing system.

→ Firstly, the existing flows calculated above were inputted into the model to identify whether sections of the existing system are currently under capacity; and

→ Secondly, flows were incrementally increased to determine the maximum amount of flow that can be added in addition to the existing flow until a pipe is full. This is called the "remaining capacity" or "flow thresholds", because flow above this threshold requires an upgrade to the existing system.

3.2.7 Required Upgrades to Service Proposed Design Flow

Once the above results were obtained, the flow capacity thresholds were compared with the calculated future design flows. Some parts of the system were found to already have the capacity to absorb the future development flows (see Results and Recommendations below). For the locations that did not have sufficient capacity, the percentage of development (or "phase" of development) at which the upgrade would be necessary was calculated.

> *For example, if the flow capacity threshold downstream of a connection point is 50 L/s and the future development design flow at that connection point is expected to be 100 L/s, the upgrade will be necessary by the time 50% of development occurs.*

3.3 Results and Recommendations

Results are presented in the following order: the design flow calculations are reported first, followed by the results of the capacity analysis and associated recommended upgrades.

3.3.1 Future Development Design Flows

The calculated design flows for Contributions Areas 1-4 of the proposed Port Wallace development are presented in the "Total Design Flow" column of Table 4. The largest flows are expected from Connection Points 1 and 3, with only minor flows at Connection Point 4.

Table 4: Estimated Wastewater Design Flows for Port Wallace

Connection Point #	Connection Point Location	Development Type	Development Area	Design Flow [HW Formula] (L/s)	Total Design Flow (L/s)	Cumulative Design Flow (L/s)	Remaining Capacity (L/s)	Percentage of Development (%)
1	Wilcot Lane & Lynwood Drive	Residential	PW-2 (Conrad)	28.7	148.3	148.3	111.0	75
		Light Industrial	PW-1 (Conrad)	119.6				
2	Applewood Lane & Waverley Road	Residential	PW-3 (Port Wallace Holdings Limited)	39.4	42.5	190.8	173.0	91
			PW-7 (Port Wallace Holdings Limited)					
		Institutional	PW-3 (Port Wallace Holdings Limited)	3.1				
3	390 Waverley Road PS	Residential	PW-4 (Port Wallace Holdings Limited)	125.2	134.0	324.8	N/A	>100
			PW-5 (Port Wallace Holdings Limited)					
			PW-6 (Port Wallace Holdings Limited)					
			PW-8 (Port Wallace Holdings Limited)					
			PW-9 (Port Wallace Holdings Limited)					
			PW-10 (Unia)					
		Commercial	PW-5 (Port Wallace Holdings Limited)	8.8				
			PW-6 (Port Wallace Holdings Limited)					
			PW-8 (Port Wallace Holdings Limited)					
4	Stanfield Avenue	Residential	PW-11 (Unia)	2.5	2.5	2.5	N/A	>100

3.3.2 Remaining Capacity of Existing System and Rcommended Upgrades

Recommendations are as follows (explained in more detail below):

1. Upgrade 390 Waverley Road Pump Station;
2. Upgrade Wastewater Pipes at 75% Development of Area 1; and
3. Revise Analysis Upon Changes to Planned Development.

1. Upgrade of 390 Waverley Road Pump Station

The key limiting component of the existing sanitary sewer system was found to be the 390 Waverley Road Pump Station. Based on a drawdown test (DesignPoint, January 29, 2015), the firm capacity of the 390 Waverley Road Pump Station is 37.0 l/s. Given that flows from the existing sewershed were calculated at 47.8 l/s (using the current HW design formula), this means that this Pump Station's current capacity is below its design capacity and that there is no available capacity for the proposed development. Figure 13: Proposed Rerouting of Flow from 390 Waverley Road Pump Station to North Dartmouth Trunk Sewer shows the comparison of upstream flows and pumping station capacities. This information therefore indicates that an upgrade to the 390 Waverley Road pumping station would be required to service any upstream future development. This upgrade should occur before development in the Port Wallace area is undertaken.

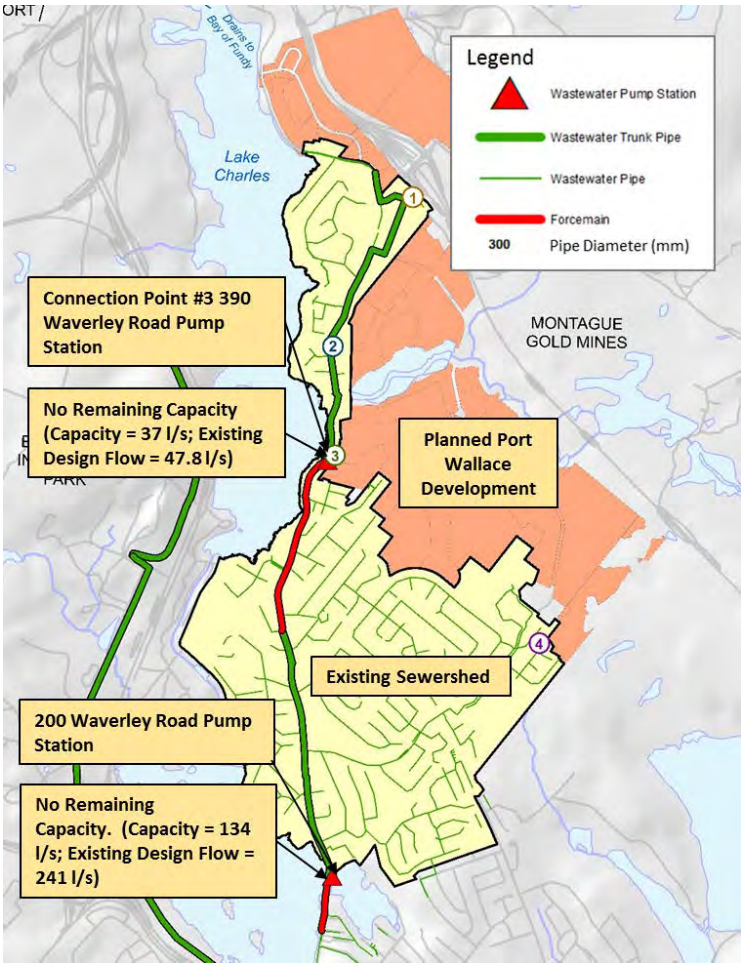


Figure 13: Proposed Rerouting of Flow from 390 Waverley Road Pump Station to North Dartmouth Trunk Sewer

2. Upgrade Wastewater Sewer Pipes at 75% Development of Area 1

If wastewater flows from Contribution Area 1 are directed to the wastewater system upstream of Connection Point 1 and exceed 111 L/s, upgrades to the wastewater system would be required. This upgrade is shown as Phase 2 in Table 5 (also see Figure 14: Proposed Options for Rerouting of Flow from 390 Waverley Road Pump Station).

Table 5: Summary of Required Upgrades to the Existing Sanitary System

PHASE #	PHASE 1	PHASE 2
Connection Point	3	1
Contribution Area(s)	All	1
Developers	Conrad, Port Wallace Holdings Limited, Unia	Conrad
Remaining Capacity (L/s)	0	111
Total Design Flow (L/s)	324.8	148
Percentage of Contribution Area Development at Which Threshold is Reached	0%	75%
Capital Works	1) Replace 390 Waverley Road Pumping Station 2) New forcemain from Pumping Station to North Dartmouth Trunk Sewer. This includes: • New trench under Jaybe Drive and Ethel Court; • Crossing under; Shubenacadie Canal; and • Crossing under Highway 118.	Pipe Upgrade - 350m of 450mm pipe Upstream of Wilcot Lane Note: Only needed if connection is made upstream of Wilcot Lane.

3. Revise Analyses upon Changes to Planned Development

Although it was found that, other than the necessary upgrades mentioned above, the remaining sanitary system has adequate capacity to meet the service demands of the existing area, thresholds at which the capacity of the existing system would be surpassed were still identified throughout the sewer. It was found that several locations would be at or near capacity with full development. For example, sections near capacity at full development include portions of the gravity system between Highway 107 and the 390 Waverley Road Pump Station. Therefore, it is recommended that the flows be reassessed if there are future changes and refinements to the proposed development.

3.3.3 Options for Rerouting Flow from 390 Waverley Road Pump Station

It was shown in the previous section that both the 390 Waverley Road and 200 Waverley Road Pump Stations are under capacity according to the current design standards. Upgrading the 390 Waverley Road Pump Station will increase the amount of flow that has to be carried by the downstream system. It is therefore important to evaluate the available options to convey the increased flows through the downstream system. Figure 14: Proposed Options for Rerouting of Flow from 390 Waverley Road Pump Station shows three potential options that have been investigated:

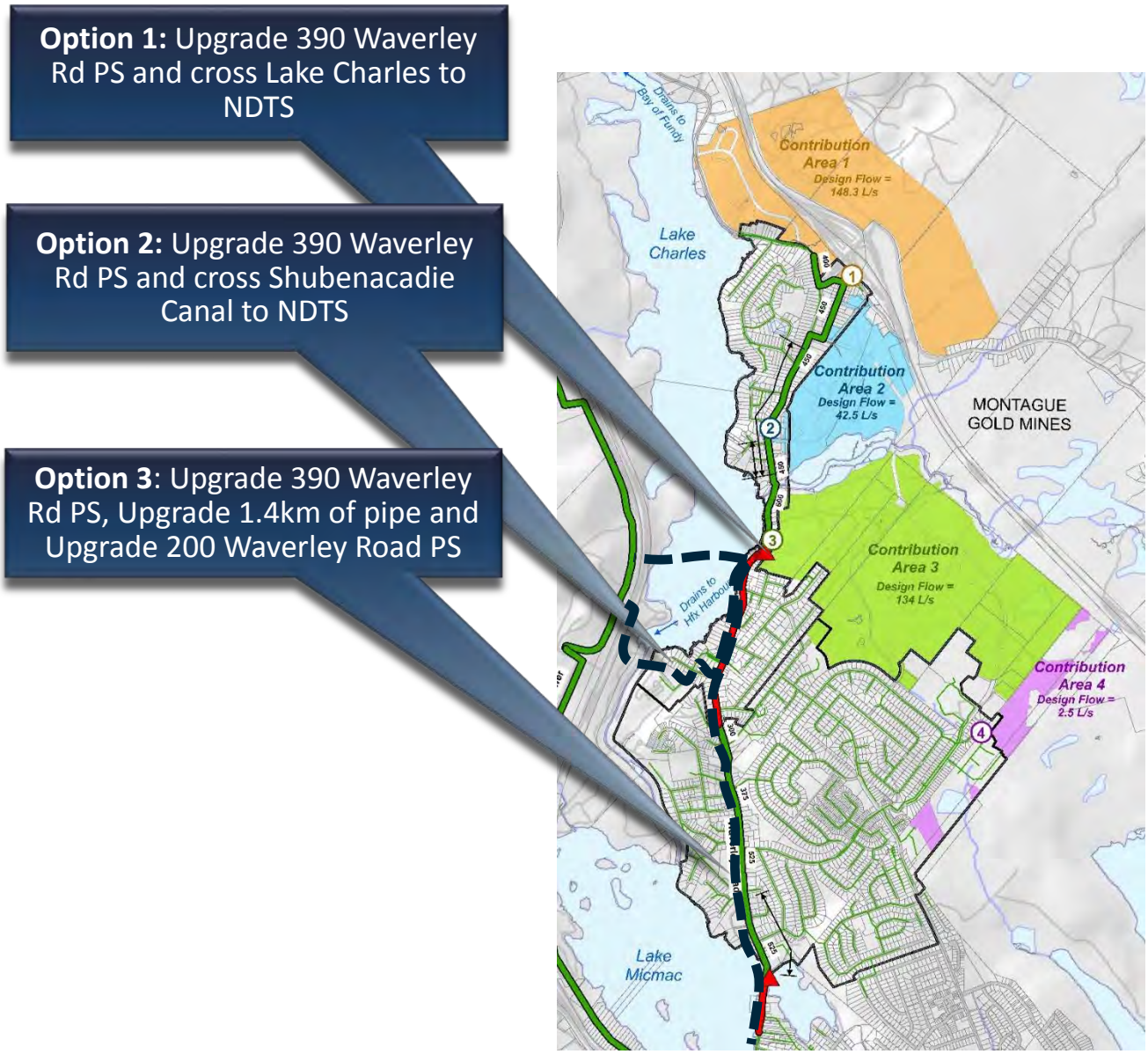


Figure 14: Proposed Options for Rerouting of Flow from 390 Waverley Road Pump Station

1. **Reroute Flow from 390 Waverley Road Pump Station to North Dartmouth Trunk Sewer by Crossing Lake Charles**

This is an option that had been investigated in the Dartmouth Cove Wastewater Management Study (CBCL, 2007) and was promoted as having potentially lower costs than crossing under the Shubenacadie Canal. Halifax Water investigated this option, and made the decision in September 2016 that it was not feasible from an access and maintenance perspective. This option was therefore not pursued further.

2. Reroute Flow from 390 Waverley Road Pump Station to North Dartmouth Trunk Sewer

The capacity analysis revealed that the 200 Waverley Road Pump Station is also under capacity and that several sections of wastewater pipes upstream of the 200 Waverley Road Pump Station are very close to capacity. The capacity analysis was based on published flow calculations in the Halifax Water Design Specification for water, wastewater and stormwater systems 2017 which include a 1.25 safety factor. It is recommended that the 390 Waverley Road Pump Station forcemain be rerouted to the NDTS west, across the Shubie Canal to the North Dartmouth Trunk Sewer on Highway 118.

Redirection of the flow will mean that the 200 Waverley Road Pump Station will not receive flows from proposed Contribution Areas 1-3. Furthermore, the area to be rerouted to the North Dartmouth Trunk Sewer represents 30.2% of the existing sewershed (hatched in Figure 15: Proposed Rerouting of Flow from 390 Waverley Road Pump Station to North Dartmouth Trunk Sewer), which means that approximately 30% of the flows to the 200 Waverley Road Pump Station will be relieved. This decrease in flows will largely offset the additional flow from Contribution Area 4, which will connect at Stanfield Avenue (downstream from the Pump Station at 390 Waverley Road) and will flow to the 200 Waverley Road Pump Station.

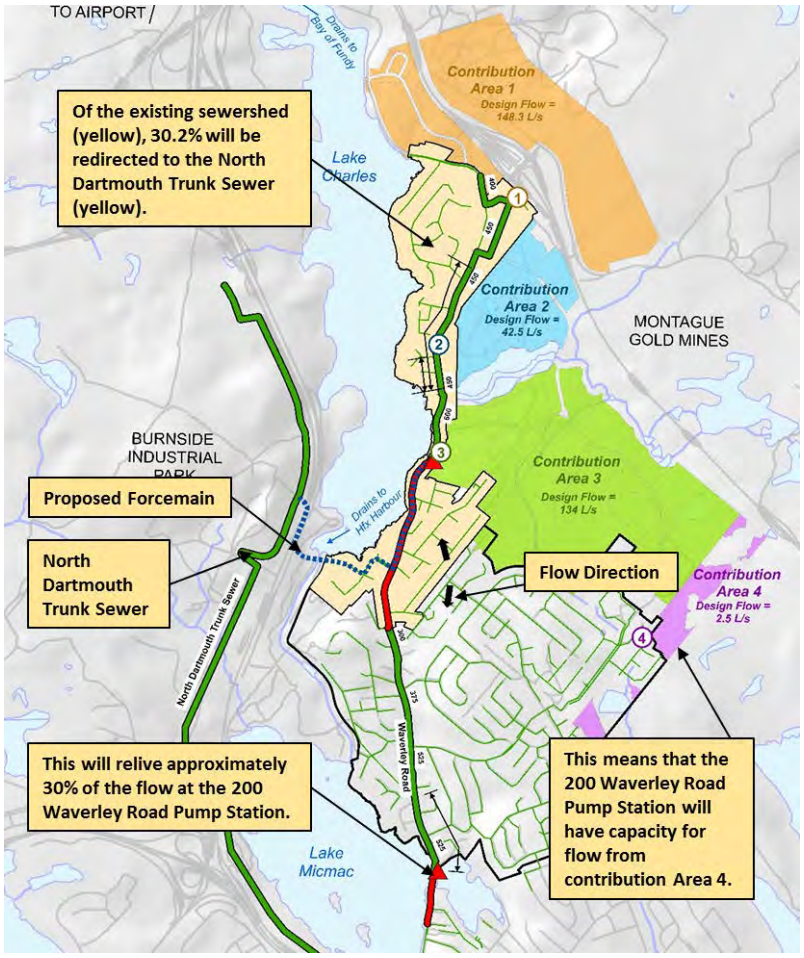


Figure 15: Proposed Rerouting of Flow from 390 Waverley Road Pump Station to North Dartmouth Trunk Sewer

Previous studies have proposed this diversion (e.g. Dartmouth Cove Wastewater Management Study, CBCL Limited, 2007) and have verified that the North Dartmouth Trunk Sewer has capacity to receive wastewater flows from the proposed Port Wallace development (Regional Wastewater Functional Plan, CBCL Limited, 2012).

The upgrade and rerouting of the 390 Waverley Road Pump Station are shown as Phase 1 in Table 5. The table shows that there is 0 l/s remaining capacity and that the upgrade must be completed prior to any development in the Port Wallace Contribution Areas.

3. Upgrade 390 Waverley Rd PS, Upgrade 1.4km of pipe and Upgrade 200 Waverley Road PS

This third option is also potentially feasible and needed to be investigated. Its benefits are that the construction will be simpler and only require an upgrade to existing components, as opposed to acquiring new easements through land owned by the Province and conducting delicate construction work under a river and through a highway. Permitting will be made simpler as well.

The significant drawback of this option is that it involves a very large amount of upgrade work: in addition to upgrading the 390 Waverley Road pumping station (and associated forcemain), the gravity pipe will need to be replaced along 1.4km Waverley Road, and the 200 Waverley Road pumping station (and associated forcemain) will need to be upgraded as well. This is a significantly larger amount of work and its costs far exceed that of option 2.

3.4 Wastewater System Upgrade Cost Sharing Mechanisim

When considering the cost of upgrades, it would be fair to assume that the portion of cost carried by each developer should be equivalent to the gross catchment area that each developer contributes to the system

Another consideration for cost sharing is that the proposed forcemain will cross the Shubenacadie Canal, since a canal crossing may also be required for water, gas and other utilities. The potential for a cost sharing mechanism between these projects should be explored as dates and timelines for each become solidified.

The development of Port Wallace will increase demand on the sanitary system. This will therefore increase operational costs such as pumping demands at lift stations. It is anticipated that these costs will be borne by Halifax Water.

Chapter 4 Stormwater

No stormwater elements have been identified which are considered to warrant capital cost contribution or shared developer cost.

There are several pipes and/or drainage courses which enter the study area from lands upstream. It is the responsibility of each land owner to manage the stormwater on their property. If the mechanism for stormwater conveyance is altered, the developer is responsible to ensure that pre and post development flows are maintained. For example, if stormwater currently flows overland or in a ditch and the developer requests a change to a hard pipe sewer system, some form of stormwater control system would likely be required to offset the reduced time of concentration.

The proposed Port Wallace development area is located within the Lake Charles watershed on the east side of the lake as shown in Figure 16. All stormwater runoff from the proposed development area is currently discharged into Lake Charles, while a portion of the development area first drains into a major watercourse referred to as Barry's Run. Since Lake Charles is a headwater lake that flows in two directions, impacts to water quality or quantity in the lake from the proposed development would be distributed to several other lakes already experiencing the effects of urbanization, and would cascade downstream in a cumulative manner. This is of concern since Fletcher's Lake is a source of drinking water in HRM, and the Shubenacadie River is the source of drinking water to Enfield (Municipality of East Hants), with many individual users drawing their drinking water directly from the river. It is emphasized that the historic gold mining operations and other past uses of the area have resulted in contamination of the soil. Further information can be obtained in the references noted below, as well as the technical appendix to this document. Following the recommendations for stormwater management will be critical to prevent further impacts.

Flooding risks are also a clear concern of a very sensitive nature in the Shubenacadie River system through the Municipality of East Hants, as well as through downtown Dartmouth and the Sullivan's Pond area residents. Protecting Lake Charles and the downstream lakes is further emphasized by the cultural significance and recreational use of the lakes. According to the Shubenacadie Lakes Subwatershed Study (AECOM, 2012), additional water quality objectives should therefore be implemented for the Port Wallace development, including a "no net export of phosphorous" objective. Thus, stormwater management for the Port Wallace development is critical and will require a specific plan to address those issues.

Additional references:

Land Suitability Analysis - Port Wallace Secondary Planning Study Area, WSP, February 23, 2016

Version 4.0Historical gold mining, Montague area, Halifax County, Nova Scotia. P. K. Smith & T. A. Goodwin.

N. S. Department of Natural Resources Open File Map 2009-1, Sheet 28, 200

(http://novascotiagold.ca/theme/exploitation_de_lor-mining/montague-eng.php)

Abandoned escape shaft on the Skerry Mine, Montague Gold District

http://www.novascotia.ca/nse/contaminatedsites/docs/goldminetailingpics.pdf

[1] Nova Scotia Department of Environment, "Historic Gold Mine Tailings".

Accessed Sept 07, 2017. <https://novascotia.ca/nse/contaminatedsites/docs/faq-goldminetailings.pdf.>

Parker, S., McNabb, D, Hartling, P., O'Rielly, G., Skilliter, D. "Consequences of Historical Mining." Virtual Museum of Canada.

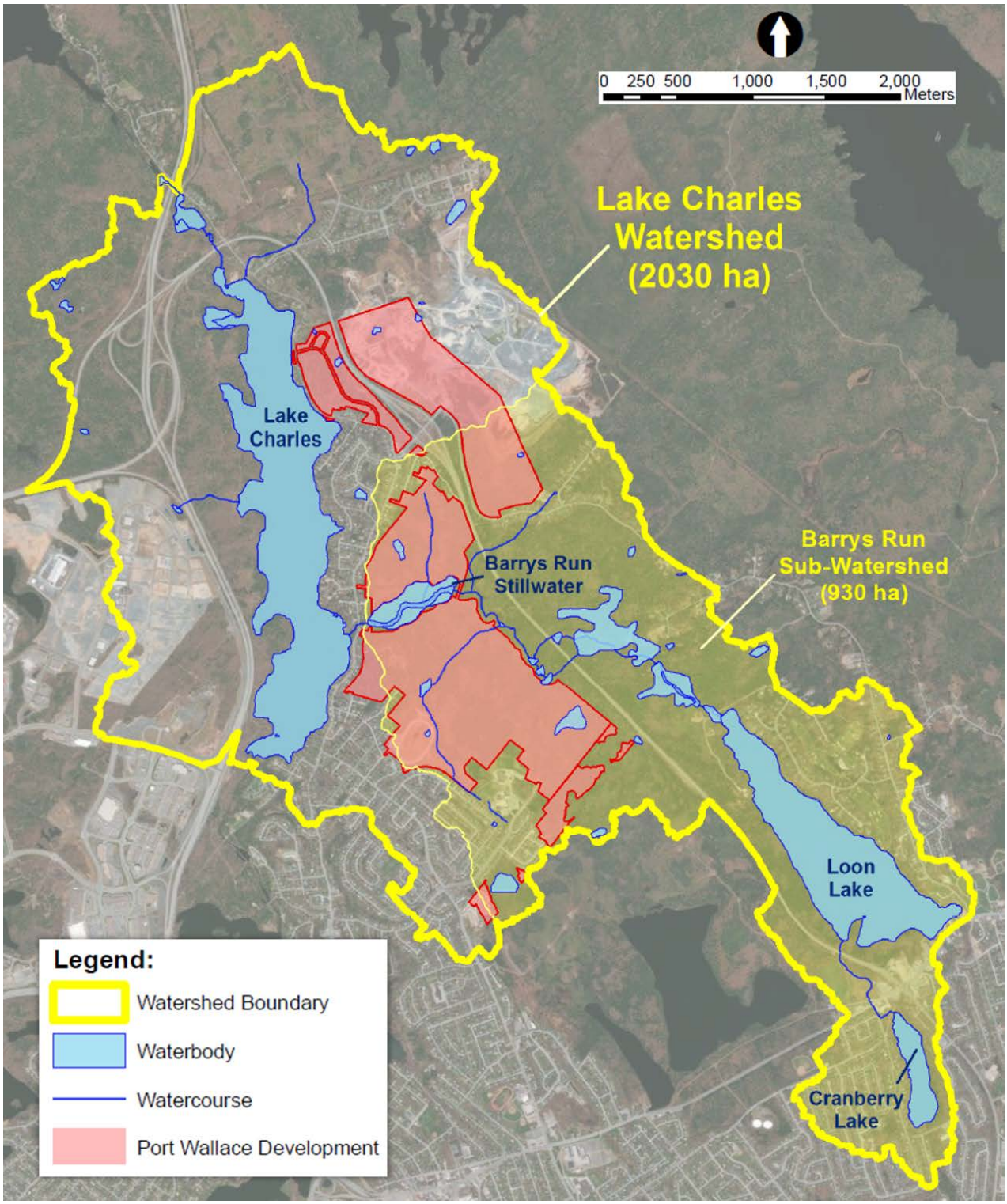


Figure 16: Lake Charles and Barry's Run Watershed Delineation

The use of LID for the Port Wallace development instead of conventional retention ponds will allow for stormwater to infiltrate with a similar amount to pre-development conditions, which will help maintain existing runoff volumes, as well as peak flows, and protect the water quality of the runoff discharged to Lake Charles.

While Halifax Water currently requires all new development to maintain pre-development peak flow rates for stormwater runoff, there are no existing requirements for controlling runoff volumes, which can also increase lake levels (and therefore in this case increase peak flows downstream), erosion risks and resuspension of sediment (that may include contamination) if they are not maintained. Meeting the Halifax Water requirements in this system will therefore entail runoff volume control, which is not provided by detention ponds. Suitable potential stormwater management approaches may include runoff source control practices that aim to mimic the natural hydrology of the watershed, providing water quality treatment and infiltration. This approach to stormwater management is commonly referred to in Canada and the USA as Low Impact Development (LID), Stormwater Best Management Practices (BMPs) or using Green Infrastructure (GI), and are infiltration-based. The use of LID techniques for the Port Wallace development will allow a similar amount of stormwater to infiltrate as during pre-development conditions, which will help maintain existing runoff volumes, peak flows, and protect the water quality of the runoff discharged to Lake Charles.

The proposed Port Wallace development area contains several small watercourses, marshes, swamps and bogs, as well as a major watercourse that discharges to a fen wetland. The major watercourse is referred to as Barry's Run, and the fen wetland is referred to as Barry's Run Stillwater or Summit Reservoir. This reservoir is potentially contaminated due to historic gold mining operations and is also a component of the Shubenacadie Canal System National Historical Civil Engineering Site. Any impacts to the current hydrology, water quality and structure of the reservoir should therefore be avoided due to the risk of contamination as well as its cultural significance. Preservation of the Barry's Run Stillwater can be achieved using LID practices in the upstream development drainage area that achieve the effect of mimicking the natural pre-development hydrology of the watershed.

4.1 Barry's Run Stillwater

According to the Land Suitability Assessment: Port Wallace Secondary Planning Study Area (WSP, 2017), one of the major natural corridors and cultural assets within the proposed Port Wallace development area is the Barry's Run Stillwater or Summit Reservoir. Barry's Run was identified by the Land Suitability Assessment as containing contaminated soils that originate from historic gold mining that are hazardous to human health. The Land Suitability Assessment also states that development in the Barry's Run Stillwater site is "totally constrained" from a cultural assets standpoint due to it being a National Historic Civil Engineering Site, whereas the dam area of the reservoir is expected to become a Registered Archaeological Site by Special Places upon submission of Maritime Archaeological Resource Inventory forms. Furthermore, the Land Suitability Assessment recommends for Barry's Run to be a central open space that provides active and passive recreational activities for the community, and local residents have identified Barry's Run as a significant cultural landmark that possesses intrinsic cultural beauty and value. The Shubenacadie Canal Commission has also expressed concern for the preservation of the dam, and an archaeological assessment carried out by CRM Group in 2014 recommended that no ground disturbance occur within a 10 m buffer of the dam extension.

The existing hydrology and water quality of the Barry's Run Stillwater should therefore be maintained under future development conditions to prevent ground disturbance and preserve the cultural asset.

Increased runoff volumes discharged to the reservoir from future development could increase erosion, disturb contaminated soils, damage existing wetland plants and/or damage the existing dam, and therefore should not be allowed.

Conventional stormwater flow control measures (retention ponds) do not adequately control runoff volumes or water quality since they do not infiltrate stormwater, and they also tend to concentrate pollutants. Thus, source control LID stormwater practices are recommended and may be required for future upstream development to maintain the existing peak flows, runoff volumes and water quality of the runoff discharged to Barry's Run from both private properties and the road right-of-way.

There has been some discussion on the use of Barry's Run Stillwater as a stormwater retention pond for the proposed Port Wallace development. However, due to the above environmental and cultural concerns, it is our recommendation that Barry's Run Stillwater not be converted into a stormwater retention pond. Furthermore, stormwater treatment would still be required upstream of the pond, as the pond would not provide adequate phosphorous treatment.

4.2 Halifax Water Requirements

Stormwater management design will be required to follow the most up-to-date version of the Halifax Water Design Specification for Water, Wastewater and Stormwater Systems (2017). A summary of the key requirements from these standards are as follows:

- → The minor system shall convey the 1 in 5 year storm and the major system shall convey the 1 in 100 year storm event;
- → A stormwater management plan shall be submitted containing design criteria for 1 in 5, 10, 25, 50 and 100 year storm events; and,
- → Peak pre-development runoff rates shall be maintained for the 1 in 2, 1 in 5, 1 in 10 and 1 in 100 year storm events.

It is noted that to adhere to this requirement, this will include no increased risk of flooding in the downstream watersheds. As noted above, this can only be achieved through measures that maintain the current infiltration volumes, such as some LID or green infrastructure.

4.3 Nova Scotia Environment Requirements

Nova Scotia Environment (NSE) currently requires the following for stormwater management in the province:

- → Pre-development peak flows must be maintained under post-development conditions for up to the 1 in 5 year storm event; and
- → For the 1 in 5 year to 1 in 100 year storm events, peak flows cannot creating flooding or cause physical damage to property or structures down gradient of the development site. NSE will accept +/- 10% allowance when balancing pre/post development flows, except where pre-existing flooding conditions exist.

Since the current NSE regulatory requirements for stormwater management are less strict than those imposed by Halifax Water, following Halifax Water specifications will ensure that the NSE regulations are also met.

4.4 Summary of Stormwater Design Criteria for Port Wallace

The following is a summary of the stormwater design criteria required by this Master Plan for the proposed Port Wallace development.

Runoff needs be controlled at its source to prevent accumulation and therefore erosion risks, which precludes the use of detention ponds. Surface water has the potential to put contaminated sediments in suspension and therefore water needs to be infiltrated to prevent an increase in volume, and the use of plant material for filtration and uptake of metals should be encouraged wherever possible.

1. Maintain 1 in 2 year, 1 in 5 year, 1 in 10 year and 1 in 100 year pre-development peak flows and runoff volumes at any discharge point from the development area as well as any point downstream;
2. Preserve the Barry's Run Stillwater as it is unsuitable for stormwater management;
3. Achieve no increase in phosphorous in stormwater runoff by using LID for stormwater management with enhanced nutrient reduction methods;
4. Eliminate the use of detention ponds and promote runoff control at its source;
5. Promote biodiversity and the use of plant material for filtration and uptake of metals, implement wetland and riparian buffer of 20 metres for all development;
6. Include LID stormwater management infrastructure on both private properties and within the road right-of-way; and
7. Encourage the use of LID systems that enhance biodiversity, carbon sequestration, filtration and treatment of other pollutants than phosphorous, notably sediment, nitrogen and substances of concern in the area.

Chapter 5 Potable Water and Fire Suppression

The proposed Port Wallace Development extends from Avenue du Portage north to lands adjacent to Spider Lake Road on both sides of the Forest Hills Parkway, Highway 107. The development falls adjacent to the Burnside High Water Pressure Zone with existing ground elevations ranging from a low of 40 m (130 ft) to a high of 85 m (279 ft). The Burnside High Zone forms part of the East Region Water system which is primarily supplied with water by the Lake Major Water Treatment Plant (WTP).

Where existing infrastructure was found deficient, possible system upgrades necessary to service the development while maintaining the existing level of service today have been identified.

The Lake Major WTP supplies the East Dartmouth Region through a 1,050 mm (42”) diameter water transmission main to the Topsail control chamber located at Topsail Lake near Main Street in Dartmouth. From the Topsail chamber, water flows either to the Mount Edward Reservoirs or the Burnside High Zone. The 1,050 mm (42”) main continues parallel to Main Street to an interconnection at the former Lake Lamont Pump Station. The interconnection is connected to the Burnside High zone through an existing 600 mm (24”) diameter water feedermain starting at Lake Lamont and follows Caledonia Road west to Shubie Park then south along Highway 111 to Ilsley Avenue in Burnside. The Akerley Reservoir floats on the Burnside High Zone and is connected to the zone with a 600 mm (24”) diameter main.

This study is intended to establish the minimum water and fire flow service requirements necessary to achieve the Halifax Water design specification within the Port Wallace development. The addition of Port Wallace to the water system will increase water demands. As a result, an analysis of the existing infrastructure has been carried out to understand the impacts of the additional demand. Where existing infrastructure was found deficient, possible system upgrades necessary to service the development, while maintaining the existing level of service, have been identified.

5.1 Port Wallace

Proposed Port Wallace land use and master plans were used to establish likely pipe line routes to service the development. Local distribution mains are assumed to be 200 mm diameter and 300 mm diameter. Through iteration, the pipe size along the Avenue du Portage Extension was established for the development to ensure a suitable level of service for the entire study area.

Assumed potential points of connection to the existing Burnside High Zone are as follows:

→ Existing 600 mm diameter transmission main at intersection of Caledonia Road and Avenue du Portage;
→ Existing 350 mm diameter at 420 Waverley Road;
→ Existing 350 mm diameter at the intersection of Applewood Lane and Waverley Road;
→ Existing 350 mm diameter at 733 Waverley Road;
→ Existing 350 mm diameter at 804 Waverley Road;
→ Existing 300 mm diameter at Marjorie Ann Drive; and
→ Existing 200 mm diameter mains at the end of White Street and Belvedere Dr. and the intersection of Lexington Avenue and Rosecroft Drive.

5.2 Water System Analysis

The water system analysis follows the Halifax Water Design Specifications for Water, Wastewater & Stormwater, 2017 Edition, to establish a desired level of service, including water consumption, fire flows and peaking factors. For the purposes of the study, Halifax Water provided a copy of the water model understood to be representative of the system to 2017. WaterCAD V8i (SELECTSeries 6) was used to model current conditions, future background growth and the addition of Port Wallace. Meetings between Halifax Water and CBCL were held to develop an understanding of current system operation. The outcome from the meetings helped establish the design constraints for evaluating the impact of future growth within the Port Wallace study area and background growth to the existing system.

In addition to the meeting with Halifax Water, CBCL has reviewed previous reports and memos pertaining to the East Region Water System:

→ East Region (Dartmouth) Water Infrastructure Master Plan (July 1999) - Final Report, CBCL Limited;
→ Cost of Servicing Plan, Regional Planning Greenfield Sites (February 2009) - Final Report, CBCL Limited; and
→ Port Wallace: Municipal Services, Pre-Design Baseline Report, September 8 2014, Halifax Water.

Following the issue of the report on November 6, 2017 a meeting was held with stakeholders to review assumptions made in the report. Conrad has confirmed that the maximum service elevation for lands north of Highway 107 is to be 70 m (229 ft). The analysis was redone taking into consideration the revised service elevation.

Subsequent to the stakeholder meeting, a second meeting with Halifax Water and CBCL was coordinated. Discussions during the meeting confirmed that Halifax Water does not intend to establish a reduced pressure zone for the Port Wallace development. However, a reduced zone may be established in the future to address high pressures along Waverley road. Therefore, the analysis should consider an impact to the development should a reduced zone be established in the future.

5.3 Water Demands

CBCL reviewed historical water consumption records. The 99.5 percentile of daily water consumption from 2015 to 2017 was defined as the baseline maximum day demand (MDD) for the study. Port Wallace and background growth water demands have been established based on the background and development growth established in Chapter 1.

Port Wallace water demands have been developed in accordance with Halifax Water Design Specification and are a function of equivalent domestic population with a design average consumption of 410 L/cap/day. Maximum day and minimum hour peaking factors have been calculated based on a weighted average of the land uses. Land use populations have been established as follows, and are shown in Table 6:

→ Domestic:
→ Single Unit: 3.35 people / unit;
→ Semi-detached and Townhouse: 3.35 people / unit;
→ Multi-Unit: 2.25 people per unit;
→ Commercial & Industrial: 45 people / hectare;

→ Institutional; and
→ School: 115 L/student/day (Assumed 1000 students).

Table 6: Port Wallace Design Demands

Water Demand (MLD)	Residential		Comm.	Ind.	Inst.
	Single/ Town House	Multi-Unit			
Average Day Demand (ADD)	2.1	2.1	0.1	1.7	0.1
Maximum Day Factor	1.65	1.3	1.1	1.1	1.1
Maximum Day Demand (MDD)	3.5	2.7	0.1	1.9	0.1
Minimum Hour Factor	0.7	0.84	0.84	0.84	0.84
Minimum Hour Demand (Min HD)	1.5	1.8	0.1	1.4	0.1

Summary of Total Port Wallace Design Demands:
→ Average Day Demand: 6.1 MLD;
→ Maximum Day Demand: 8.1 MLD;
→ Weighted Maximum Day Factor: 1.33;
→ Minimum Hour Demand: 4.8 MLD; and
→ Weighted Min Hour Factor: 0.79.

The East Region maximum day demands under existing conditions and the study horizon are summarized in Table 7.

Table 7: East Region Maximum Day Demand

Demand Allocation Area	Baseline Year	15 year Horizon 2032	30 Year Horizon 2047
East Region MDD (excluding Port Wallace)	42.3 MLD	47.3 MLD	52.9 MLD
Port Wallace MDD	-	4.2 MLD	8.2 MLD
Total East Region MDD	**42.3 MLD**	**51.5 MLD**	**61.1 MLD**

Fire Flow requirements are based on the established Halifax Water Design Specification estimated flows and durations:
→ Domestic;
→ Single Unit: 3,300 L/min for 1.5 hours;
→ Semi-detached and Townhouse: 4,542 L/min for 1.75 hours;
→ Multi-Unit: 13,620 L/min for 3 hours;
→ Commercial & Industrial: 13,620 L/min for 3 hours; and
→ Institutional: 13,620 L/min for 3 hours.

The system should be capable of achieving the desired fire flow for the given land use while maintaining a minimum of 22 psi throughout the system. The above fire flow requirements are guidelines for the purposes of evaluating the system capacity only. Fire Underwriters Survey calculations have not been undertaken at this time.

5.4 Existing East Region Operation

The Mount Edward Reservoirs and the Burnside High Zone are on the same maximum Hydraulic Grade Line (HGL) of 119 m (390 ft). Water is supplied to either the Mount Edward Reservoirs or the Burnside High Zone utilizing the Topsail control chamber. Under typical operation, flow is controlled by Halifax Water to direct water to either the Mount Edward Reservoirs or to the Burnside High Zone or both at the same time. Under a fire flow scenario, it is assumed that water supply from the Lake Major WTP is unavailable, however, the Mount Edward Reservoirs can backfeed and supply the Burnside High Zone. Under these scenarios, it was assumed the Mount Edward Reservoirs are at 115.8 m (380 ft).

The Akerley Reservoir water level varies daily and has a maximum level of 119 m (390 ft) to a low of 115 m (375 ft) and is always available to supply water. For the purposes of the hydraulic analysis, the Akerley Reservoir HGL was assumed to be 115.8 m (380 ft) under all scenarios.

5.5 Hydraulic Modelling Results

A number of model scenarios were generated to establish existing conditions, and impact of future growth, with and without the addition of Port Wallace.

5.5.1 Transmission System Considerations

The model shows that under both current and future maximum day conditions, the Lake Major WTP can supply the Eastern Region system the required maximum day demand while maintaining the Akerley and Mount Edward Reservoirs at the Full Service Level (FSL) of 119 m (390 ft). These results were validated with historical data recorded by the Halifax Water SCADA system. Therefore, the existing transmission system appears sufficient to service the Port Wallace development and regional updates do not appear to be required.

5.5.2 Port Wallace Storage Requirements

The Port Wallace potable water storage requirements are established in accordance with the Atlantic Canada Guidelines for Supply, Treatment, Storage, Distribution and Operating of Drinking Water Supply systems and are a function of MDD and Fire Flow requirements. A summary of the water storage requirements is shown in Table 8.

Table 8: Water Storage Requirements

Item	Requirement
Fire Storage	Required fire flow over required duration (as per IAO – FUS Guidelines and/or as established by the Community's Regulators)
Peak Balancing Storage	25% of maximum day demand
Emergency Storage	25% of fire storage plus peak balancing storage OR 15% of projected average daily design flow

The water storage requirements for Port Wallace are calculated assuming development occurring over a 30 year horizon MDD and a 13,620 L/min fire flow resulting in a required storage volume of 5.7 ML (1.25 MIG).

The primary water storage for the Eastern Region is the Mount Edward Reservoirs at 45 ML and Akerley Reservoir with 36 ML for a total of 81 ML. The total required volume for the Eastern Region for the 30 year

horizon, including Port Wallace and allowing for two fire flow volumes, is 27.2 ML based on the above calculation. Alternatively, storage equivalent to an average day demand may be desirable from an operational perspective. The 30 year ADD is 47.1 ML which is less than current storage volume. Therefore, the total existing storage volume in the Eastern Region appears sufficient for the 30 year demand horizon including the proposed Port Wallace development.

The Akerley Reservoir has sufficient emergency and fire volume storage for future demands. However, peak balance is restricted to the top 4.57 m (15 ft) of the tank and represents a volume of 9 ML. The 30 year demand attributed to the Akerley Reservoir is 32.8 MLD which results in a required peak balance volume of 8.2 ML. Therefore, the Akerley Reservoir has sufficient volume for future growth including Port Wallace.

5.5.3 Port Wallace Internal Distribution

Water distribution mains within Port Wallace are assumed to follow proposed rights-of-way. A new primary watermain to connect the 600 mm diameter Caledonia Road feedermain(s) appears necessary to service the entire development. This primary watermain will also provide redundancy to the exiting 350 mm watermain on Waverley Road. The existing 300 mm diameter watermain along Avenue du Portage is not sufficient to satisfy fire flow requirements at the ends of the development. Therefore, it is assumed that a new watermain paralleling the existing will connect at Caledonia Road and be extended along Avenue du Portage, across Barry's Run and terminating at the existing 350 mm diameter Waverley Road watermain. A primary watermain leg off the Avenue du Portage main to connect to the Conrad Lands north of Highway 107 will also be required. This leg is assumed to connect to the existing 400 mm diameter main crossing Highway 107. All Conrad Lands north east of Highway 107 are understood to be light industrial. It is assumed that the watermain will be looped within Conrad lands with a connection to the existing 300 mm watermain on Marjorie Ann Drive providing a secondary connection.

A new primary watermain to connect the 600 mm diameter Caledonia Road feedermains will be necessary to service the entire development.

Utilizing existing contour information, it would appear that elevations within Port Wallace and along Waverley Road will result in pressures exceeding Halifax Water Design Specification maximums. Halifax Water's preference is to not affect the current level of service for existing customers along Waverley Road and would approve pressures exceeding the maximum pressure range for the Port Wallace development. Halifax Water noted that a pressure zone may be created in the future to address these high pressures and such a zone would not be tied to the development. For the purposes of the analysis, the reduced pressure zone was assumed to have a HGL of 103.6 m (340 ft). The primary watermain within Port Wallace would be excluded from a future zone.

It is understood that construction of Avenue du Portage may precede the initial phases of the development and it assumed that the primary watermain will be constructed at this time. Therefore, construction of the primary watermain may not be driven by buildout of the development. Conrad Lands south of Highway 107 can be serviced off the Waverley Road main.

The modelling shows that the primary watermain along Avenue du Portage should be a minimum of 400 mm diameter to provide an adequate level of service under a fire flow scenario to the proposed Port Wallace development. This primary watermain would also connect to the Conrad lands north of Highway 107. This primary watermain size appears to satisfy hydraulic constraints with or without regional feedermain twinning and/or with or without a future pressure zone. Note that should a pressure zone be implemented in the future,

it appears necessary for local watermain upgrades from 350 mm to 400 mm on Waverley Road from Avenue du Portage connection to the future Conrad Land Connection at 805 Waverley Road. It is assumed that the local watermain upgrades would be covered by Halifax Water under the implementation of the reduced pressure zone should that proceed in the future.

5.5.4 Hydrant Flow Testing Review

Hydrant flow testing was undertaken by Risk Management Services in May of 2016 and provided to CBCL by Port Wallace Holdings Ltd. A summary of the hydrant flow testing results and model outputs as shown in Table 9. The model outputs are based on an assumed Akerley reservoir level of 119 m (390 ft) and the Topsail Feed to the Burnside High Zone closed. System demands were modeled at 50% of current Maximum Day Demand. It would be recommend to collect the data recorded by the Halifax Water PI system during the flow testing to establish the actual baseline conditions at the time of the Hydrant flow testing. However, this is outside of the scope of this study.

Table 9: Hydrant Flow Testing and Model Output

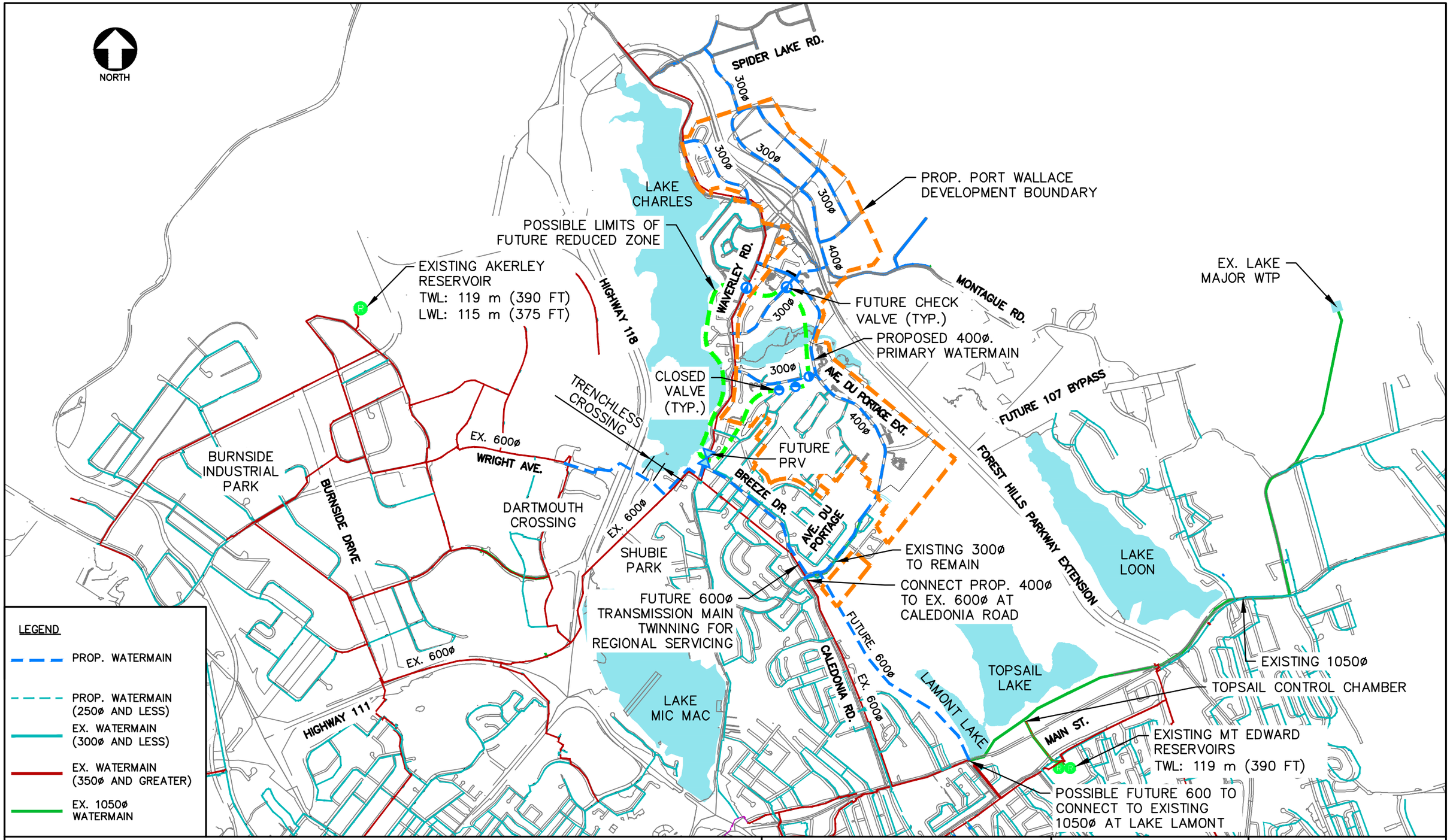
Item	Hydrant Flow Testing			Model Output	
Test #	Flow (L/min)	Static (Pre-test) Pressure (psi)	Residual Pressure (psi)	Static (Pre-test) Pressure (psi)	Residual Pressure (psi)
1	8,750	100	76	99	67
2	6,210	108	99	106	92
3	5,900	100	85	98	89
4	6,820	67	50	72	55
5	6,740	70	56	75	38
6	6,815	68	52	67	43
7	6,360	50	42	52	43

5.6 Water System Analysis Summary

The water system analysis is summarized as follows:

- → The existing Eastern Region water transmission system has sufficient capacity to service future growth, including Port Wallace. Regional upgrades are not required.
- → The existing Eastern Region water service area appears to have sufficient water storage considering the 30 year horizon, including the Port Wallace development;
- → Halifax Water may implement a reduced pressure zone for the low lands along Waverley Road in the future, however, the related infrastructure would not be tied to the development. The primary watermain along Ave du Portage Extension would not fall within the reduced pressure zone.
- → Halifax Water has approved pressures within Port Wallace to exceed design specification maximums;
- → The maximum service elevation within the Conrad Lands north of Highway 107 was confirmed by the developer to be no greater than 70 m (229 feet); and
- → The Port Wallace development can be adequately serviced with a 400 mm diameter primary watermain along the Avenue du Portage Extension.

Refer to Figure 17 for the Port Wallace water system master plan considered in the analysis.



CBCL LIMITED
Consulting Engineers

HALIFAX

PORT WALLACE MASTER PLAN
INFRASTRUCTURE STUDY

WATER SYSTEM MASTER PLAN

PROJECT NO.: 171013.00
DATE: JULY 2017

FIGURE
17

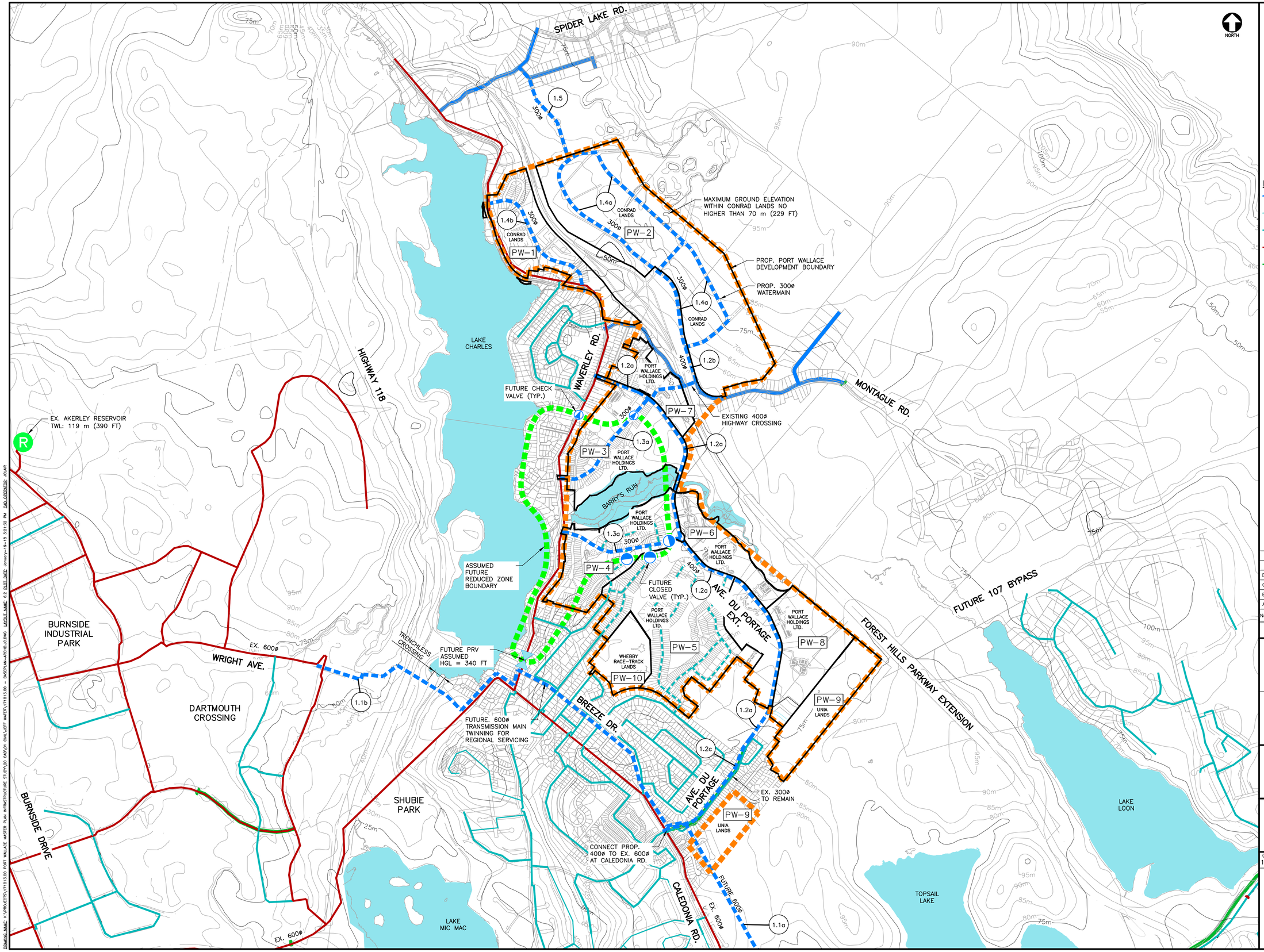
5.7 Water System Cost Sharing Mechanisim

The key infrastructure that is recommend for the Port Wallace development is identified on Figure 18 and summarized in Table 10. A proposed cost sharing mechanism along with infrastructure triggers have also been identified.

Estimates for key infrastructure have been included in the Appendix E.

Table 10: Water Infrastructure Phasing and Cost Sharing Mechanism

Water Infrastructure Phasing	Development Trigger	Recommended Cost Sharing Mechanism	
		Municipal	Developer
1.1a – 600 mm diameter Water Transmission Main (Lake Lamont to Ave du Portage)	Regionally Driven	100%	0%
1.1b – 600 mm diameter Water Transmission Main (Ave du Portage to Burnside)	Regionally Driven	100%	0%
1.2a - 400 mm diameter Primary Watermain along Ave du Portage	Construction of Ave du Portage Extension	0%	100% Developer Cost-Shared
1.2b - 400 mm diameter Primary from Ave du Portage to Conrad Lands	Development of PW-2 Lands	0%	100% Developer Cost-Shared
1.2c - 400 mm diameter from Caledonia Road to parallel existing 300 mm	Construction of 1.2a	0%	100% Developer Cost-Shared
1.3a – 300 mm diameter Mains from Waverley Road (base cost for developer)	0 – 10%	0%	100% Developer Cost-Shared
1.4a – 300 mm Conrad Lands Looping (base cost for developer)	Development of PW-2 Lands	0%	100% Developer Cost-Shared
1.4b – 300 mm diameter off Waverley Road to service Conrad Lands (base cost for developer)	Development of PW-1 Lands	0%	100% Developer Cost-Shared
1.5 – 300 mm Diameter connection to Spider Lake Rd (base cost for developer)	Development of PW-2 Lands	0%	100% Developer Cost-Shared



LEGEND

- PROP. WATERMAIN (300ø & LARGER)
- PROP. WATERMAIN (250ø & LESS)
- EX. WATERMAIN (LESS THAN 350ø)
- EX. WATERMAIN (350ø & GREATER)
- EX. WATERMAIN (1050ø & GREATER)

No.	Description	Date	By
D	REVISED FOR REISSUED FINAL RPT	15 JAN/18	JAB
C	REVISED FOR FINAL REPORT	27 OCT/17	JAB
B	RE–ISSUED FOR FINAL DRAFT	30 AUG/17	JAB
A	ISSUED FOR DRAFT REPORT	16 AUG/17	JAB

Revision or Issue

HALIFAX

PORT WALLACE MASTER PLAN INFRASTRUCTURE STUDY

WATER SYSTEM MASTER PLAN

HALIFAX

CBCL LIMITED
Consulting Engineers

CBCL No	Contract No	Date	Scale
171013.00		AUG 2017	N.T.S.

Designed	Drawn
JC	BWM
Checked	Approved
	JAB

Sheet No 1 of 1

Drawing No 18

DRAWING NAME: K:\PROJECTS\171013.00 PORT WALLACE MASTER PLAN INFRASTRUCTURE STUDY\20 CAD\01 CIVIL\ARF WATER\171013.00 – BASEPLAN–ARCHD.JC.DWG LAYOUT NAME: 8.2 PLOT DATE: January–19–18 3:21:32 PM CAD OPERATOR: JCAIR

APPENDIX A – Baseline Turning Movements

Port Wallace Master Plan- Infrastructure Study
2017 Existing Volumes - AM Peak Hour (Total)

Note: Total volume includes lights, mediums, articulated trucks , and bicycles

Run ID 1

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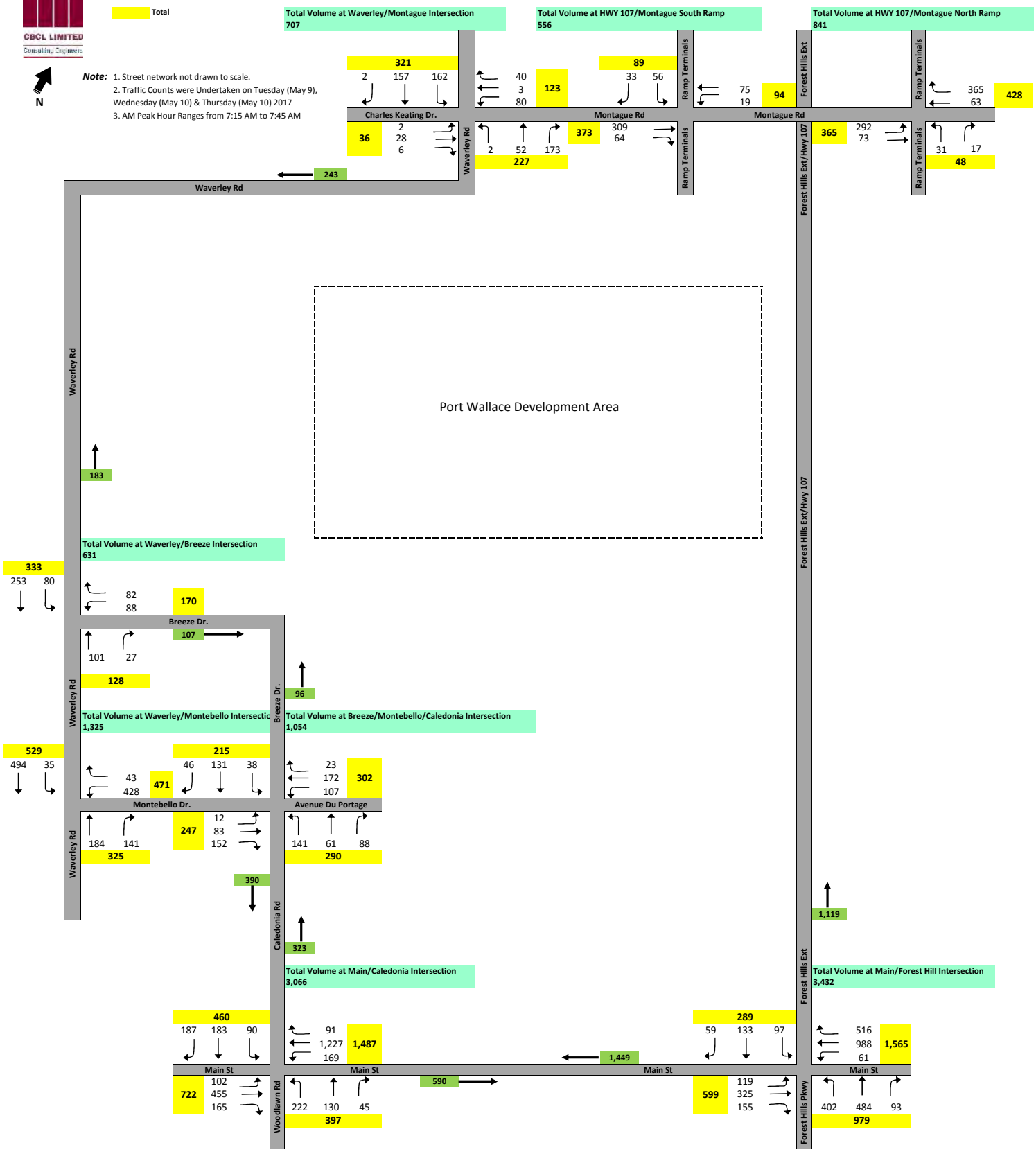
Total

Note:
1. Street network not drawn to scale.
2. Traffic Counts were Undertaken on Tuesday (May 9), Wednesday (May 10) & Thursday (May 10) 2017
3. AM Peak Hour Ranges from 7:15 AM to 7:45 AM

N



Port Wallace Master Plan- Infrastructure Study
2017 Existing Volumes - PM Peak Hour (Total)

Note: Total volume includes lights, mediums, articulated trucks , and bicycles

Run ID 2

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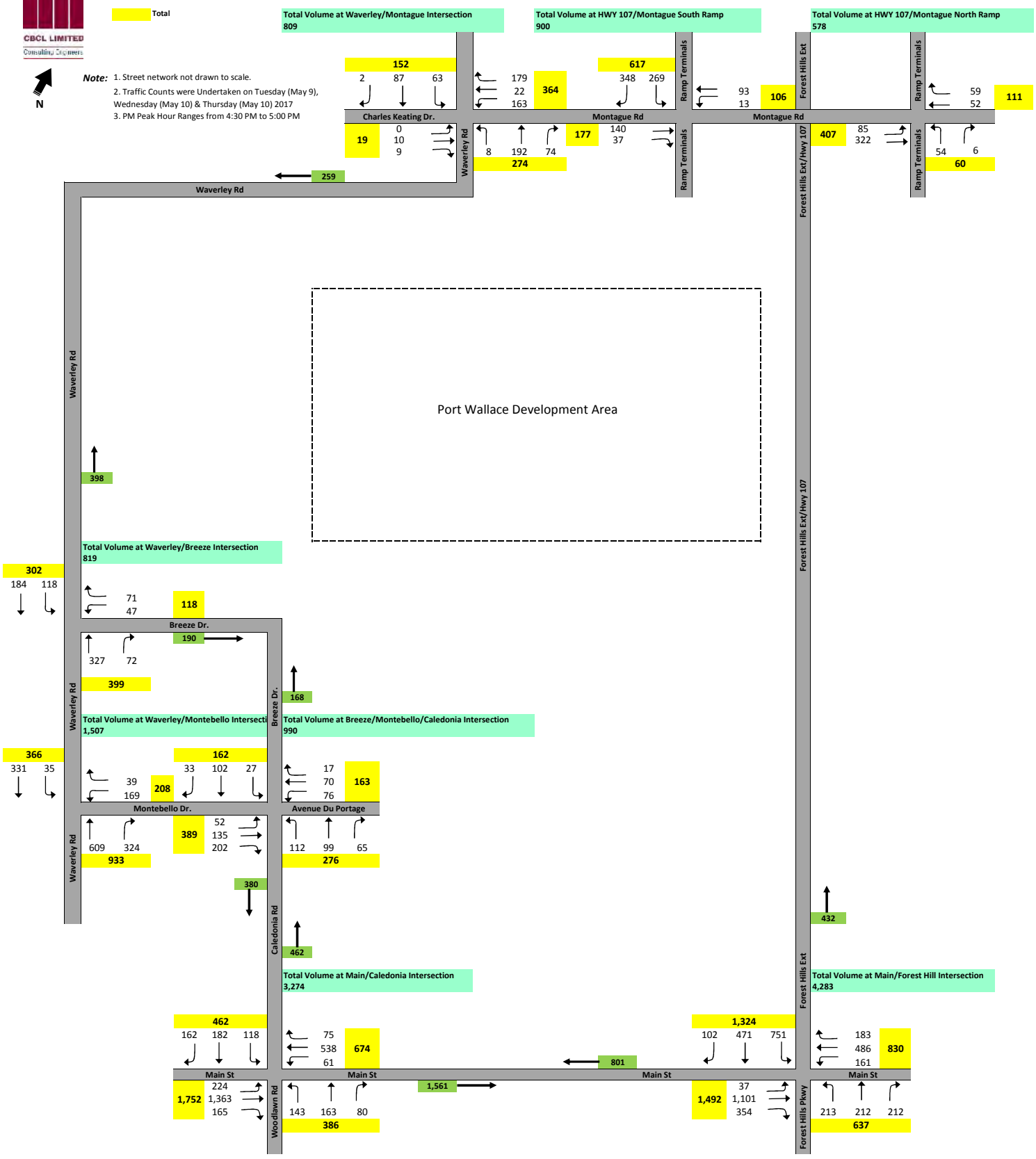
Total

Note:
1. Street network not drawn to scale.
2. Traffic Counts were Undertaken on Tuesday (May 9), Wednesday (May 10) & Thursday (May 10) 2017
3. PM Peak Hour Ranges from 4:30 PM to 5:00 PM

N



APPENDIX B – Trip Reduction Rates

Port Wallace Master Plan - Infrastructure Study - 171013.00
2031-Scene 1

Port Wallace Master Plan - Infrastructure Study (Residential-Single Unit)-Clayton						
ITE Land Use Code 210 (Single-family Detached Housing) pages 297 and 298						
987 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.75	25%	75%	186	556	**742**
PM Peak Hour of Adjacent Street	1.00	63%	37%	622	366	**988**

Port Wallace Master Plan - Infrastructure Study (Residential-Town House)-Clayton						
ITE Land Use Code 230 (Residential Condominium/Townhouse) pages 395 and 396						
176 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.44	17%	83%	14	65	**79**
PM Peak Hour of Adjacent Street	0.52	67%	33%	62	31	**93**

Port Wallace Master Plan - Infrastructure Study (Residential-Multi Unit)-Clayton						
ITE Land Use Code 220 (Apartment) pages 334 and 335						
1,582 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.51	20%	80%	162	646	**808**
PM Peak Hour of Adjacent Street	0.62	65%	35%	638	344	**982**

Port Wallace Master Plan - Infrastructure Study (Commercial)-Clayton						
ITE Land Use Code 820 (Shopping Center) pages 1562 and 1563						
152,000 sq.ft.	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.96	62%	38%	90	55	**146**
PM Peak Hour of Adjacent Street	3.71	48%	52%	271	293	**564**

Port Wallace Master Plan - Infrastructure Study (Institutional)-Clayton						
ITE Land Use Code 520 (Elementary School) pages 988 and 989						
37,674 sq.ft	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	5.20	56%	44%	110	86	**196**
PM Peak Hour of Adjacent Street	1.21	45%	55%	21	25	**46**

Port Wallace Master Plan - Infrastructure Study (Combined Trips)						
ITE Land Use Codes (as shown above)						
	Rate	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street				**562**	**1409**	**1971**
PM Peak Hour of Adjacent Street				**1613**	**1059**	**2673**
					Check	1971
						2673

Option 1

Anticipated Trip Reduction Category	**Trip Reduction Rates**	**Entering Trip Reductions in AM Peak Hour**	**Exiting Trip Reductions in AM Peak Hour**	**Entering Trips in AM Peak Hour after Reduction**				**Exiting Trips in AM Peak Hour after Reduction**				**Total Trips in AM Peak Hour after Reduction**
Internal Trips	10%	57	141	**407**				**1027**				
Walking/cycling mode share	3%	19	47	**Waverley-EW-53%**	**Waverley-NS-7%**	**Main St-40%**	**Forest Hills-0%**	**Waverley-EW-53%**	**Waverley-NS-7%**	**Main St-40%**	**Forest Hills-0%**	
Transit mode share	7%	38	94	**216**	**29**	**163**	**0**	**545**	**72**	**411**	**0**	**1436**
Retired residents	2%	12	29									
Working from home	5%	29	71									
Total	**27%**	**155**	**382**									

Anticipated Trip Reduction Category	**Trip Reduction Rates**	**Entering Trip Reductions in PM Peak Hour**	**Exiting Trip Reductions in PM Peak Hour**	**Entering Trips in PM Peak Hour after Reduction**				**Exiting Trips in PM Peak Hour after Reduction**				**Total Trips in PM Peak Hour after Reduction**
Internal Trips	10%	162	106	**1175**				**771**				
Walking/cycling mode share	3%	54	36	**Waverley-EW-53%**	**Waverley-NS-7%**	**Main St-40%**	**Forest Hills-0%**	**Waverley-EW-53%**	**Waverley-NS-7%**	**Main St-40%**	**Forest Hills-0%**	
Transit mode share	7%	108	71	**623**	**83**	**471**	**0**	**409**	**54**	**309**	**0**	**1949**
Retired residents	2%	33	22									
Working from home	5%	81	53									
Total	**27%**	**438**	**288**									

Option 1A

Anticipated Trip Reduction Category	**Trip Reduction Rates**	**Entering Trip Reductions in AM Peak Hour**	**Exiting Trip Reductions in AM Peak Hour**	**Entering Trips in AM Peak Hour after Reduction**				**Exiting Trips in AM Peak Hour after Reduction**				**Total Trips in AM Peak Hour after Reduction**
Internal Trips	10%	57	141	**407**				**1027**				
Walking/cycling mode share	3%	19	47	**Waverley-EW-50%**	**Waverley-NS-7%**	**Main St-38%**	**Forest Hills-5%**	**Waverley-EW-50%**	**Waverley-NS-7%**	**Main St-38%**	**Forest Hills-5%**	
Transit mode share	7%	38	94	**204**	**29**	**155**	**21**	**514**	**72**	**391**	**52**	**1438**
Retired residents	2%	12	29									
Working from home	5%	29	71									
Total	**27%**	**155**	**382**									

Anticipated Trip Reduction Category	**Trip Reduction Rates**	**Entering Trip Reductions in PM Peak Hour**	**Exiting Trip Reductions in PM Peak Hour**	**Entering Trips in PM Peak Hour after Reduction**				**Exiting Trips in PM Peak Hour after Reduction**				**Total Trips in PM Peak Hour after Reduction**
Internal Trips	10%	162	106	**1175**				**771**				
Walking/cycling mode share	3%	54	36	**Waverley-EW-50%**	**Waverley-NS-7%**	**Main St-38%**	**Forest Hills-5%**	**Waverley-EW-50%**	**Waverley-NS-7%**	**Main St-38%**	**Forest Hills-5%**	
Transit mode share	7%	108	71	**588**	**83**	**447**	**59**	**386**	**54**	**294**	**39**	**1950**
Retired residents	2%	33	22									
Working from home	5%	81	53									
Total	**27%**	**438**	**288**									

Port Wallace Master Plan - Infrastructure Study - 171013.00
2047-Scene 2

Port Wallace Master Plan - Infrastructure Study (Residential-Single Unit)-Clayton						
ITE Land Use Code 210 (Single-family Detached Housing) pages 297 and 298						
987 **Dwelling Units**	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.75	25%	75%	186	556	**742**
PM Peak Hour of Adjacent Street	1.00	63%	37%	622	366	**988**

Port Wallace Master Plan - Infrastructure Study (Residential-Single Unit)-Unia Estates						
ITE Land Use Code 210 (Single-family Detached Housing) pages 297 and 298						
64 **Dwelling Units**	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.75	25%	75%	12	36	**48**
PM Peak Hour of Adjacent Street	1.00	63%	37%	41	24	**65**

Port Wallace Master Plan - Infrastructure Study (Residential-Single Unit)-Whebbys						
ITE Land Use Code 210 (Single-family Detached Housing) pages 297 and 298						
175 **Dwelling Units**	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.75	25%	75%	33	99	**132**
PM Peak Hour of Adjacent Street	1.00	63%	37%	111	65	**176**

Port Wallace Master Plan - Infrastructure Study (Residential-Single Unit)-All Developers Total						
ITE Land Use Code 210 (Single-family Detached Housing) pages 297 and 298						
1,226 **Dwelling Units**	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street				231	691	**922**
PM Peak Hour of Adjacent Street				774	455	**1229**

Port Wallace Master Plan - Infrastructure Study (Residential-Town House)-Clayton						
ITE Land Use Code 230 (Residential Condominium/Townhouse) pages 395 and 396						
176 **Dwelling Units**	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.44	17%	83%	14	65	**79**
PM Peak Hour of Adjacent Street	0.52	67%	33%	62	31	**93**

Port Wallace Master Plan - Infrastructure Study (Residential-Town House)-Conrad						
ITE Land Use Code 230 (Residential Condominium/Townhouse) pages 395 and 396						
28 **Dwelling Units**	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.44	17%	83%	3	11	**14**
PM Peak Hour of Adjacent Street	0.52	67%	33%	10	5	**15**

Port Wallace Master Plan - Infrastructure Study (Residential-Town House)-Unia Estates						
ITE Land Use Code 230 (Residential Condominium/Townhouse) pages 395 and 396						
40 **Dwelling Units**	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.44	17%	83%	3	15	**18**
PM Peak Hour of Adjacent Street	0.52	67%	33%	14	7	**21**

Port Wallace Master Plan - Infrastructure Study (Residential-Town House)-All Developers Total						
ITE Land Use Code 230 (Residential Condominium/Townhouse) pages 395 and 396						
244 **Dwelling Units**	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street				20	91	**111**
PM Peak Hour of Adjacent Street				86	43	**129**

Port Wallace Master Plan - Infrastructure Study (Residential-Multi Unit)-Clayton						
ITE Land Use Code 220 (Apartment) pages 334 and 335						
1,582 **Dwelling Units**	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.51	20%	80%	162	646	**808**
PM Peak Hour of Adjacent Street	0.62	65%	35%	638	344	**982**

Port Wallace Master Plan - Infrastructure Study (Residential-Multi Unit)-Conrad						
ITE Land Use Code 220 (Apartment) pages 334 and 335						
468 **Dwelling Units**	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.51	20%	80%	48	191	**239**
PM Peak Hour of Adjacent Street	0.62	65%	35%	189	102	**291**

Port Wallace Master Plan - Infrastructure Study (Residential-Multi Unit)-Unia Estates						
ITE Land Use Code 220 (Apartment) pages 334 and 335						
224 **Dwelling Units**	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.51	20%	80%	23	92	**115**
PM Peak Hour of Adjacent Street	0.62	65%	35%	91	49	**140**

Port Wallace Master Plan - Infrastructure Study (Residential-Multi Unit)-All Developers Total						
ITE Land Use Code 220 (Apartment) pages 334 and 335						
2,274 **Dwelling Units**	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street				233	929	**1162**
PM Peak Hour of Adjacent Street				918	495	**1413**

Port Wallace Master Plan - Infrastructure Study (Commercial)-Clayton						
ITE Land Use Code 820 (Shopping Center) pages 1562 and 1563						
152,000 **sq.ft.**	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.96	62%	38%	90	55	**146**
PM Peak Hour of Adjacent Street	3.71	48%	52%	271	293	**564**

Port Wallace Master Plan - Infrastructure Study (Institutional)-Clayton						
ITE Land Use Code 520 (Elementary School) pages 988 and 989						
37,674 **sq.ft**	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	5.20	56%	44%	110	86	**196**
PM Peak Hour of Adjacent Street	1.21	45%	55%	21	25	**46**

Port Wallace Master Plan - Infrastructure Study (Industrial)						
ITE Land Use Code 110 (General Light Industrial) pages 114 and 113-Fitted Curve						
184 **Acres**	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street		85%	15%	689	122	**810**
PM Peak Hour of Adjacent Street		22%	78%	175	620	**795**

Port Wallace Master Plan - Infrastructure Study (Park)-Unia Estates						
ITE Land Use Code 411 (Park) page 693						
3 **Acres**	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	1.89	50%	50%	3	3	**6**
PM Peak Hour of Adjacent Street	1.89	50%	50%	3	3	**6**

Port Wallace Master Plan - Infrastructure Study (Combined Trips)						
ITE Land Use Codes (as shown above)						
	Rate	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street				**1376**	**1977**	**3353**
PM Peak Hour of Adjacent Street				**2247**	**1934**	**4182**
					Check	3353
						4182

Option 1

Anticipated Trip Reduction Category	Trip Reduction Rates	Entering Trip Reductions in AM Peak Hour	Exiting Trip Reductions in AM Peak Hour	Entering Trips in AM Peak Hour after Reduction				Exiting Trips in AM Peak Hour after Reduction				Total Trips in AM Peak Hour after Reduction
Internal Trips	10%	138	198	1003				1442				
Walking/cycling mode share	3%	46	66	Waverley-EW-53%	Waverley-NS-7%	Main St-40%	Forest Hills-0%	Waverley-EW-53%	Waverley-NS-7%	Main St-40%	Forest Hills-0%	
Transit mode share	7%	92	132	532	71	402	0	765	101	577	0	2448
Retired residents	2%	28	40									
Working from home	5%	69	99									
Total	**27%**	**373**	**535**									

Anticipated Trip Reduction Category	Trip Reduction Rates	Entering Trip Reductions in PM Peak Hour	Exiting Trip Reductions in PM Peak Hour	Entering Trips in PM Peak Hour after Reduction				Exiting Trips in PM Peak Hour after Reduction				Total Trips in PM Peak Hour after Reduction
Internal Trips	10%	225	194	1639				1410				
Walking/cycling mode share	3%	75	65	Waverley-EW-53%	Waverley-NS-7%	Main St-40%	Forest Hills-0%	Waverley-EW-53%	Waverley-NS-7%	Main St-40%	Forest Hills-0%	
Transit mode share	7%	150	129	869	115	656	0	748	99	565	0	3052
Retired residents	2%	45	39									
Working from home	5%	113	97									
Total	**27%**	**608**	**524**									

Option 1A

Anticipated Trip Reduction Category	Trip Reduction Rates	Entering Trip Reductions in AM Peak Hour	Exiting Trip Reductions in AM Peak Hour	Entering Trips in AM Peak Hour after Reduction				Exiting Trips in AM Peak Hour after Reduction				Total Trips in AM Peak Hour after Reduction
Internal Trips	10%	138	198	1003				1442				
Walking/cycling mode share	3%	46	66	Waverley-EW-50%	Waverley-NS-7%	Main St-38%	Forest Hills-5%	Waverley-EW-50%	Waverley-NS-7%	Main St-38%	Forest Hills-5%	
Transit mode share	7%	92	132	502	71	382	51	722	101	549	73	2451
Retired residents	2%	28	40									
Working from home	5%	69	99									
Total	**27%**	**373**	**535**									

Anticipated Trip Reduction Category	Trip Reduction Rates	Entering Trip Reductions in PM Peak Hour	Exiting Trip Reductions in PM Peak Hour	Entering Trips in PM Peak Hour after Reduction				Exiting Trips in PM Peak Hour after Reduction				Total Trips in PM Peak Hour after Reduction
Internal Trips	10%	225	194	1639				1410				
Walking/cycling mode share	3%	75	65	Waverley-EW-50%	Waverley-NS-7%	Main St-38%	Forest Hills-5%	Waverley-EW-50%	Waverley-NS-7%	Main St-38%	Forest Hills-5%	
Transit mode share	7%	150	129	820	115	623	82	706	99	536	71	3052
Retired residents	2%	45	39									
Working from home	5%	113	97									
Total	**27%**	**608**	**524**									

Option 2

Anticipated Trip Reduction Category	Trip Reduction Rates	Entering Trip Reductions in AM Peak Hour	Exiting Trip Reductions in AM Peak Hour	Entering Trips in AM Peak Hour after Reduction				Exiting Trips in AM Peak Hour after Reduction				Total Trips in AM Peak Hour after Reduction
Internal Trips	10%	138	198	1003				1442				
Walking/cycling mode share	3%	46	66	Waverley-EW-43%	Waverley-NS-7%	Main St-35%	Forest Hills-15%	Waverley-EW-43%	Waverley-NS-7%	Main St-35%	Forest Hills-15%	
Transit mode share	7%	92	132	432	71	351	151	621	101	505	217	2449
Retired residents	2%	28	40									
Working from home	5%	69	99									
Total	**27%**	**373**	**535**									

Anticipated Trip Reduction Category	Trip Reduction Rates	Entering Trip Reductions in PM Peak Hour	Exiting Trip Reductions in PM Peak Hour	Entering Trips in PM Peak Hour after Reduction				Exiting Trips in PM Peak Hour after Reduction				Total Trips in PM Peak Hour after Reduction
Internal Trips	10%	225	194	1639				1410				
Walking/cycling mode share	3%	75	65	Waverley-EW-43%	Waverley-NS-7%	Main St-35%	Forest Hills-15%	Waverley-EW-43%	Waverley-NS-7%	Main St-35%	Forest Hills-15%	
Transit mode share	7%	150	129	705	115	574	246	607	99	494	212	3052
Retired residents	2%	45	39									
Working from home	5%	113	97									
Total	**27%**	**608**	**524**									

Port Wallace Master Plan - Infrastructure Study - 171013.00

2047- Scene 3

Port Wallace Master Plan - Infrastructure Study (Residential-Single Unit)-Clayton						
ITE Land Use Code 210 (Single-family Detached Housing) pages 297 and 298						
987 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.75	25%	75%	186	556	**742**
PM Peak Hour of Adjacent Street	1.00	63%	37%	622	366	**988**

Port Wallace Master Plan - Infrastructure Study (Residential-Single Unit)-Unia Estates						
ITE Land Use Code 210 (Single-family Detached Housing) pages 297 and 298						
64 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.75	25%	75%	12	36	**48**
PM Peak Hour of Adjacent Street	1.00	63%	37%	41	24	**65**

Port Wallace Master Plan - Infrastructure Study (Residential-Single Unit)-Whebbys						
ITE Land Use Code 210 (Single-family Detached Housing) pages 297 and 298						
175 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.75	25%	75%	33	99	**132**
PM Peak Hour of Adjacent Street	1.00	63%	37%	111	65	**176**

Port Wallace Master Plan - Infrastructure Study (Residential-Single Unit)-All Developers Total						
ITE Land Use Code 210 (Single-family Detached Housing) pages 297 and 298						
1,226 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street				231	691	**922**
PM Peak Hour of Adjacent Street				774	455	**1229**

Port Wallace Master Plan - Infrastructure Study (Residential-Town House)-Clayton						
ITE Land Use Code 230 (Residential Condominium/Townhouse) pages 395 and 396						
176 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.44	17%	83%	14	65	**79**
PM Peak Hour of Adjacent Street	0.52	67%	33%	62	31	**93**

Port Wallace Master Plan - Infrastructure Study (Residential-Town House)-Conrad						
ITE Land Use Code 230 (Residential Condominium/Townhouse) pages 395 and 396						
28 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.44	17%	83%	3	11	**14**
PM Peak Hour of Adjacent Street	0.52	67%	33%	10	5	**15**

Port Wallace Master Plan - Infrastructure Study (Residential-Town House)-Unia Estates						
ITE Land Use Code 230 (Residential Condominium/Townhouse) pages 395 and 396						
40 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.44	17%	83%	3	15	**18**
PM Peak Hour of Adjacent Street	0.52	67%	33%	14	7	**21**

Port Wallace Master Plan - Infrastructure Study (Residential-Town House)-All Developers Total						
ITE Land Use Code 230 (Residential Condominium/Townhouse) pages 395 and 396						
244 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street				20	91	**111**
PM Peak Hour of Adjacent Street				86	43	**129**

Port Wallace Master Plan - Infrastructure Study (Residential-Multi Unit)-Clayton						
ITE Land Use Code 220 (Apartment) pages 334 and 335						
1,582 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.51	20%	80%	162	646	**808**
PM Peak Hour of Adjacent Street	0.62	65%	35%	638	344	**982**

Port Wallace Master Plan - Infrastructure Study (Residential-Multi Unit)-Conrad						
ITE Land Use Code 220 (Apartment) pages 334 and 335						
468 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.51	20%	80%	48	191	**239**
PM Peak Hour of Adjacent Street	0.62	65%	35%	189	102	**291**

Port Wallace Master Plan - Infrastructure Study (Residential-Multi Unit)-Unia Estates						
ITE Land Use Code 220 (Apartment) pages 334 and 335						
224 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.51	20%	80%	23	92	**115**
PM Peak Hour of Adjacent Street	0.62	65%	35%	91	49	**140**

Port Wallace Master Plan - Infrastructure Study (Residential-Multi Unit)-All Developers Total						
ITE Land Use Code 220 (Apartment) pages 334 and 335						
2,274 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street				233	929	**1162**
PM Peak Hour of Adjacent Street				918	495	**1413**

Port Wallace Master Plan - Infrastructure Study (Commercial)-Clayton						
ITE Land Use Code 820 (Shopping Center) pages 1562 and 1563						
152,000 sq.ft.	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.96	62%	38%	90	55	**146**
PM Peak Hour of Adjacent Street	3.71	48%	52%	271	293	**564**

Port Wallace Master Plan - Infrastructure Study (Institutional)-Clayton						
ITE Land Use Code 520 (Elementary School) pages 988 and 989						
87,674 sq.ft	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	5.20	56%	44%	110	86	**196**
PM Peak Hour of Adjacent Street	1.21	45%	55%	21	25	**46**

Port Wallace Master Plan - Infrastructure Study (Industrial)						
ITE Land Use Code 110 (General Light Industrial) pages 114 and 113-Fitted Curve						
184 Acres	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street		85%	15%	689	122	**810**
PM Peak Hour of Adjacent Street		22%	78%	175	620	**795**

Port Wallace Master Plan - Infrastructure Study (Park)-Unia Estates						
ITE Land Use Code 411 (Park) page 693						
3 Acres	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	1.89	50%	50%	3	3	**6**
PM Peak Hour of Adjacent Street	1.89	50%	50%	3	3	**6**

Port Wallace Master Plan - Infrastructure Study (Combined Trips)						
ITE Land Use Codes (as shown above)						
	Rate	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street				**1376**	**1977**	**3353**
PM Peak Hour of Adjacent Street				**2247**	**1934**	**4182**

Check	
	3353
	4182

Option 1

Anticipated Trip Reduction Category	Trip Reduction Rates	Entering Trip Reductions in AM Peak Hour	Exiting Trip Reductions in AM Peak Hour	Entering Trips in AM Peak Hour after Reduction				Exiting Trips in AM Peak Hour after Reduction				Total Trips in AM Peak Hour after Reduction
Internal Trips	10%	138	198	865				1244				
Walking/cycling mode share	7%	92	132	Waverley-EW-53%	Waverley-NS-7%	Main St-40%	Forest Hills-0%	Waverley-EW-53%	Waverley-NS-7%	Main St-40%	Forest Hills-0%	
Transit mode share	13%	184	264	459	61	346	0	660	88	498	0	2112
Retired residents	2%	28	40									
Working from home	5%	69	99									
Total	**37%**	**511**	**733**									

Anticipated Trip Reduction Category	Trip Reduction Rates	Entering Trip Reductions in PM Peak Hour	Exiting Trip Reductions in PM Peak Hour	Entering Trips in PM Peak Hour after Reduction				Exiting Trips in PM Peak Hour after Reduction				Total Trips in PM Peak Hour after Reduction
Internal Trips	10%	225	194	1414				1217				
Walking/cycling mode share	7%	150	129	Waverley-EW-53%	Waverley-NS-7%	Main St-40%	Forest Hills-0%	Waverley-EW-53%	Waverley-NS-7%	Main St-40%	Forest Hills-0%	
Transit mode share	13%	300	258	750	99	566	0	646	86	487	0	2634
Retired residents	2%	45	39									
Working from home	5%	113	97									
Total	**37%**	**833**	**717**									

Option 1A

Anticipated Trip Reduction Category	Trip Reduction Rates	Entering Trip Reductions in AM Peak Hour	Exiting Trip Reductions in AM Peak Hour	Entering Trips in AM Peak Hour after Reduction				Exiting Trips in AM Peak Hour after Reduction				Total Trips in AM Peak Hour after Reduction
Internal Trips	10%	138	198	865				1244				
Walking/cycling mode share	7%	92	132	Waverley-EW-50%	Waverley-NS-7%	Main St-38%	Forest Hills-5%	Waverley-EW-50%	Waverley-NS-7%	Main St-38%	Forest Hills-5%	
Transit mode share	13%	184	264	433	61	329	44	623	88	473	63	2114
Retired residents	2%	28	40									
Working from home	5%	69	99									
Total	**37%**	**511**	**733**									

Anticipated Trip Reduction Category	Trip Reduction Rates	Entering Trip Reductions in PM Peak Hour	Exiting Trip Reductions in PM Peak Hour	Entering Trips in PM Peak Hour after Reduction				Exiting Trips in PM Peak Hour after Reduction				Total Trips in PM Peak Hour after Reduction
Internal Trips	10%	225	194	1414				1217				
Walking/cycling mode share	7%	150	129	Waverley-EW-50%	Waverley-NS-7%	Main St-38%	Forest Hills-5%	Waverley-EW-50%	Waverley-NS-7%	Main St-38%	Forest Hills-5%	
Transit mode share	13%	300	258	708	99	538	71	609	86	463	61	2635
Retired residents	2%	45	39									
Working from home	5%	113	97									
Total	**37%**	**833**	**717**									

Option 2

Anticipated Trip Reduction Category	Trip Reduction Rates	Entering Trip Reductions in AM Peak Hour	Exiting Trip Reductions in AM Peak Hour	Entering Trips in AM Peak Hour after Reduction				Exiting Trips in AM Peak Hour after Reduction				Total Trips in AM Peak Hour after Reduction
Internal Trips	10%	138	198	865				1244				
Walking/cycling mode share	7%	92	132	Waverley-EW-43%	Waverley-NS-7%	Main St-35%	Forest Hills-15%	Waverley-EW-43%	Waverley-NS-7%	Main St-35%	Forest Hills-15%	
Transit mode share	13%	184	264	372	61	303	130	535	88	436	187	2112
Retired residents	2%	28	40									
Working from home	5%	69	99									
Total	**37%**	**511**	**733**									

Anticipated Trip Reduction Category	Trip Reduction Rates	Entering Trip Reductions in PM Peak Hour	Exiting Trip Reductions in PM Peak Hour	Entering Trips in PM Peak Hour after Reduction				Exiting Trips in PM Peak Hour after Reduction				Total Trips in PM Peak Hour after Reduction
Internal Trips	10%	225	194	1414				1217				
Walking/cycling mode share	7%	150	129	Waverley-EW-43%	Waverley-NS-7%	Main St-35%	Forest Hills-15%	Waverley-EW-43%	Waverley-NS-7%	Main St-35%	Forest Hills-15%	
Transit mode share	13%	300	258	609	99	495	213	524	86	427	183	2636
Retired residents	2%	45	39									
Working from home	5%	113	97									
Total	**37%**	**833**	**717**									

Port Wallace Master Plan - Infrastructure Study - 171013.00
2047- Scene 4

Port Wallace Master Plan - Infrastructure Study (Residential-Single Unit)-Clayton						
ITE Land Use Code 210 (Single-family Detached Housing) pages 297 and 298						
987 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.75	25%	75%	186	556	**742**
PM Peak Hour of Adjacent Street	1.00	63%	37%	622	366	**988**

Port Wallace Master Plan - Infrastructure Study (Residential-Single Unit)-Unia Estates						
ITE Land Use Code 210 (Single-family Detached Housing) pages 297 and 298						
64 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.75	25%	75%	12	36	**48**
PM Peak Hour of Adjacent Street	1.00	63%	37%	41	24	**65**

Port Wallace Master Plan - Infrastructure Study (Residential-Single Unit)-Whebbys						
ITE Land Use Code 210 (Single-family Detached Housing) pages 297 and 298						
175 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.75	25%	75%	33	99	**132**
PM Peak Hour of Adjacent Street	1.00	63%	37%	111	65	**176**

Port Wallace Master Plan - Infrastructure Study (Residential-Single Unit)-All Developers Total						
ITE Land Use Code 210 (Single-family Detached Housing) pages 297 and 298						
1,226 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street				231	691	**922**
PM Peak Hour of Adjacent Street				774	455	**1229**

Port Wallace Master Plan - Infrastructure Study (Residential-Town House)-Clayton						
ITE Land Use Code 230 (Residential Condominium/Townhouse) pages 395 and 396						
176 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.44	17%	83%	14	65	**79**
PM Peak Hour of Adjacent Street	0.52	67%	33%	62	31	**93**

Port Wallace Master Plan - Infrastructure Study (Residential-Town House)-Conrad						
ITE Land Use Code 230 (Residential Condominium/Townhouse) pages 395 and 396						
28 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.44	17%	83%	3	11	**14**
PM Peak Hour of Adjacent Street	0.52	67%	33%	10	5	**15**

Port Wallace Master Plan - Infrastructure Study (Residential-Town House)-Unia Estates						
ITE Land Use Code 230 (Residential Condominium/Townhouse) pages 395 and 396						
40 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.44	17%	83%	3	15	**18**
PM Peak Hour of Adjacent Street	0.52	67%	33%	14	7	**21**

Port Wallace Master Plan - Infrastructure Study (Residential-Town House)-All Developers Total						
ITE Land Use Code 230 (Residential Condominium/Townhouse) pages 395 and 396						
244 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street				20	91	**111**
PM Peak Hour of Adjacent Street				86	43	**129**

Port Wallace Master Plan - Infrastructure Study (Residential-Multi Unit)-Clayton						
ITE Land Use Code 220 (Apartment) pages 334 and 335						
1,582 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.51	20%	80%	162	646	**808**
PM Peak Hour of Adjacent Street	0.62	65%	35%	638	344	**982**

Port Wallace Master Plan - Infrastructure Study (Residential-Multi Unit)-Conrad						
ITE Land Use Code 220 (Apartment) pages 334 and 335						
468 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.51	20%	80%	48	191	**239**
PM Peak Hour of Adjacent Street	0.62	65%	35%	189	102	**291**

Port Wallace Master Plan - Infrastructure Study (Residential-Multi Unit)-Unia Estates						
ITE Land Use Code 220 (Apartment) pages 334 and 335						
224 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.51	20%	80%	23	92	**115**
PM Peak Hour of Adjacent Street	0.62	65%	35%	91	49	**140**

Port Wallace Master Plan - Infrastructure Study (Residential-Multi Unit)-All Developers Total						
ITE Land Use Code 220 (Apartment) pages 334 and 335						
2,274 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street				233	929	**1162**
PM Peak Hour of Adjacent Street				918	495	**1413**

Port Wallace Master Plan - Infrastructure Study (Commercial)-Clayton						
ITE Land Use Code 820 (Shopping Center) pages 1562 and 1563						
152,000 sq.ft.	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.96	62%	38%	90	55	**146**
PM Peak Hour of Adjacent Street	3.71	48%	52%	271	293	**564**

Port Wallace Master Plan - Infrastructure Study (Institutional)-Clayton						
ITE Land Use Code 520 (Elementary School) pages 988 and 989						
87,674 sq.ft	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	5.20	56%	44%	110	86	**196**
PM Peak Hour of Adjacent Street	1.21	45%	55%	21	25	**46**

Port Wallace Master Plan - Infrastructure Study (Industrial)						
ITE Land Use Code 110 (General Light Industrial) pages 114 and 113-Fitted Curve						
184 Acres	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street		85%	15%	689	122	**810**
PM Peak Hour of Adjacent Street		22%	78%	175	620	**795**

Port Wallace Master Plan - Infrastructure Study (Park)-Unia Estates						
ITE Land Use Code 411 (Park) page 693						
3 Acres	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	1.89	50%	50%	3	3	**6**
PM Peak Hour of Adjacent Street	1.89	50%	50%	3	3	**6**

Port Wallace Master Plan - Infrastructure Study (Combined Trips)						
ITE Land Use Codes (as shown above)						
	Rate	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street				**1376**	**1977**	**3353**
PM Peak Hour of Adjacent Street				**2247**	**1934**	**4182**

Check	
	3353
	4182

Option 3A

Anticipated Trip Reduction Category	Trip Reduction Rates	Entering Trip Reductions in AM Peak Hour	Exiting Trip Reductions in AM Peak Hour	Entering Trips in AM Peak Hour after Reduction				Exiting Trips in AM Peak Hour after Reduction				Total Trips in AM Peak Hour after Reduction
Internal Trips	10%	138	198	1003				1442				
Walking/cycling mode share	3%	46	66	Waverley-EW-50%	Waverley-NS-10%	Main St-40%	Forest Hills-0%	Waverley-EW-50%	Waverley-NS-10%	Main St-40%	Forest Hills-0%	
Transit mode share	7%	92	132	502	101	402	0	722	145	577	0	2449
Retired residents	2%	28	40									
Working from home	5%	69	99									
Total	27%	373	535									

Anticipated Trip Reduction Category	Trip Reduction Rates	Entering Trip Reductions in PM Peak Hour	Exiting Trip Reductions in PM Peak Hour	Entering Trips in PM Peak Hour after Reduction				Exiting Trips in PM Peak Hour after Reduction				Total Trips in PM Peak Hour after Reduction
Internal Trips	10%	225	194	1639				1410				
Walking/cycling mode share	3%	75	65	Waverley-EW-50%	Waverley-NS-10%	Main St-40%	Forest Hills-0%	Waverley-EW-50%	Waverley-NS-10%	Main St-40%	Forest Hills-0%	
Transit mode share	7%	150	129	820	164	656	0	706	142	565	0	3053
Retired residents	2%	45	39									
Working from home	5%	113	97									
Total	27%	608	524									

Port Wallace Master Plan - Infrastructure Study - 171013.00
2047-Scene 5

Port Wallace Master Plan - Infrastructure Study (Residential-Single Unit)-Clayton						
ITE Land Use Code 210 (Single-family Detached Housing) pages 297 and 298						
987 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.75	25%	75%	186	556	**742**
PM Peak Hour of Adjacent Street	1.00	63%	37%	622	366	**988**

Port Wallace Master Plan - Infrastructure Study (Residential-Single Unit)-Unia Estates						
ITE Land Use Code 210 (Single-family Detached Housing) pages 297 and 298						
64 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.75	25%	75%	12	36	**48**
PM Peak Hour of Adjacent Street	1.00	63%	37%	41	24	**65**

Port Wallace Master Plan - Infrastructure Study (Residential-Single Unit)-Whebbys						
ITE Land Use Code 210 (Single-family Detached Housing) pages 297 and 298						
175 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.75	25%	75%	33	99	**132**
PM Peak Hour of Adjacent Street	1.00	63%	37%	111	65	**176**

Port Wallace Master Plan - Infrastructure Study (Residential-Single Unit)-All Developers Total						
ITE Land Use Code 210 (Single-family Detached Housing) pages 297 and 298						
1,226 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street				231	691	**922**
PM Peak Hour of Adjacent Street				774	455	**1229**

Port Wallace Master Plan - Infrastructure Study (Residential-Town House)-Clayton						
ITE Land Use Code 230 (Residential Condominium/Townhouse) pages 395 and 396						
176 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.44	17%	83%	14	65	**79**
PM Peak Hour of Adjacent Street	0.52	67%	33%	62	31	**93**

Port Wallace Master Plan - Infrastructure Study (Residential-Town House)-Conrad						
ITE Land Use Code 230 (Residential Condominium/Townhouse) pages 395 and 396						
28 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.44	17%	83%	3	11	**14**
PM Peak Hour of Adjacent Street	0.52	67%	33%	10	5	**15**

Port Wallace Master Plan - Infrastructure Study (Residential-Town House)-Unia Estates						
ITE Land Use Code 230 (Residential Condominium/Townhouse) pages 395 and 396						
40 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.44	17%	83%	3	15	**18**
PM Peak Hour of Adjacent Street	0.52	67%	33%	14	7	**21**

Port Wallace Master Plan - Infrastructure Study (Residential-Town House)-All Developers Total						
ITE Land Use Code 230 (Residential Condominium/Townhouse) pages 395 and 396						
244 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street				20	91	**111**
PM Peak Hour of Adjacent Street				86	43	**129**

Port Wallace Master Plan - Infrastructure Study (Residential-Multi Unit)-Clayton						
ITE Land Use Code 220 (Apartment) pages 334 and 335						
1,582 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.51	20%	80%	162	646	**808**
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Port Wallace Master Plan - Infrastructure Study (Residential-Multi Unit)-Conrad						
ITE Land Use Code 220 (Apartment) pages 334 and 335						
468 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.51	20%	80%	48	191	**239**
PM Peak Hour of Adjacent Street	0.62	65%	35%	189	102	**291**

Port Wallace Master Plan - Infrastructure Study (Residential-Multi Unit)-Unia Estates						
ITE Land Use Code 220 (Apartment) pages 334 and 335						
224 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.51	20%	80%	23	92	**115**
PM Peak Hour of Adjacent Street	0.62	65%	35%	91	49	**140**

Port Wallace Master Plan - Infrastructure Study (Residential-Multi Unit)-All Developers Total						
ITE Land Use Code 220 (Apartment) pages 334 and 335						
2,274 Dwelling Units	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street				233	929	**1162**
PM Peak Hour of Adjacent Street				918	495	**1413**

Port Wallace Master Plan - Infrastructure Study (Commercial)-Clayton						
ITE Land Use Code 820 (Shopping Center) pages 1562 and 1563						
152,000 sq.ft.	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	0.96	62%	38%	90	55	**146**
PM Peak Hour of Adjacent Street	3.71	48%	52%	271	293	**564**

Port Wallace Master Plan - Infrastructure Study (Institutional)-Clayton						
ITE Land Use Code 520 (Elementary School) pages 988 and 989						
87,674 sq.ft	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	5.20	56%	44%	110	86	**196**
PM Peak Hour of Adjacent Street	1.21	45%	55%	21	25	**46**

Port Wallace Master Plan - Infrastructure Study (Industrial)						
ITE Land Use Code 110 (General Light Industrial) pages 114 and 113-Fitted Curve						
184 Acres	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street		85%	15%	689	122	**810**
PM Peak Hour of Adjacent Street		22%	78%	175	620	**795**

Port Wallace Master Plan - Infrastructure Study (Park)-Unia Estates						
ITE Land Use Code 411 (Park) page 693						
3 Acres	**Rate**	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street	1.89	50%	50%	3	3	**6**
PM Peak Hour of Adjacent Street	1.89	50%	50%	3	3	**6**

Port Wallace Master Plan - Infrastructure Study (Combined Trips)						
ITE Land Use Codes (as shown above)						
	Rate	**Entering**	**Exiting**	**Trips Ent**	**Trips Ex**	**Total Trips**
AM Peak Hour of Adjacent Street				**1376**	**1977**	**3353**
PM Peak Hour of Adjacent Street				**2247**	**1934**	**4182**

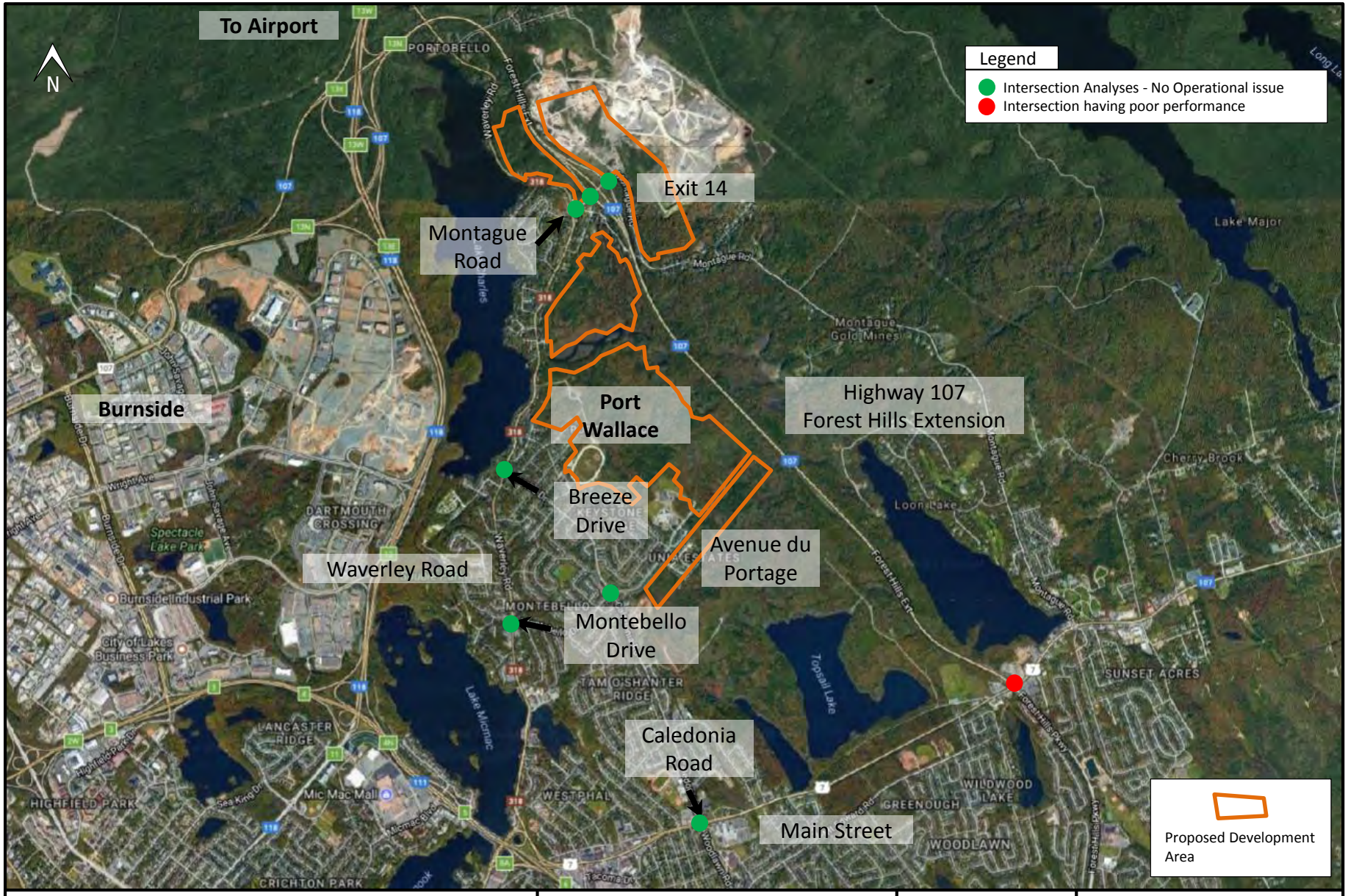
Check	
	3353
	4182

Option 3B

Anticipated Trip Reduction Category	Trip Reduction Rates	Entering Trip Reductions in AM Peak Hour	Exiting Trip Reductions in AM Peak Hour	Entering Trips in AM Peak Hour after Reduction				Exiting Trips in AM Peak Hour after Reduction				Total Trips in AM Peak Hour after Reduction
Internal Trips	10%	138	198	1003				1442				
Walking/cycling mode share	3%	46	66	Waverley-EW-35%	Waverley-NS-10%	Main St-35%	Forest Hills-20%	Waverley-EW-35%	Waverley-NS-10%	Main St-35%	Forest Hills-20%	
Transit mode share	7%	92	132	351	101	351	201	505	145	505	289	2448
Retired residents	2%	28	40									
Working from home	5%	69	99									
Total	27%	373	535									

Anticipated Trip Reduction Category	Trip Reduction Rates	Entering Trip Reductions in PM Peak Hour	Exiting Trip Reductions in PM Peak Hour	Entering Trips in PM Peak Hour after Reduction				Exiting Trips in PM Peak Hour after Reduction				Total Trips in PM Peak Hour after Reduction
Internal Trips	10%	225	194	1639				1410				
Walking/cycling mode share	3%	75	65	Waverley-EW-35%	Waverley-NS-10%	Main St-35%	Forest Hills-20%	Waverley-EW-35%	Waverley-NS-10%	Main St-35%	Forest Hills-20%	
Transit mode share	7%	150	129	574	164	574	328	494	142	494	283	3053
Retired residents	2%	45	39									
Working from home	5%	113	97									
Total	27%	608	524									

APPENDIX C – Level of Service (LoS) Analysis



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Final Report

Project No.: 171013.00
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Figure C1
LOS Table 1
2017 - Existing

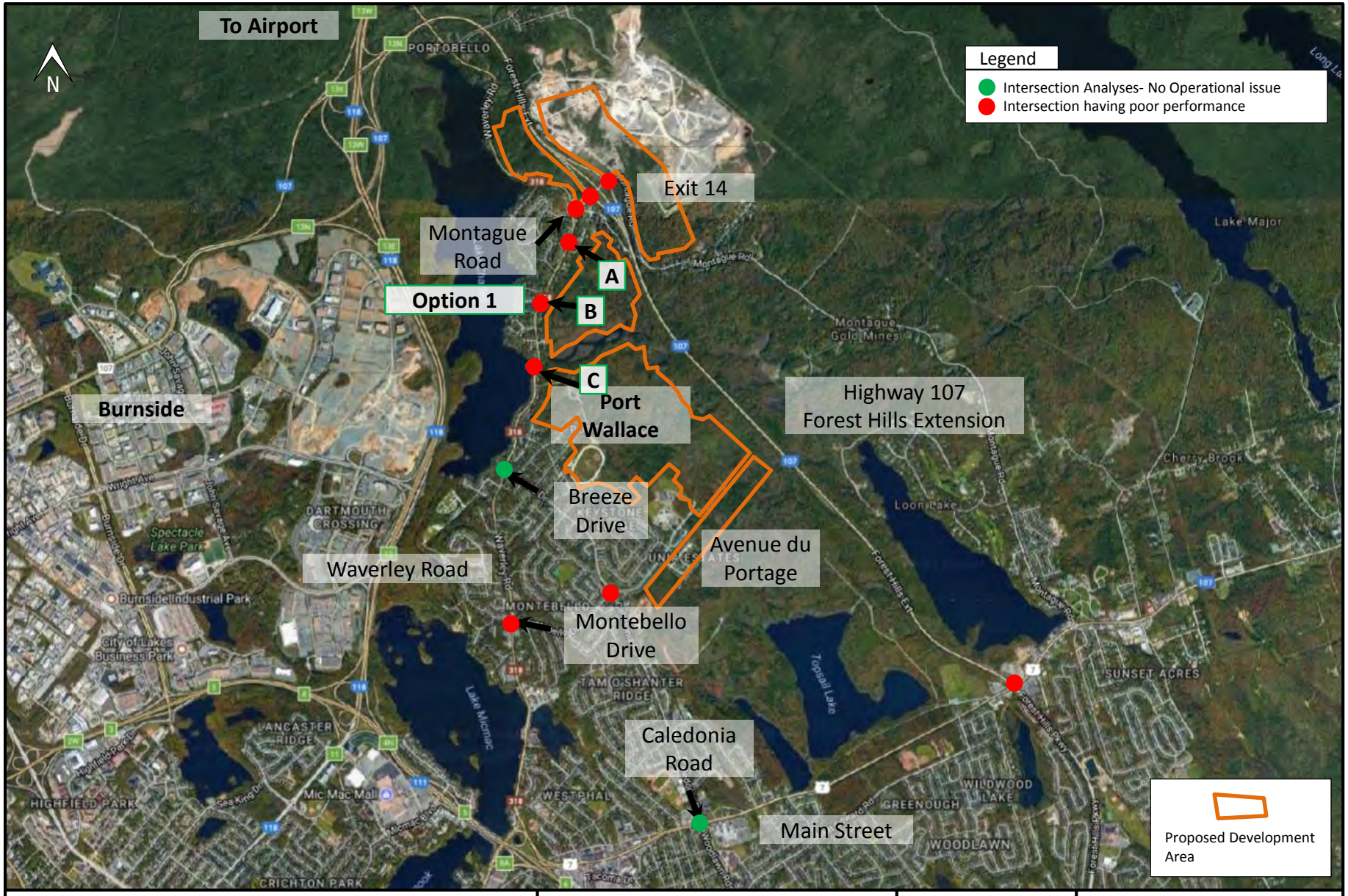

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Figure C2
LOS Table 2
2031 - 1% GR - Option 1-
50% Buildout - 10% NAMC

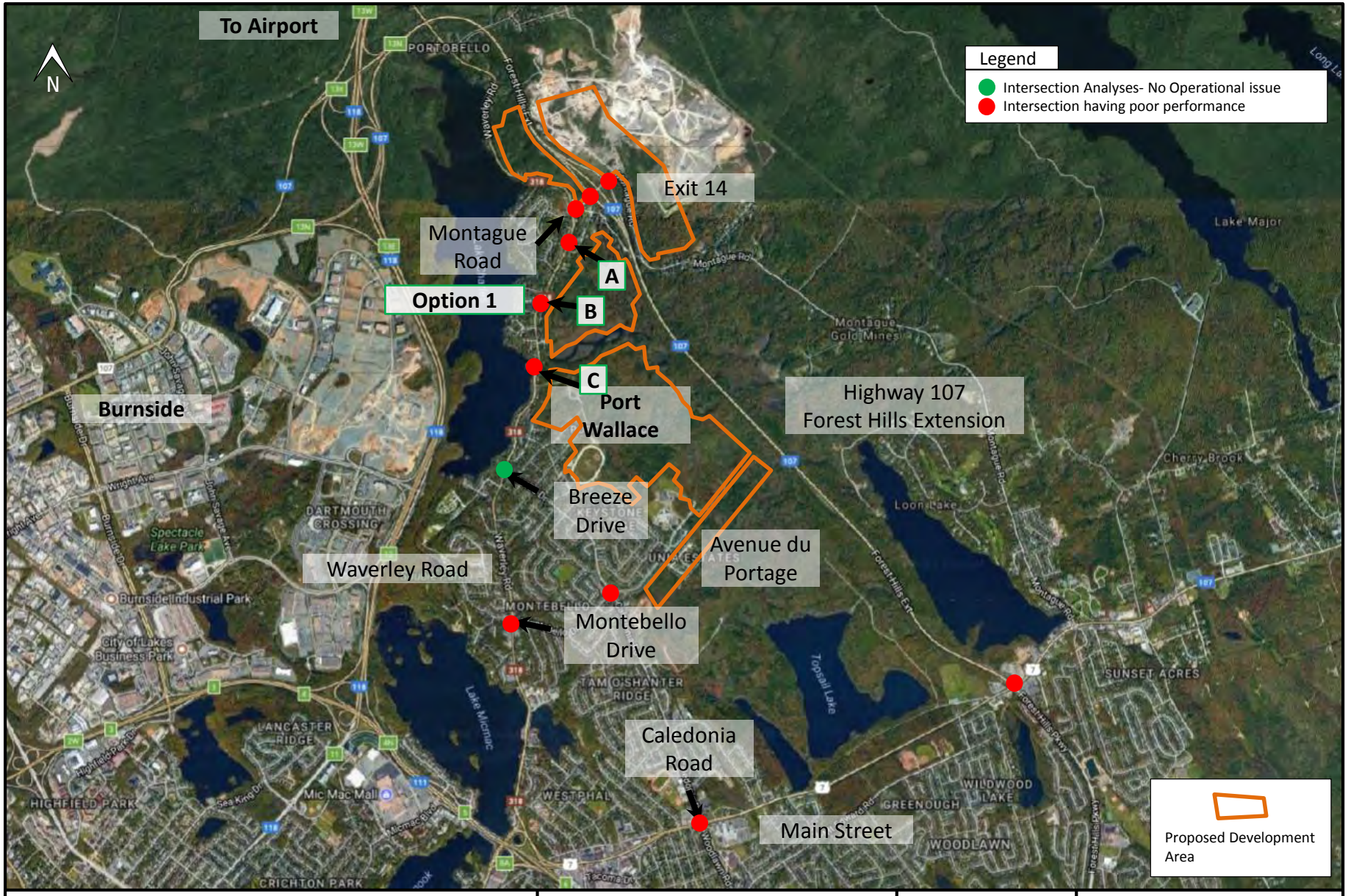

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Figure C3
LOS Table 4
2047 - 0.75% GR - Option 1-
Full Buildout - 10% NAMC

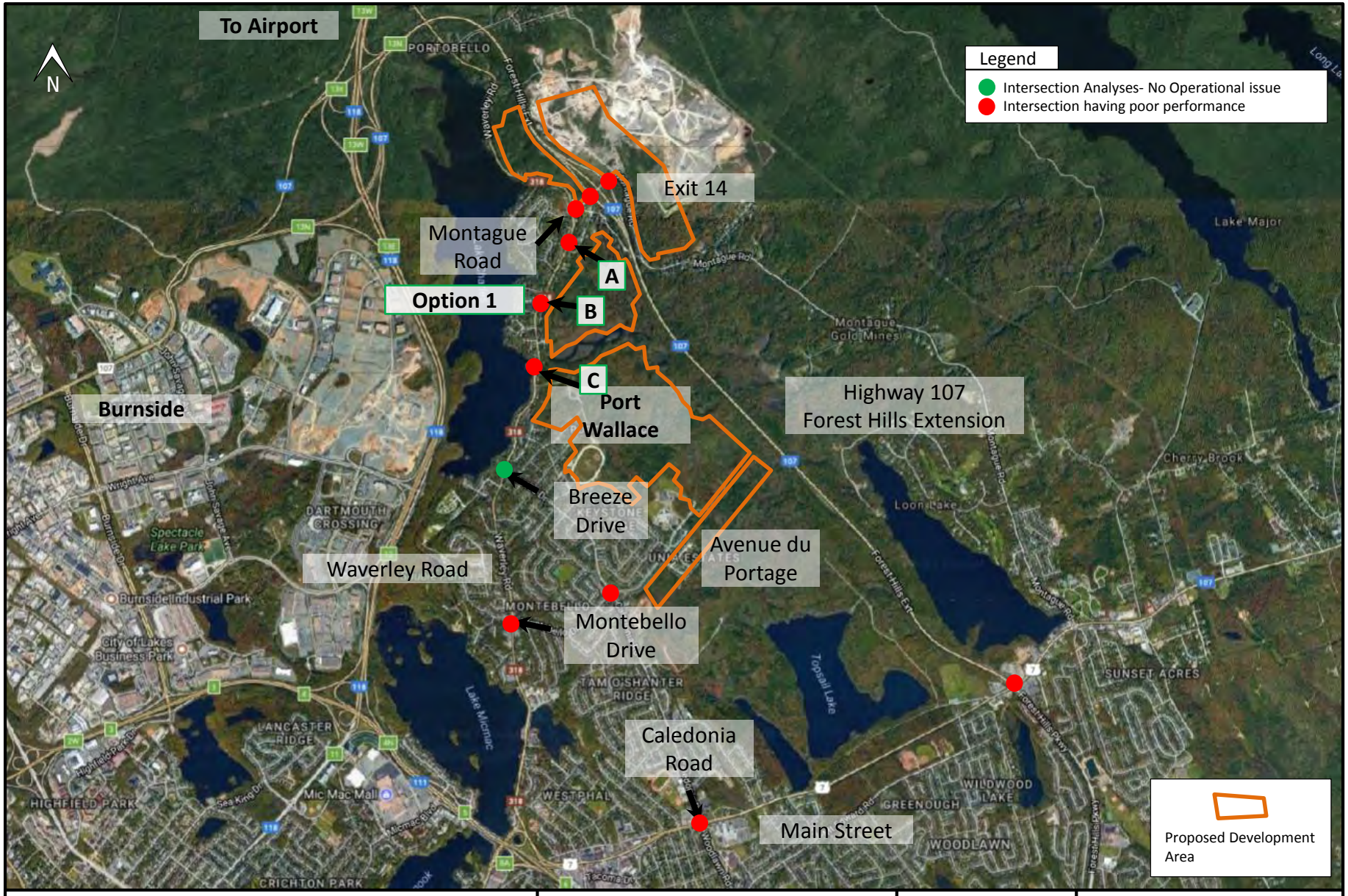

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Figure C4
LOS Table 7
2047 - 0.75% GR - Option 1-
Full Buildout - 20% NAMC

APPENDIX D – Synchro and Arcady Model Outputs

Port Wallace Master Plan-Infrastructure Study
CBCL Limited 171013.00
2-Aug-17

Table 1 - Synchro Analysis Results: 2017 Baseline Volumes & Existing Street Network

Intersection [Synchro Node No.]	Lane / Movement	AM Peak Hour				PM Peak Hour			
		95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]	95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]
Montague Rd & Ramp Terminal (North) [5] (Unsignalized)	EB Left/Thru	9.1	0.30	9.7	A	1.4	0.07	7.6	A
	WB Thru/Right				A				A
	NB Left/Thru/Right	5.6	0.21	22.6	C	4.2	0.16	15.1	C
	Overall			**4.7**	**A**			**2.7**	**A**
Montague Rd & Ramp Terminal (South) [6] (Unsignalized)	EB Thru/Right								
	WB Left/Thru	0.7	0.02	8.2	A	0.0	0.01	7.6	A
	SB Left/Thru/Right	4.2	0.16	12.1	B	70.7	0.85	29.0	D
	Overall			**2.2**	**A**			**20.0**	**C**
Montague/Charles Keating & Waverley [12] (Unsignalized)	EB Left/Thru/Right	2.8	0.13	18.1	C	0.7	0.04	11.6	B
	WB Left/Thru	9.8	0.33	23.8	C	17.5	0.48	20.7	C
	WB Right	1.4	0.05	9.3	A	7.0	0.25	11.1	B
	NB Left/Thru/Right	0.0	0.00	7.6	A	0.0	0.01	7.4	A
	SB Left	3.5	0.14	8.2	A	1.4	0.06	8.0	A
	SB Thru/Right				A				A
	Overall			**6.1**	**A**			**8.2**	**A**
Breeze & Waverley [18] (Unsignalized)	WB Left/Right	9.8	0.33	14.2	B	9.1	0.31	17.5	C
	NB Thru/Right				A				A
	SB Left/Thru	1.4	0.06	7.7	A	2.8	0.12	8.7	A
	Overall			**4.8**	**A**			**3.8**	**A**
Montebello & Waverley [24] (Signalized)	WB Left	86.8	0.68	21.0	C	50.0	0.60	38.0	D
	WB Right	5.7	0.07	4.9	A	8.1	0.13	10.8	B
	NB Thru/Right	47.9	0.52	14.5	B	234.2	0.89	22.1	C
	SB Left	8.5	0.12	13.4	B	9.1	0.29	12.9	B
	SB Thru	91.5	0.78	24.9	C	38.3	0.30	6.8	A
	Overall			**20.2**	**C**			**20.0**	**B**
Main & Forest Hills [56] (Signalized)	EB Left	49.6	0.69	42.6	D	11.8	0.11	19.3	B
	EB Thru	51.3	0.25	29.7	C	226.8	1.02	74.3	E
	EB Right	0.0	0.11	0.7	A	0.0	0.25	0.4	A
	WB Left	19.1	0.13	20.4	C	54.2	0.76	48.5	D
	WB Thru	176.5	0.79	44.6	D	69.3	0.38	30.0	C
	WB Right	0.0	0.37	0.7	A	0.0	0.13	0.2	A
	NB Left	71.8	0.48	46.2	D	42.8	0.50	56.3	E
	NB Thru	237.5	1.07	109.1	F	107.4	0.92	94.1	F
	NB Right	0.0	0.06	0.1	A	0.0	0.15	0.2	A
	SB Left	23.6	0.28	59.3	E	151.6	0.97	73.0	E
	SB Thru	62.9	0.71	79.5	E	223.5	1.12	124.6	F
	SB Right	0.0	0.04	0.1	A	0.0	0.07	0.1	A
	Overall			**43.2**	**D**			**58.5**	**E**
Main & Caledonia/ Woodlawn [71] (Signalized)	EB Left	22.2	0.52	20.1	C	40.8	0.45	12.3	B
	EB Thru	53.6	0.28	19.5	B	210.9	0.75	25.7	C
	EB Right	0.0	0.12	0.2	A	0.0	0.11	0.1	A
	WB Left	32.4	0.33	12.1	B	12.8	0.35	15.2	B
	WB Thru	184.2	0.73	28.1	C	70.3	0.33	20.6	C
	WB Right	0.0	0.06	0.1	A	0.0	0.05	0.1	A
	NB Left	76.4	0.82	58.8	E	47.7	0.60	46.6	D
	NB Thru	43.5	0.27	36.5	D	64.1	0.62	59.8	E
	NB Right	0.0	0.03	0.0	A	0.0	0.06	0.1	A
	SB Left	40.5	0.53	60.4	E	40.1	0.46	40.9	D
	SB Thru	72.1	0.70	65.2	E	71.4	0.70	64.3	E
	SB Right	0.0	0.13	0.2	A	0.0	0.11	0.1	A
	Overall			**26.9**	**C**			**25.3**	**C**
Montebello/Avenue Du Portage & Caledonia/ Breeze [30] (Unsignalized)	EB Left/Thru/Right	2.5	0.47	14.7	B	35.7	0.67	19.2	C
	WB Left/Thru/Right	3.9	0.60	18.6	C	9.8	0.32	12.4	B
	NB Left/Thru/Right	3.5	0.57	17.6	C	21.0	0.52	15.6	C
	SB Left/Thru/Right	2.2	0.44	14.6	B	9.8	0.32	12.3	B
	Overall			**16.6**	**C**			**15.9**	**C**
Access C/ Meadow Walk & Waverley [81] (Unsignalized)	EB Left/Thru/Right				A				A
	WB Left/Thru/Right				A				A
	NB Left/Thru/Right				A				A
	SB Left/Thru/Right				A				A
	Overall				**A**				**A**
Access B /Applewood lane & Waverley [84] (Unsignalized)	EB Left/Thru/Right				A				A
	WB Left/Thru/Right				A				A
	NB Left/Thru/Right				A				A
	SB Left/Thru/Right				A				A
	Overall				**A**				**A**
Access A & Waverley [87] (Unsignalized)	WB Left/Right				A				A
	NB Thru/Right				A				A
	SB Left/Thru				A				A
	Overall				**A**				**A**
Forest Hills Ext Access [89] (Unsignalised)	EB Right				A				A
	NB thru				A				A
	SB Thru				A				A
	SB Thru/Right				A				A
	Overall				**A**				**A**

Notes:
Analysis by CBCL Limited using Synchro 9.0
1. 95% Queue - 95th percentile queue [highlighted if >100m or if available storage is exceeded]
2. V/C Ratio - Volume-to-Capacity ratio [highlighted if >0.85]
3. Average Delay - average total delay per vehicle [highlighted for LOS E
4. LOS - Level of Service [highlighted for LOS E or F]

Table 12 - Synchro Analysis Results: 2031 Volumes & Existing Street Network, 1% Growth, No Developement

Intersection [Synchro Node No.]	Lane / Movement	AM Peak Hour				PM Peak Hour			
		95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]	95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]
Montague Rd & Ramp Terminal (North) [5] (Unsignalized)	EB Left/Thru	11.9	0.37	10.5	B	1.4	0.08	7.7	A
	WB Thru/Right				A				A
	NB Left/Thru/Right	9.1	0.32	32.1	D	5.6	0.21	17.4	C
	Overall			**5.5**	**A**			**2.9**	**A**
Montague Rd & Ramp Terminal (South) [6] (Unsignalized)	EB Thru/Right								
	WB Left/Thru	0.7	0.02	8.4	A	0.0	0.01	7.7	A
	SB Left/Thru/Right	5.6	0.20	13.1	B	126.7	1.02	60.4	F
	Overall			**2.4**	**A**			**41.5**	**E**
Montague/Charles Keating & Waverley [12] (Unsignalized)	EB Left/Thru/Right	4.2	0.17	21.5	C	0.7	0.05	12.3	B
	WB Left/Thru	16.1	0.47	34.2	D	28.0	0.62	28.9	D
	WB Right	1.4	0.06	9.4	A	9.1	0.31	11.9	B
	NB Left/Thru/Right	0.0	0.00	7.6	A	0.0	0.01	7.5	A
	SB Left	4.2	0.16	8.4	A	1.4	0.07	8.2	A
	SB Thru/Right				A				A
	Overall			**7.6**	**A**			**10.2**	**B**
Breeze & Waverley [18] (Unsignalized)	WB Left/Right	14.0	0.42	16.7	C	14.7	0.43	22.6	C
	NB Thru/Right				A				A
	SB Left/Thru	1.4	0.07	7.8	A	3.5	0.14	9.0	A
	Overall			**5.5**	**A**			**4.6**	**A**
Montebello & Waverley [24] (Signalized)	WB Left	133.1	0.73	25.6	C	57.2	0.72	48.4	D
	WB Right	6.7	0.07	5.3	A	8.9	0.15	10.1	B
	NB Thru/Right	56.5	0.58	17.0	B	295.0	0.96	32.3	C
	SB Left	9.3	0.16	14.3	B	22.8	0.53	37.2	D
	SB Thru	109.4	0.87	33.0	C	44.8	0.33	7.0	A
	Overall			**25.3**	**C**			**28.1**	**C**
Main & Forest Hills [56] (Signalized)	EB Left	72.1	0.83	64.6	E	13.4	0.14	19.7	B
	EB Thru	59.5	0.30	32.1	C	278.7	1.20	137.4	F
	EB Right	0.0	0.13	0.2	A	0.0	0.29	0.5	A
	WB Left	21.4	0.17	21.1	C	72.7	0.83	57.0	E
	WB Thru	228.8	0.94	57.0	E	80.6	0.44	31.1	C
	WB Right	0.0	0.42	0.8	A	0.0	0.15	0.2	A
	NB Left	82.7	0.55	47.8	D	48.5	0.56	57.8	E
	NB Thru	287.4	1.23	163.1	F	129.4	1.04	120.2	F
	NB Right	0.0	0.07	0.1	A	0.0	0.17	0.2	A
	SB Left	26.3	0.30	59.0	E	187.0	1.12	115.9	F
	SB Thru	71.7	0.77	83.5	F	268.0	1.30	190.3	F
	SB Right	0.0	0.05	0.1	A	0.0	0.08	0.1	A
	Overall			**55.7**	**E**			**91.3**	**F**
Main & Caledonia/ Woodlawn [71] (Signalized)	EB Left	42.5	0.70	44.0	D	49.7	0.57	15.4	B
	EB Thru	62.2	0.33	20.9	C	299.3	0.89	34.0	C
	EB Right	0.0	0.13	0.2	A	0.0	0.13	0.2	A
	WB Left	37.1	0.42	14.0	B	21.7	0.45	25.6	C
	WB Thru	246.6	0.87	35.4	D	88.1	0.40	24.0	C
	WB Right	0.0	0.07	0.1	A	0.0	0.06	0.1	A
	NB Left	106.6	0.97	87.7	F	52.6	0.70	50.9	D
	NB Thru	49.5	0.30	36.0	D	71.7	0.65	59.2	E
	NB Right	0.0	0.04	0.0	A	0.0	0.06	0.1	A
	SB Left	45.4	0.57	60.8	E	44.1	0.54	41.9	D
	SB Thru	82.8	0.75	66.2	E	79.8	0.73	63.9	E
	SB Right	0.0	0.15	0.2	A	0.0	0.13	0.2	A
	Overall			**32.7**	**C**			**29.9**	**C**
Montebello/Avenue Du Portage & Caledonia/ Breeze [30] (Unsignalized)	EB Left/Thru/Right	31.5	0.64	22.7	C	65.1	0.85	35.2	E
	WB Left/Thru/Right	51.1	0.79	33.7	D	14.0	0.42	15.2	C
	NB Left/Thru/Right	46.9	0.76	31.0	D	34.3	0.66	22.4	C
	SB Left/Thru/Right	25.9	0.59	21.4	C	14.0	0.41	15.2	C
	Overall			**27.9**	**D**			**25.1**	**D**
Access C/ Meadow Walk & Waverley [81] (Unsignalized)	EB Left/Thru/Right				A				A
	WB Left/Thru/Right				A				A
	NB Left/Thru/Right				A				A
	SB Left/Thru/Right				A				A
	Overall				**A**				**A**
Access B /Applewood lane & Waverley [84] (Unsignalized)	EB Left/Thru/Right				A				A
	WB Left/Thru/Right				A				A
	NB Left/Thru/Right				A				A
	SB Left/Thru/Right				A				A
	Overall				**A**				**A**
Access A & Waverley [87] (Unsignalized)	WB Left/Right				A				A
	NB Thru/Right				A				A
	SB Left/Thru				A				A
	Overall				**A**				**A**
Forest Hills Ext Access [89] (Unsignalised)	EB Right				A				A
	NB thru				A				A
	SB Thru				A				A
	SB Thru/Right				A				A
	Overall				**A**				**A**

Notes:
Analysis by CBCL Limited using Synchro 9.0
1. 95% Queue - 95th percentile queue [highlighted if >100m or if available storage is exceeded]
2. V/C Ratio - Volume-to-Capacity ratio [highlighted if >0.85]
3. Average Delay - average total delay per vehicle [highlighted for LOS E or F]
4. LOS - Level of Service [highlighted for LOS E or F]

Level of Service Table - HCM 2010

Level of Service	Average Delay per Vehicle (sec)	
	Signalized	Unisignalized
A	<10	<10
B	>10 and <20	>10 and <15
C	>20 and <35	>15 and <25
D	>35 and <55	>25 and <35
E	>55 and <80	>35 and <50
F	>80	>50

Legend

- Queue Length > 100m
- V/C > 0.85
- LOS E
- LOS F

Port Wallace Master Plan-Infrastructure Study
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2-Aug-17

Table 1 - Synchro Analysis Results: 2017 Baseline Volumes & Existing Street Network

Intersection [Synchro Node No.]	Lane / Movement	AM Peak Hour				PM Peak Hour			
		95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]	95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]
Montague Rd & Ramp Terminal (North) [5] (Unsignalized)	EB Left/Thru	9.1	0.30	9.7	A	1.4	0.07	7.6	A
	WB Thru/Right				A				A
	NB Left/Thru/Right	5.6	0.21	22.6	C	4.2	0.16	15.1	C
	Overall			**4.7**	**A**			**2.7**	**A**
Montague Rd & Ramp Terminal (South) [6] (Unsignalized)	EB Thru/Right								
	WB Left/Thru	0.7	0.02	8.2	A	0.0	0.01	7.6	A
	SB Left/Thru/Right	4.2	0.16	12.1	B	70.7	0.85	29.0	D
	Overall			**2.2**	**A**			**20.0**	**C**
Montague/Charles Keating & Waverley [12] (Unsignalized)	EB Left/Thru/Right	2.8	0.13	18.1	C	0.7	0.04	11.6	B
	WB Left/Thru	9.8	0.33	23.8	C	17.5	0.48	20.7	C
	WB Right	1.4	0.05	9.3	A	7.0	0.25	11.1	B
	NB Left/Thru/Right	0.0	0.00	7.6	A	0.0	0.01	7.4	A
	SB Left	3.5	0.14	8.2	A	1.4	0.06	8.0	A
	SB Thru/Right				A				A
	Overall			**6.1**	**A**			**8.2**	**A**
Breeze & Waverley [18] (Unsignalized)	WB Left/Right	9.8	0.33	14.2	B	9.1	0.31	17.5	C
	NB Thru/Right				A				A
	SB Left/Thru	1.4	0.06	7.7	A	2.8	0.12	8.7	A
	Overall			**4.8**	**A**			**3.8**	**A**
Montebello & Waverley [24] (Signalized)	WB Left	86.8	0.68	21.0	C	50.0	0.60	38.0	D
	WB Right	5.7	0.07	4.9	A	8.1	0.13	10.8	B
	NB Thru/Right	47.9	0.52	14.5	B	234.2	0.89	22.1	C
	SB Left	8.5	0.12	13.4	B	9.1	0.29	12.9	B
	SB Thru	91.5	0.78	24.9	C	38.3	0.30	6.8	A
	Overall			**20.2**	**C**			**20.0**	**B**
Main & Forest Hills [56] (Signalized)	EB Left	49.6	0.69	42.6	D	11.8	0.11	19.3	B
	EB Thru	51.3	0.25	29.7	C	226.8	1.02	74.3	E
	EB Right	0.0	0.11	0.7	A	0.0	0.25	0.4	A
	WB Left	19.1	0.13	20.4	C	54.2	0.76	48.5	D
	WB Thru	176.5	0.79	44.6	D	69.3	0.38	30.0	C
	WB Right	0.0	0.37	0.7	A	0.0	0.13	0.2	A
	NB Left	71.8	0.48	46.2	D	42.8	0.50	56.3	E
	NB Thru	237.5	1.07	103.1	F	107.4	0.92	94.1	F
	NB Right	0.0	0.06	0.1	A	0.0	0.15	0.2	A
	SB Left	23.6	0.28	59.3	E	151.6	0.97	73.0	E
	SB Thru	62.9	0.71	79.5	E	223.5	1.12	124.6	F
	SB Right	0.0	0.04	0.1	A	0.0	0.07	0.1	A
	Overall			**43.2**	**D**			**58.5**	**E**
Main & Caledonia/ Woodlawn [71] (Signalized)	EB Left	22.2	0.52	20.1	C	40.8	0.45	12.3	B
	EB Thru	53.6	0.28	19.5	B	210.9	0.75	25.7	C
	EB Right	0.0	0.12	0.2	A	0.0	0.11	0.1	A
	WB Left	32.4	0.33	12.1	B	12.8	0.35	15.2	B
	WB Thru	184.2	0.73	28.1	C	70.3	0.33	20.6	C
	WB Right	0.0	0.06	0.1	A	0.0	0.05	0.1	A
	NB Left	76.4	0.82	58.8	E	47.7	0.60	46.6	D
	NB Thru	43.5	0.27	36.5	D	64.1	0.62	59.8	E
	NB Right	0.0	0.03	0.0	A	0.0	0.06	0.1	A
	SB Left	40.5	0.53	60.4	E	40.1	0.46	40.9	D
	SB Thru	72.1	0.70	65.2	E	71.4	0.70	64.3	E
	SB Right	0.0	0.13	0.2	A	0.0	0.11	0.1	A
	Overall			**26.9**	**C**			**25.3**	**C**
Montebello/Avenue Du Portage & Caledonia/ Breeze [30] (Unsignalized)	EB Left/Thru/Right	2.5	0.47	14.7	B	35.7	0.67	19.2	C
	WB Left/Thru/Right	3.9	0.60	18.6	C	9.8	0.32	12.4	B
	NB Left/Thru/Right	3.5	0.57	17.6	C	21.0	0.52	15.6	C
	SB Left/Thru/Right	2.2	0.44	14.6	B	9.8	0.32	12.3	B
	Overall			**16.6**	**C**			**15.9**	**C**
Access C/ Meadow Walk & Waverley [81] (Unsignalized)	EB Left/Thru/Right				A				A
	WB Left/Thru/Right				A				A
	NB Left/Thru/Right				A				A
	SB Left/Thru/Right				A				A
	Overall				**A**				**A**
Access B /Applewood lane & Waverley [84] (Unsignalized)	EB Left/Thru/Right				A				A
	WB Left/Thru/Right				A				A
	NB Left/Thru/Right				A				A
	SB Left/Thru/Right				A				A
	Overall				**A**				**A**
Access A & Waverley [87] (Unsignalized)	WB Left/Right				A				A
	NB Thru/Right				A				A
	SB Left/Thru				A				A
	Overall				**A**				**A**
Forest Hills Ext Access [89] (Unsignalised)	EB Right				A				A
	NB thru				A				A
	SB Thru				A				A
	SB Thru/Right				A				A
	Overall				**A**				**A**

Notes:
Analysis by CBCL Limited using Synchro 9.0
1. 95% Queue - 95th percentile queue [highlighted if >100m or if available storage is exceeded]
2. V/C Ratio - Volume-to-Capacity ratio [highlighted if >0.85]
3. Average Delay - average total delay per vehicle [highlighted for LOS E or F]
4. LOS - Level of Service [highlighted for LOS E or F]

Table 2 - Synchro Analysis Results: 2031, 1% growth, Opt 1, 50% build-out, 10% NAMC, 7% Nth

Intersection [Synchro Node No.]	Lane / Movement	AM Peak Hour				PM Peak Hour			
		95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]	95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]
Montague Rd & Ramp Terminal (North) [5] (Unsignalized)	EB Left/Thru	71.4	0.84	23.4	C	9.8	0.33	8.7	A
	WB Thru/Right				A				A
	NB Left/Thru/Right	63.0	5.66	2769.5	F	36.4	0.97	185.2	F
	Overall			**123.6**	**F**			**16.6**	**C**
Montague Rd & Ramp Terminal (South) [6] (Unsignalized)	EB Thru/Right								
	WB Left/Thru	0.7	0.03	10.2	B	0.7	0.02	8.7	A
	SB Left/Thru/Right	23.8	0.56	19.5	C	609.7	1.95	447.6	F
	Overall			**4.5**	**A**			**290.7**	**F**
Montague/Charles Keating & Waverley [12] (Unsignalized)	EB Left/Thru/Right	10.5	0.36	47.9	E	1.4	0.07	16.1	C
	WB Left/Thru	182.0	2.42	721.5	F	476.0	2.85	868.5	F
	WB Right	2.1	0.08	11.2	B	12.6	0.39	14.9	B
	NB Left/Thru/Right	0.0	0.00	7.6	A	0.0	0.01	7.5	A
	SB Left	7.0	0.25	10.6	B	2.1	0.09	9.4	A
	SB Thru/Right				A				A
	Overall			**138.9**	**F**			**353.9**	**F**
Breeze & Waverley [18] (Unsignalized)	WB Left/Right	24.5	0.58	27.2	D	32.9	0.72	56.1	F
	NB Thru/Right				A				A
	SB Left/Thru	2.1	0.08	8.0	A	4.2	0.18	10.1	B
	Overall			**6.1**	**A**			**7.0**	**A**
Montebello & Waverley [24] (Signalized)	WB Left	184.6	0.87	44.3	D	57.2	0.72	48.4	D
	WB Right	8.6	0.09	7.6	A	8.9	0.15	10.1	B
	NB Thru/Right	70.0	0.56	15.3	B	387.1	1.14	91.1	F
	SB Left	8.7	0.13	11.6	B	22.8	0.53	37.2	D
	SB Thru	165.0	0.91	34.3	C	67.4	0.45	8.2	A
	Overall			**31.1**	**C**			**63.7**	**E**
Main & Forest Hills [56] (Signalized)	EB Left	72.1	0.83	64.6	E	13.4	0.17	20.1	C
	EB Thru	81.5	0.41	33.9	C	319.6	1.32	187.6	F
	EB Right	0.0	0.13	0.2	A	0.0	0.29	0.5	A
	WB Left	21.4	0.21	21.5	C	72.7	0.83	57.0	E
	WB Thru	255.4	1.00	69.5	E	100.2	0.53	32.9	C
	WB Right	0.0	0.42	0.8	A	0.0	0.15	0.2	A
	NB Left	82.7	0.55	47.8	D	48.5	0.56	57.8	E
	NB Thru	287.4	1.23	163.1	F	129.4	1.04	120.2	F
	NB Right	0.0	0.07	0.1	A	0.0	0.17	0.2	A
	SB Left	26.3	0.30	59.0	E	187.0	1.12	115.9	F
	SB Thru	71.7	0.77	83.5	F	268.0	1.30	190.3	F
	SB Right	0.0	0.05	0.1	A	0.0	0.08	0.1	A
	Overall			**58.8**	**E**			**104.9**	**F**
Main & Caledonia/ Woodlawn [71] (Signalized)	EB Left	102.8	1.15	142.6	F	246.1	1.13	99.7	F
	EB Thru	62.2	0.35	22.6	C	299.3	0.89	34.0	C
	EB Right	0.0	0.13	0.2	A	0.0	0.13	0.2	A
	WB Left	37.1	0.45	15.8	B	17.6	0.45	24.9	C
	WB Thru	246.6	0.93	44.2	D	90.4	0.52	33.8	C
	WB Right	0.0	0.13	0.2	A	0.0	0.14	0.2	A
	NB Left	98.1	0.84	57.4	E	52.6	0.70	51.1	D
	NB Thru	49.5	0.27	33.7	C	71.7	0.65	59.5	E
	NB Right	0.0	0.04	0.0	A	0.0	0.06	0.1	A
	SB Left	130.1	1.11	138.7	F	111.6	1.05	108.0	F
	SB Thru	82.8	0.63	56.4	E	79.8	0.73	63.9	E
	SB Right	0.0	0.35	0.6	A	0.0	0.26	0.4	A
	Overall			**41.7**	**D**			**43.7**	**D**
Montebello/Avenue Du Portage & Caledonia/ Breeze [30] (Unsignalized)	EB Left/Thru/Right	5.5	0.99	40.7	E	97.3	1.56	122.5	F
	WB Left/Thru/Right	52.6	2.04	453.7	F	137.9	1.72	190.7	F
	NB Left/Thru/Right	18.2	1.54	150.2	F	368.2	2.13	457.9	F
	SB Left/Thru/Right	4.5	0.92	37.3	E	21.0	0.80	32.8	D
	Overall			**245.9**	**F**			**269.4**	**F**
Access C/ Meadow Walk & Waverley [81] (Unsignalized)	EB Left/Thru/Right	0.0	0.00	9.7	A	0.0	0.00	10.8	B
	WB Left/Thru/Right	7.7	0.28	11.1	B	6.3	0.24	11.9	B
	NB Left/Thru/Right	16.8	0.46	12.6	B	142.1	1.06	78.7	F
	SB Left/Thru/Right	71.4	0.85	30.3	D	88.9	0.95	43.5	E
	Overall			**22.3**	**C**			**58.1**	**F**
Access B /Applewood lane & Waverley [84] (Unsignalized)	EB Left/Thru/Right	0.0	0.00	10.0	A	0.0	0.00	11.1	B
	WB Left/Thru/Right	8.4	0.29	11.5	B	0.9	0.25	12.2	B
	NB Left/Thru/Right	28.7	0.61	16.2	C	22.6	1.14	94.3	F
	SB Left/Thru/Right	74.9	0.87	33.1	D	19.7	1.11	80.2	F
	Overall			**24.2**	**C**			**81.5**	**F**
Access A & Waverley [87] (Unsignalized)	WB Left/Right	30.1	0.63	20.2	C	17.5	0.54	17.5	C
	NB Thru/Right	70.0	0.89	38.3	E	199.5	1.39	155.2	F
	SB Left/Thru	121.1	1.04	77.0	F	308.0	1.59	255.1	F
	Overall			**50.3**	**F**			**184.2**	**F**
Forest Hills Ext Access [89] (Unsignalised)	EB Right				A				A
	NB thru				A				A
	SB Thru				A				A
	SB Thru/Right				A				A
	Overall				**A**				**A**

Notes:
Analysis by CBCL Limited using Synchro 9.0
1. 95% Queue - 95th percentile queue [highlighted if >100m or if available storage is exceeded]
2. V/C Ratio - Volume-to-Capacity ratio [highlighted if >0.85]
3. Average Delay - average total delay per vehicle [highlighted for LOS E or F]
4. LOS - Level of Service [highlighted for LOS E or F]

Table 3 - Synchro Analysis Results: 2031, 1% growth, Opt 1A, 50% build-out, 10% NAMC, 7% Nth

Intersection [Synchro Node No.]	Lane / Movement	AM Peak Hour				PM Peak Hour			
		95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]	95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]
Montague Rd & Ramp Terminal (North) [5] (Unsignalized)	EB Left/Thru	65.1	0.81	21.6	C	9.8	0.31	8.6	A
	WB Thru/Right				A				A
	NB Left/Thru/Right	60.9	4.44	2093.0	F	28.7	0.77	114.1	F
	Overall			**96.7**	**F**			**11.7**	**B**
Montague Rd & Ramp Terminal (South) [6] (Unsignalized)	EB Thru/Right								
	WB Left/Thru	0.7	0.03	10.1	B	0.7	0.02	8.7	A
	SB Left/Thru/Right	21.7	0.54	18.8	C	583.1	1.90	424.1	F
	Overall			**4.3**	**A**			**275.9**	**F**
Montague/Charles Keating & Waverley [12] (Unsignalized)	EB Left/Thru/Right	9.8	0.34	45.1	E	1.4	0.07	15.9	C
	WB Left/Thru	170.8	2.26	646.1	F	448.0	2.70	801.2	F
	WB Right	2.1	0.08	11.1	B	12.6	0.38	14.7	B
	NB Left/Thru/Right	0.0	0.00	7.6	A	0.0	0.01	7.5	A
	SB Left	6.3	0.24	10.5	B	2.1	0.09	9.3	A
	SB Thru/Right				A				A
	Overall			**123.6**	**F**			**322.7**	**F**
Breeze & Waverley [18] (Unsignalized)	WB Left/Right	29.4	0.65	33.2	D	31.5	0.70	52.6	F
	NB Thru/Right				A				A
	SB Left/Thru	2.1	0.08	8.0	A	4.2	0.17	10.0	A
	Overall			**7.4**	**A**			**6.7**	**A**
Montebello & Waverley [24] (Signalized)	WB Left	184.6	0.87	43.4	D	57.2	0.72	48.4	D
	WB Right	8.6	0.09	7.6	A	8.9	0.15	10.1	B
	NB Thru/Right	69.0	0.56	15.3	B	382.2	1.13	87.2	F
	SB Left	8.7	0.13	11.6	B	22.8	0.53	37.2	D
	SB Thru	161.1	0.91	33.8	C	65.9	0.44	8.1	A
	Overall			**30.6**	**C**			**61.3**	**E**
Main & Forest Hills [56] (Signalized)	EB Left	72.1	0.83	64.6	E	13.4	0.17	20.1	C
	EB Thru	80.6	0.40	33.8	C	317.4	1.32	184.8	F
	EB Right	0.0	0.13	0.2	A	0.0	0.29	0.5	A
	WB Left	21.4	0.20	21.5	C	72.7	0.83	57.0	E
	WB Thru	253.8	1.00	68.6	E	99.4	0.53	32.8	C
	WB Right	0.0	0.42	0.8	A	0.0	0.15	0.2	A
	NB Left	82.7	0.55	47.8	D	48.5	0.56	57.8	E
	NB Thru	287.4	1.23	163.1	F	129.4	1.04	120.2	F
	NB Right	0.0	0.07	0.1	A	0.0	0.17	0.2	A
	SB Left	36.4	0.44	61.8	E	199.4	1.17	134.2	F
	SB Thru	71.7	0.77	83.5	F	268.0	1.30	190.3	F
	SB Right	0.0	0.05	0.1	A	0.0	0.08	0.1	A
	Overall			**58.7**	**E**			**107.3**	**F**
Main & Caledonia/ Woodlawn [71] (Signalized)	EB Left	100.1	1.13	134.1	F	234.8	1.09	87.5	F
	EB Thru	62.2	0.35	22.6	C	299.3	0.89	34.0	C
	EB Right	0.0	0.13	0.2	A	0.0	0.13	0.2	A
	WB Left	37.1	0.45	15.8	B	17.6	0.45	24.9	C
	WB Thru	246.6	0.93	44.2	D	90.4	0.52	33.8	C
	WB Right	0.0	0.13	0.2	A	0.0	0.14	0.2	A
	NB Left	98.1	0.84	57.4	E	52.6	0.70	51.1	D
	NB Thru	49.5	0.27	33.7	C	71.7	0.65	59.5	E
	NB Right	0.0	0.04	0.0	A	0.0	0.06	0.1	A
	SB Left	126.4	1.08	130.2	F	106.0	1.02	101.6	F
	SB Thru	82.8	0.63	56.4	E	79.8	0.73	63.9	E
	SB Right	0.0	0.34	0.6	A	0.0	0.25	0.4	A
	Overall			**40.7**	**D**			**41.6**	**D**
Montebello/Avenue Du Portage & Caledonia/ Breeze [30] (Unsignalized)	EB Left/Thru/Right	38.5	0.97	40.0	E	98.7	2.04	430.3	F
	WB Left/Thru/Right	352.8	1.96	430.6	F	129.5	1.54	120.3	F
	NB Left/Thru/Right	123.9	1.49	142.4	F	350.7	1.64	173.3	F
	SB Left/Thru/Right	31.5	0.90	36.6	E	21.0	0.78	32.0	D
	Overall			**231.9**	**F**			**251.3**	**F**
Access C/ Meadow Walk & Waverley [81] (Unsignalized)	EB Left/Thru/Right	0.0	0.00	9.7	A	0.0	0.00	10.7	B
	WB Left/Thru/Right	7.0	0.26	10.9	B	5.6	0.23	11.6	B
	NB Left/Thru/Right	16.1	0.45	12.3	B	131.6	1.03	69.5	F
	SB Left/Thru/Right	66.5	0.83	27.9	D	81.2	0.93	38.5	E
	Overall			**20.9**	**C**			**51.6**	**F**
Access B /Applewood lane & Waverley [84] (Unsignalized)	EB Left/Thru/Right	0.0	0.00	9.9	A	0.0	0.00	11.0	B
	WB Left/Thru/Right	7.7	0.27	11.3	B	6.3	0.24	12.0	B
	NB Left/Thru/Right	27.3	0.59	15.5	C	146.3	1.11	83.5	F
	SB Left/Thru/Right	69.3	0.85	30.1	D	129.5	1.06	72.5	F
	Overall			**22.5**	**C**			**73.1**	**F**
Access A & Waverley [87] (Unsignalized)	WB Left/Right	27.3	0.59	18.8	C	16.1	0.51	16.7	C
	NB Thru/Right	64.4	0.85	34.4	D	186.9	1.33	140.0	F
	SB Left/Thru	109.2	1.01	64.9	F	284.9	1.52	229.8	F
	Overall			**43.8**	**E**			**166.4**	**F**
Forest Hills Ext [89] (Unsignalised)	EB Right	1.4	0.07	9.8	A	3.5	0.15	19.5	C
	NB thru				A				A
	SB Thru				A				A
	SB Thru/Right				A				A
	Overall			**0.3**	**A**			**0.4**	**A**

Notes:
Analysis by CBCL Limited using Synchro 9.0
1. 95% Queue - 95th percentile queue [highlighted if >100m or if available storage is exceeded]
2. V/C Ratio - Volume-to-Capacity ratio [highlighted if >0.85]
3. Average Delay - average total delay per vehicle [highlighted for LOS E or F]
4. LOS - Level of Service [highlighted for LOS E or F]

Intersection [Arcady Node No.]	Lane / Movement	AM Peak Hour				PM Peak Hour			
		95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]	95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]
Montague Rd & Ramp Terminal (North) [5] (Unsignalized)	EB Left/Thru	51.9		30.6	D	3.9		4.2	A
	WB Thru/Right	137.6		115.8	F	1.1		3.8	A
	NB Left/Thru/Right	0.4		3.6	A	0.4		2.1	A
	Overall			**61.7**	**F**			**3.9**	**A**
Montague Rd & Ramp Terminal (South) [6] (Unsignalized)	EB Thru/Right	277.83		134.06	F	16.59		14.4	B
	WB Left/Thru	0.3		1.3	A	0.4		1.4	A
	SB Left/Thru/Right	1.3		2.0	A	373.5		129.7	F
	Overall			**92.8**	**F**			**88.5**	**F**

Notes:
Analysis by CBCL Limited using Arcady 8
1. 95% Queue - 95th percentile queue [highlighted if >100m or if available storage is exceeded]
2. V/C Ratio - Volume-to-Capacity ratio [highlighted if >0.85]
3. Average Delay - average total delay per vehicle [highlighted for LOS E or F]
4. LOS - Level of Service [highlighted for LOS E or F]

Level of Service Table - HCM 2010

Level of Service	Average Delay per Vehicle (sec)	
	Signalized	Unisignalized
A	<10	<10
B	>10 and <20	>10 and <15
C	>20 and <35	>15 and <25
D	>35 and <55	>25 and <35
E	>55 and <80	>35 and <50
F	>80	>50

Legend

Queue Length > 100m
V/C > 0.85
LOS E
LOS F

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CBCL Limited 171013.00
2-Aug-17

Table 1 - Synchro Analysis Results: 2017 Baseline Volumes & Existing Street Network

Intersection [Synchro Node No.]	Lane / Movement	AM Peak Hour				PM Peak Hour			
		95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]	95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]
Montague Rd & Ramp Terminal (North) [5] (Unsignalized)	EB Left/Thru	9.1	0.30	9.7	A	1.4	0.07	7.6	A
	WB Thru/Right				A				A
	NB Left/Thru/Right	5.6	0.21	22.6	C	4.2	0.16	15.1	C
	Overall			**4.7**	**A**			**2.7**	**A**
Montague Rd & Ramp Terminal (South) [6] (Unsignalized)	EB Thru/Right								
	WB Left/Thru	0.7	0.02	8.2	A	0.0	0.01	7.6	A
	SB Left/Thru/Right	4.2	0.16	12.1	B	70.7	0.85	29.0	D
	Overall			**2.2**	**A**			**20.0**	**C**
Montague/Charles Keating & Waverley [12] (Unsignalized)	EB Left/Thru/Right	2.8	0.13	18.1	C	0.7	0.04	11.6	B
	WB Left/Thru	9.8	0.33	23.8	C	17.5	0.48	20.7	C
	WB Right	1.4	0.05	9.3	A	7.0	0.25	11.1	B
	NB Left/Thru/Right	0.0	0.00	7.6	A	0.0	0.01	7.4	A
	SB Left	3.5	0.14	8.2	A	1.4	0.06	8.0	A
	SB Thru/Right				A				A
	Overall			**6.1**	**A**			**8.2**	**A**
Breeze & Waverley [18] (Unsignalized)	WB Left/Right	9.8	0.33	14.2	B	9.1	0.31	17.5	C
	NB Thru/Right				A				A
	SB Left/Thru	1.4	0.06	7.7	A	2.8	0.12	8.7	A
	Overall			**4.8**	**A**			**3.8**	**A**
Montebello & Waverley [24] (Signalized)	WB Left	86.8	0.68	21.0	C	50.0	0.60	38.0	D
	WB Right	5.7	0.07	4.9	A	8.1	0.13	10.8	B
	NB Thru/Right	47.9	0.52	14.5	B	234.2	0.89	22.1	C
	SB Left	8.5	0.12	13.4	B	9.1	0.29	12.9	B
	SB Thru	91.5	0.78	24.9	C	38.3	0.30	6.8	A
	Overall			**20.2**	**C**			**20.0**	**B**
Main & Forest Hills [56] (Signalized)	EB Left	49.6	0.69	42.6	D	11.8	0.11	19.3	B
	EB Thru	51.3	0.25	29.7	C	226.8	1.02	74.3	E
	EB Right	0.0	0.11	0.7	A	0.0	0.25	0.4	A
	WB Left	19.1	0.13	20.4	C	54.2	0.76	48.5	D
	WB Thru	176.5	0.79	44.6	D	69.3	0.38	30.0	C
	WB Right	0.0	0.37	0.7	A	0.0	0.13	0.2	A
	NB Left	71.8	0.48	46.2	D	42.8	0.50	56.3	E
	NB Thru	237.5	1.07	109.1	F	107.4	0.92	94.1	F
	NB Right	0.0	0.06	0.1	A	0.0	0.15	0.2	A
	SB Left	23.6	0.28	59.3	E	151.6	0.97	73.0	E
	SB Thru	62.9	0.71	79.5	E	223.5	1.12	124.6	F
	SB Right	0.0	0.04	0.1	A	0.0	0.07	0.1	A
	Overall			**43.2**	**D**			**58.5**	**E**
Main & Caledonia/ Woodlawn [71] (Signalized)	EB Left	22.2	0.52	20.1	C	40.8	0.45	12.3	B
	EB Thru	53.6	0.28	19.5	B	210.9	0.75	25.7	C
	EB Right	0.0	0.12	0.2	A	0.0	0.11	0.1	A
	WB Left	32.4	0.33	12.1	B	12.8	0.35	15.2	B
	WB Thru	184.2	0.73	28.1	C	70.3	0.33	20.6	C
	WB Right	0.0	0.06	0.1	A	0.0	0.05	0.1	A
	NB Left	76.4	0.82	58.8	E	47.7	0.60	46.6	D
	NB Thru	43.5	0.27	36.5	D	64.1	0.62	59.8	E
	NB Right	0.0	0.03	0.0	A	0.0	0.06	0.1	A
	SB Left	40.5	0.53	60.4	E	40.1	0.46	40.9	D
	SB Thru	72.1	0.70	65.2	E	71.4	0.70	64.3	E
	SB Right	0.0	0.13	0.2	A	0.0	0.11	0.1	A
	Overall			**26.9**	**C**			**25.3**	**C**
Montebello/Avenue Du Portage & Caledonia/ Breeze [30] (Unsignalized)	EB Left/Thru/Right	2.5	0.47	14.7	B	35.7	0.67	19.2	C
	WB Left/Thru/Right	3.9	0.60	18.6	C	9.8	0.32	12.4	B
	NB Left/Thru/Right	3.5	0.57	17.6	C	21.0	0.52	15.6	C
	SB Left/Thru/Right	2.2	0.44	14.6	B	9.8	0.32	12.3	B
	Overall			**16.6**	**C**			**15.9**	**C**
Access C/ Meadow Walk & Waverley [81] (Unsignalized)	EB Left/Thru/Right				A				A
	WB Left/Thru/Right				A				A
	NB Left/Thru/Right				A				A
	SB Left/Thru/Right				A				A
	Overall				**A**				**A**
Access B /Applewood lane & Waverley [84] (Unsignalized)	EB Left/Thru/Right				A				A
	WB Left/Thru/Right				A				A
	NB Left/Thru/Right				A				A
	SB Left/Thru/Right				A				A
	Overall				**A**				**A**
Access A & Waverley [87] (Unsignalized)	WB Left/Right				A				A
	NB Thru/Right				A				A
	SB Left/Thru				A				A
	Overall				**A**				**A**
Forest Hills Ext Access [89] (Unsignalised)	EB Right				A				A
	NB thru				A				A
	SB Thru				A				A
	SB Thru/Right				A				A
	Overall				**A**				**A**

Notes:
Analysis by CBCL Limited using Synchro 9.0
1. 95% Queue - 95th percentile queue [highlighted if >100m or if available storage is exceeded]
2. V/C Ratio - Volume-to-Capacity ratio [highlighted if >0.85]
3. Average Delay - average total delay per vehicle [highlighted for LOS E or F]
4. LOS - Level of Service [highlighted for LOS E or F]

Table 13 - Synchro Analysis Results: 2047 Volumes & Existing Street Network, 0.75% Growth, No Development

Intersection [Synchro Node No.]	Lane / Movement	AM Peak Hour				PM Peak Hour			
		95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]	95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]
Montague Rd & Ramp Terminal (North) [5] (Unsignalized)	EB Left/Thru	14.7	0.41	11.2	B	2.1	0.08	7.8	A
	WB Thru/Right				A				A
	NB Left/Thru/Right	14.7	0.47	50.5	F	7.0	0.25	19.4	C
	Overall			**6.8**	**A**			**3.2**	**A**
Montague Rd & Ramp Terminal (South) [6] (Unsignalized)	EB Thru/Right								
	WB Left/Thru	0.7	0.03	8.5	A	0.0	0.01	7.8	A
	SB Left/Thru/Right	6.3	0.24	14.0	B	179.9	1.14	100.2	F
	Overall			**2.5**	**A**			**68.9**	**F**
Montague/Charles Keating & Waverley [12] (Unsignalized)	EB Left/Thru/Right	5.6	0.22	25.0	C	1.4	0.06	13.0	B
	WB Left/Thru	23.8	0.61	49.1	E	41.3	0.75	41.6	E
	WB Right	1.4	0.07	9.5	A	10.5	0.34	12.6	B
	NB Left/Thru/Right	0.0	0.00	7.7	A	0.0	0.01	7.5	A
	SB Left	4.9	0.18	8.5	A	1.4	0.07	8.3	A
	SB Thru/Right				A				A
	Overall			**9.6**	**A**			**13.3**	**B**
Breeze & Waverley [18] (Unsignalized)	WB Left/Right	18.2	0.49	19.2	C	19.6	0.52	28.3	D
	NB Thru/Right				A				A
	SB Left/Thru	2.1	0.08	7.8	A	4.2	0.16	9.3	A
	Overall			**6.2**	**A**			**5.4**	**A**
Montebello & Waverley [24] (Signalized)	WB Left	165.1	0.83	33.8	C	62.0	0.75	50.0	D
	WB Right	8.2	0.09	6.5	A	9.2	0.16	9.8	A
	NB Thru/Right	62.0	0.59	16.7	B	336.9	1.05	58.0	E
	SB Left	10.1	0.17	14.0	B	25.5	0.58	43.3	D
	SB Thru	122.6	0.88	33.2	C	49.9	0.36	7.5	A
	Overall			**28.0**	**C**			**44.4**	**D**
Main & Forest Hills [56] (Signalized)	EB Left	81.4	0.89	74.8	E	14.2	0.16	20.0	B
	EB Thru	64.9	0.33	33.2	C	312.6	1.32	186.9	F
	EB Right	0.0	0.14	0.2	A	0.0	0.31	0.5	A
	WB Left	22.8	0.19	21.6	C	83.2	0.87	62.8	E
	WB Thru	263.1	1.04	79.9	E	88.7	0.48	31.8	C
	WB Right	0.0	0.46	1.0	A	0.0	0.16	0.2	A
	NB Left	90.7	0.60	49.0	D	52.6	0.62	59.3	E
	NB Thru	320.9	1.34	205.7	F	143.3	1.13	144.3	F
	NB Right	0.0	0.08	0.1	A	0.0	0.19	0.3	A
	SB Left	28.1	0.32	58.8	E	211.3	1.22	153.1	F
	SB Thru	82.0	0.80	85.6	F	298.6	1.42	236.5	F
	SB Right	0.0	0.05	0.1	A	0.0	0.09	0.1	A
	Overall			**69.0**	**E**			**117.2**	**F**
Main & Caledonia/ Woodlawn [71] (Signalized)	EB Left	50.0	0.74	47.8	D	55.3	0.65	18.4	B
	EB Thru	68.2	0.36	21.8	C	347.0	1.01	55.9	E
	EB Right	0.0	0.15	0.2	A	0.0	0.14	0.2	A
	WB Left	40.1	0.49	15.5	B	23.8	0.48	28.1	C
	WB Thru	285.6	0.96	46.1	D	99.6	0.45	26.3	C
	WB Right	0.0	0.08	0.1	A	0.0	0.07	0.1	A
	NB Left	110.0	1.09	116.7	F	58.3	0.78	57.6	E
	NB Thru	53.5	0.32	36.0	D	77.2	0.67	59.4	E
	NB Right	0.0	0.04	0.1	A	0.0	0.07	0.1	A
	SB Left	50.3	0.62	63.0	E	47.5	0.59	43.4	D
	SB Thru	90.2	0.79	68.7	E	86.3	0.75	64.3	E
	SB Right	0.0	0.16	0.2	A	0.0	0.14	0.2	A
	Overall			**40.1**	**D**			**40.0**	**D**
Montebello/Avenue Du Portage & Caledonia/ Breeze [30] (Unsignalized)	EB Left/Thru/Right	53.2	0.82	41.3	E	99.4	1.00	65.1	F
	WB Left/Thru/Right	88.2	1.00	75.8	F	18.9	0.50	18.5	C
	NB Left/Thru/Right	79.1	0.96	65.1	F	49.0	0.78	32.1	D
	SB Left/Thru/Right	43.4	0.76	35.7	E	18.9	0.50	18.4	C
	Overall			**56.6**	**F**			**40.6**	**E**
Access C/ Meadow Walk & Waverley [81] (Unsignalized)	EB Left/Thru/Right				A				A
	WB Left/Thru/Right				A				A
	NB Left/Thru/Right				A				A
	SB Left/Thru/Right				A				A
	Overall				**A**				**A**
Access B /Applewood lane & Waverley [84] (Unsignalized)	EB Left/Thru/Right				A				A
	WB Left/Thru/Right				A				A
	NB Left/Thru/Right				A				A
	SB Left/Thru/Right				A				A
	Overall				**A**				**A**
Access A & Waverley [87] (Unsignalized)	WB Left/Right				A				A
	NB Thru/Right				A				A
	SB Left/Thru				A				A
	Overall				**A**				**A**
Forest Hills Ext Access [89] (Unsignalised)	EB Right				A				A
	NB thru				A				A
	SB Thru				A				A
	SB Thru/Right				A				A
	Overall				**A**				**A**

Notes:
Analysis by CBCL Limited using Synchro 9.0
1. 95% Queue - 95th percentile queue [highlighted if >100m or if available storage is exceeded]
2. V/C Ratio - Volume-to-Capacity ratio [highlighted if >0.85]
3. Average Delay - average total delay per vehicle [highlighted for LOS E or F]
4. LOS - Level of Service [highlighted for LOS E or F]

Level of Service Table - HCM 2010

Level of Service	Average Delay per Vehicle (sec)	
	Signalized	Unisignalized
A	<10	<10
B	>10 and <20	>10 and <15
C	>20 and <35	>15 and <25
D	>35 and <55	>25 and <35
E	>55 and <80	>35 and <50
F	>80	>50

Legend

Queue Length > 100m
V/C > 0.85
LOS E
LOS F

Port Wallace Master Plan-Infrastructure Study
CBCL Limited 171013.00
2-Aug-17

Table 1 - Synchro Analysis Results: 2017 Baseline Volumes & Existing Street Network

Intersection [Synchro Node No.]	Lane / Movement	AM Peak Hour				PM Peak Hour			
		95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]	95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]
Montague Rd & Ramp Terminal (North) [5] (Unsignalized)	EB Left/Thru	9.1	0.30	9.7	A	1.4	0.07	7.6	A
	WB Thru/Right				A				A
	NB Left/Thru/Right	5.6	0.21	22.6	C	4.2	0.16	15.1	C
	Overall			4.7	A			2.7	A
Montague Rd & Ramp Terminal (South) [6] (Unsignalized)	EB Thru/Right								
	WB Left/Thru	0.7	0.02	8.2	A	0.0	0.01	7.6	A
	SB Left/Thru/Right	4.2	0.16	12.1	B	70.7	0.85	29.0	D
	Overall			2.2	A			20.0	C
Montague/Charles Keating & Waverley [12] (Unsignalized)	EB Left/Thru/Right	2.8	0.13	18.1	C	0.7	0.04	11.6	B
	WB Left/Thru	9.8	0.33	23.8	C	17.5	0.48	20.7	C
	WB Right	1.4	0.05	9.3	A	7.0	0.25	11.1	B
	NB Left/Thru/Right	0.0	0.00	7.6	A	0.0	0.01	7.4	A
	SB Left	3.5	0.14	8.2	A	1.4	0.06	8.0	A
	SB Thru/Right				A				A
	Overall			6.1	A			8.2	A
Breeze & Waverley [18] (Unsignalized)	WB Left/Right	9.8	0.33	14.2	B	9.1	0.31	17.5	C
	NB Thru/Right				A				A
	SB Left/Thru	1.4	0.06	7.7	A	2.8	0.12	8.7	A
	Overall			4.8	A			3.8	A
Montebello & Waverley [24] (Signalized)	WB Left	86.8	0.68	21.0	C	50.0	0.60	38.0	D
	WB Right	5.7	0.07	4.9	A	8.1	0.13	10.8	B
	NB Thru/Right	47.9	0.52	14.5	B	234.2	0.89	22.1	C
	SB Left	8.5	0.12	13.4	B	9.1	0.29	12.9	B
	SB Thru	91.5	0.78	24.9	C	38.3	0.30	6.8	A
	Overall			20.2	C			20.0	B
Main & Forest Hills [56] (Signalized)	EB Left	49.6	0.69	42.6	D	11.8	0.11	19.3	B
	EB Thru	51.3	0.25	29.7	C	226.8	1.02	74.3	E
	EB Right	0.0	0.11	0.7	A	0.0	0.25	0.4	A
	WB Left	19.1	0.13	20.4	C	54.2	0.76	48.5	D
	WB Thru	176.5	0.79	44.6	D	69.3	0.38	30.0	C
	WB Right	0.0	0.37	0.7	A	0.0	0.13	0.2	A
	NB Left	71.8	0.48	46.2	D	42.8	0.50	56.3	E
	NB Thru	237.5	1.07	109.1	F	107.4	0.92	94.1	F
	NB Right	0.0	0.06	0.1	A	0.0	0.15	0.2	A
	SB Left	23.6	0.28	59.3	E	151.6	0.97	73.0	E
	SB Thru	62.9	0.71	79.5	E	223.5	1.12	124.6	F
	SB Right	0.0	0.04	0.1	A	0.0	0.07	0.1	A
	Overall			43.2	D			58.5	E
Main & Caledonia/ Woodlawn [71] (Signalized)	EB Left	22.2	0.52	20.1	C	40.8	0.45	12.3	B
	EB Thru	53.6	0.28	19.5	B	210.9	0.75	25.7	C
	EB Right	0.0	0.12	0.2	A	0.0	0.11	0.1	A
	WB Left	32.4	0.33	12.1	B	12.8	0.35	15.2	B
	WB Thru	184.2	0.73	28.1	C	70.3	0.33	20.6	C
	WB Right	0.0	0.06	0.1	A	0.0	0.05	0.1	A
	NB Left	76.4	0.82	58.8	E	47.7	0.60	46.6	D
	NB Thru	43.5	0.27	36.5	D	64.1	0.62	59.8	E
	NB Right	0.0	0.03	0.0	A	0.0	0.06	0.1	A
	SB Left	40.5	0.53	60.4	E	40.1	0.46	40.9	D
	SB Thru	72.1	0.70	65.2	E	71.4	0.70	64.3	E
	SB Right	0.0	0.13	0.2	A	0.0	0.11	0.1	A
	Overall			26.9	C			25.3	C
Montebello/Avenue Du Portage & Caledonia/ Breeze [30] (Unsignalized)	EB Left/Thru/Right	2.5	0.47	14.7	B	35.7	0.67	19.2	C
	WB Left/Thru/Right	3.9	0.60	18.6	C	9.8	0.32	12.4	B
	NB Left/Thru/Right	3.5	0.57	17.6	C	21.0	0.52	15.6	C
	SB Left/Thru/Right	2.2	0.44	14.6	B	9.8	0.32	12.3	B
	Overall			16.6	C			15.9	C
Access C/ Meadow Walk & Waverley [81] (Unsignalized)	EB Left/Thru/Right				A				A
	WB Left/Thru/Right				A				A
	NB Left/Thru/Right				A				A
	SB Left/Thru/Right				A				A
	Overall				A				A
Access B /Applewood lane & Waverley [84] (Unsignalized)	EB Left/Thru/Right				A				A
	WB Left/Thru/Right				A				A
	NB Left/Thru/Right				A				A
	SB Left/Thru/Right				A				A
	Overall				A				A
Access A & Waverley [87] (Unsignalized)	WB Left/Right				A				A
	NB Thru/Right				A				A
	SB Left/Thru				A				A
	Overall				A				A
Forest Hills Ext Access [89] (Unsignalised)	EB Right				A				A
	NB thru				A				A
	SB Thru				A				A
	SB Thru/Right				A				A
	Overall				A				A

Notes:
Analysis by CBCL Limited using Synchro 9.0
1. 95% Queue - 95th percentile queue [highlighted if >100m or if available storage is exceeded]
2. V/C Ratio - Volume-to-Capacity ratio [highlighted if >0.85]
3. Average Delay - average total delay per vehicle [highlighted for LOS E or F]
4. LOS - Level of Service [highlighted for LOS E or F]

Table 4 - Synchro Analysis Results: 2047, 0.75% growth, Opt 1, 100% build-out, 10% NAMC, 7% Nth

Intersection [Synchro Node No.]	Lane / Movement	AM Peak Hour				PM Peak Hour			
		95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]	95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]
Montague Rd & Ramp Terminal (North) [5] (Unsignalized)	EB Left/Thru	191.1	1.10	80.1	F	23.8	0.55	10.5	B
	WB Thru/Right				A				A
	NB Left/Thru/Right	1.4	0.07	9.1	A	78.4	4.97	2236.4	F
	Overall			47.2	E			134.7	F
Montague Rd & Ramp Terminal (South) [6] (Unsignalized)	EB Thru/Right								
	WB Left/Thru	0.7	0.05	11.4	B	0.7	0.02	9.9	A
	SB Left/Thru/Right	113.4	1.03	73.4	F	1006.6	3.20	1013.1	F
	Overall			22.9	C			615.0	F
Montague/Charles Keating & Waverley [12] (Unsignalized)	EB Left/Thru/Right	20.3	0.64	108.0	F	2.8	0.13	24.0	C
	WB Left/Thru	479.5	9.43	3918.9	F	759.5	5.56	2100.9	F
	WB Right	2.1	0.10	12.3	B	21.0	0.53	20.9	C
	NB Left/Thru/Right	0.0	0.00	7.7	A	0.0	0.01	7.5	A
	SB Left	9.8	0.32	12.6	B	2.8	0.13	11.1	B
	SB Thru/Right				A				A
	Overall			1080.7	F			845.8	F
Breeze & Waverley [18] (Unsignalized)	WB Left/Right	56.0	0.90	74.8	F	70.0	1.23	215.1	F
	NB Thru/Right				A				A
	SB Left/Thru	2.1	0.10	8.4	A	5.6	0.22	11.0	B
	Overall			13.6	B			21.3	C
Montebello & Waverley [24] (Signalized)	WB Left	206.9	1.07	93.2	F	62.0	0.75	50.0	D
	WB Right	9.7	0.11	9.0	A	902.0	0.16	9.8	A
	NB Thru/Right	107.2	0.65	17.2	B	463.4	1.31	164.2	F
	SB Left	10.1	0.18	11.8	B	25.5	0.58	43.3	D
	SB Thru	248.1	0.95	38.5	D	99.0	0.58	10.4	B
	Overall			45.2	D			106.8	F
Main & Forest Hills [56] (Signalized)	EB Left	81.4	0.89	74.8	E	14.2	0.21	20.8	C
	EB Thru	97.5	0.49	36.0	D	388.3	1.55	285.9	F
	EB Right	0.0	0.14	0.2	A	0.0	0.31	0.5	A
	WB Left	22.8	0.25	22.4	C	83.2	0.87	62.8	E
	WB Thru	328.0	1.20	137.7	F	117.8	0.61	34.7	C
	WB Right	0.0	0.46	1.0	A	0.0	0.16	0.2	A
	NB Left	90.7	0.60	49.0	D	52.6	0.62	59.3	E
	NB Thru	320.9	1.34	205.7	F	143.3	1.13	144.3	F
	NB Right	0.0	0.08	0.1	A	0.0	0.19	0.3	A
	SB Left	28.1	0.32	58.8	E	211.3	1.22	153.1	F
	SB Thru	82.0	0.80	85.6	F	298.6	1.42	236.5	F
	SB Right	0.0	0.05	0.1	A	0.0	0.09	0.1	A
	Overall			86.0	F			145.8	F
Main & Caledonia/ Woodlawn [71] (Signalized)	EB Left	194.7	1.92	454.7	F	363.6	1.53	270.7	F
	EB Thru	68.2	0.38	23.1	C	347.0	1.01	55.9	E
	EB Right	0.0	0.15	0.2	A	0.0	0.14	0.2	A
	WB Left	40.1	0.52	17.2	B	19.5	0.48	26.1	C
	WB Thru	285.6	1.02	61.0	E	99.6	0.57	34.8	C
	WB Right	0.0	0.21	0.3	A	0.0	0.18	0.3	A
	NB Left	122.3	0.97	81.0	F	58.3	0.78	57.6	E
	NB Thru	53.5	0.29	34.1	C	77.2	0.67	59.4	E
	NB Right	0.0	0.04	0.1	A	0.0	0.07	0.1	A
	SB Left	173.0	1.43	254.2	F	207.7	1.54	292.6	F
	SB Thru	90.2	0.69	59.1	E	86.3	0.75	64.3	E
	SB Right	0.0	0.44	0.9	A	0.0	0.37	0.7	A
	Overall			79.7	E			90.3	F
Montebello/Avenue Du Portage & Caledonia/ Breeze [30] (Unsignalized)	EB Left/Thru/Right	42.0	1.54	66.1	F	99.4	2.38	185.7	F
	WB Left/Thru/Right	476.0	3.12	735.6	F	282.1	3.13	525.7	F
	NB Left/Thru/Right	284.2	2.70	459.6	F	466.2	3.22	718.2	F
	SB Left/Thru/Right	35.0	1.41	58.9	F	23.1	1.27	50.3	F
	Overall			474.3	F			497.5	F
Access C/ Meadow Walk & Waverley [81] (Unsignalized)	EB Left/Thru/Right	0.0	0.00	11.2	B	0.0	0.00	12.6	B
	WB Left/Thru/Right	14.7	0.45	14.7	B	15.4	0.49	16.3	C
	NB Left/Thru/Right	44.1	0.77	24.2	C	252.0	1.45	196.0	F
	SB Left/Thru/Right	199.5	1.21	133.4	F	217.0	1.39	168.6	F
	Overall			81.0	F			162.5	F
Access B /Applewood lane & Waverley [84] (Unsignalized)	EB Left/Thru/Right	0.0	0.00	11.8	B	0.0	0.00	13.2	B
	WB Left/Thru/Right	15.4	0.47	15.5	C	15.4	0.51	16.9	C
	NB Left/Thru/Right	77.0	0.96	41.7	E	308.7	1.64	256.9	F
	SB Left/Thru/Right	246.4	1.32	180.1	F	300.3	1.64	253.4	F
	Overall			108.2	F			229.0	F
Access A & Waverley [87] (Unsignalized)	WB Left/Right	67.2	1.05	48.3	E	59.5	1.12	46.7	E
	NB Thru/Right	178.5	1.45	168.8	F	394.8	2.33	445.2	F
	SB Left/Thru	375.9	1.85	374.2	F	520.1	2.56	580.5	F
	Overall			232.2	F			435.0	F
Forest Hills Ext Access [89] (Unsignalised)	EB Right				A				A
	NB thru				A				A
	SB Thru				A				A
	SB Thru/Right				A				A
	Overall				A				A

Notes:
Analysis by CBCL Limited using Synchro 9.0
1. 95% Queue - 95th percentile queue [highlighted if >100m or if available storage is exceeded]
2. V/C Ratio - Volume-to-Capacity ratio [highlighted if >0.85]
3. Average Delay - average total delay per vehicle [highlighted for LOS E or F]
4. LOS - Level of Service [highlighted for LOS E or F]

Table 5 - Synchro Analysis Results: 2047, 0.75% growth, Opt 1A, 100% build-out, 10% NAMC, 7% Nth

Intersection [Synchro Node No.]	Lane / Movement	AM Peak Hour				PM Peak Hour			
		95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]	95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]
Montague Rd & Ramp Terminal (North) [5] (Unsignalized)	EB Left/Thru	170.1	1.07	68.3	F	22.4	0.52	10.2	B
	WB Thru/Right				A				A
	NB Left/Thru/Right	1.4	0.07	9.1	A	75.6	4.02	1735.0	F
	Overall			39.8	E			107.7	F
Montague Rd & Ramp Terminal (South) [6] (Unsignalized)	EB Thru/Right								
	WB Left/Thru	0.7	0.04	11.2	B	0.7	0.02	9.8	A
	SB Left/Thru/Right	98.0	0.98	59.9	F	918.4	2.77	818.4	F
	Overall			18.5	C			498.3	F
Montague/Charles Keating & Waverley [12] (Unignalized)	EB Left/Thru/Right	19.6	0.61	99.0	F	2.8	0.12	23.0	C
	WB Left/Thru	455.0	8.38	3437.3	F	720.3	5.18	1928.7	F
	WB Right	2.1	0.10	12.1	B	20.3	0.52	20.2	C
	NB Left/Thru/Right	0.0	0.00	7.7	A	0.0	0.01	7.5	A
	SB Left	9.1	0.31	12.3	B	2.8	0.13	10.9	B
	SB Thru/Right				A				A
	Overall			935.4	F			768.7	F
Breeze & Waverley [18] (Unsignalized)	WB Left/Right	53.2	0.88	68.2	F	66.5	1.18	193.0	F
	NB Thru/Right				A				A
	SB Left/Thru	2.1	0.09	8.4	A	5.6	0.21	10.9	B
	Overall			12.7	B			19.5	C
Montebello & Waverley [24] (Signalized)	WB Left	206.9	1.06	88.8	F	62.0	0.75	50.0	D
	WB Right	9.7	0.11	9.0	A	9.2	0.16	9.8	A
	NB Thru/Right	104.2	0.65	17.1	B	457.9	1.30	159.3	F
	SB Left	10.0	0.18	11.8	B	25.5	0.58	43.3	D
	SB Thru	241.9	0.94	37.7	D	95.9	0.57	10.2	B
	Overall			43.9	D			104.0	F
Main & Forest Hills [56] (Signalized)	EB Left	81.4	0.89	74.8	E	14.2	0.20	20.8	C
	EB Thru	95.8	0.48	35.9	D	384.3	1.54	280.7	F
	EB Right	0.0	0.14	0.2	A	0.0	0.31	0.5	A
	WB Left	22.8	0.25	22.4	C	83.2	0.87	62.8	E
	WB Thru	324.6	0.19	134.4	F	116.0	0.60	34.5	C
	WB Right	0.0	0.46	1.0	A	0.0	0.16	0.2	A
	NB Left	90.7	0.60	49.0	D	52.6	0.62	59.3	E
	NB Thru	320.9	1.34	205.7	F	143.3	1.13	144.3	F
	NB Right	0.0	0.08	0.1	A	0.0	0.19	0.3	A
	SB Left	42.5	0.51	62.8	E	233.5	1.32	190.2	F
	SB Thru	82.0	0.80	85.6	F	298.6	1.42	236.5	F
	SB Right	0.0	0.05	0.1	A	0.0	0.09	0.1	A
	Overall			84.8	F			150.8	F
Main & Caledonia/ Woodlawn [71] (Signalized)	EB Left	188.7	1.86	430.6	F	347.4	1.48	249.0	F
	EB Thru	68.2	0.38	23.1	C	347.0	1.01	55.9	E
	EB Right	0.0	0.15	0.2	A	0.0	0.14	0.2	A
	WB Left	40.1	0.52	17.2	B	19.5	0.48	26.1	C
	WB Thru	285.6	1.02	61.0	E	99.6	0.57	34.8	C
	WB Right	0.0	0.21	0.3	A	0.0	0.18	0.2	A
	NB Left	122.3	0.97	81.0	F	58.3	0.78	57.6	E
	NB Thru	53.5	0.29	34.1	C	77.2	0.67	59.4	E
	NB Right	0.0	0.04	0.1	A	0.0	0.07	0.1	A
	SB Left	167.1	1.39	237.3	F	200.8	1.50	273.1	F
	SB Thru	90.2	0.69	59.1	E	86.3	0.75	64.3	E
	SB Right	0.0	0.43	0.8	A	0.0	0.36	0.6	A
	Overall			76.3	E			85.0	F
Montebello/Avenue Du Portage & Caledonia/ Breeze [30] (Unsignalized)	EB Left/Thru/Right	42.7	1.49	64.5	F	101.5	2.27	183.7	F
	WB Left/Thru/Right	459.9	3.03	701.5	F	268.8	2.94	490.3	F
	NB Left/Thru/Right	275.1	2.63	437.6	F	450.1	3.13	681.7	F
	SB Left/Thru/Right	35.7	1.37	57.6	F	23.1	1.22	48.6	E
	Overall			449.5	F			467.9	F
Access C/ Meadow Walk & Waverley [81] (Unsignalized)	EB Left/Thru/Right	0.0	0.00	11.0	B	0.0	0.00	12.3	B
	WB Left/Thru/Right	13.3	0.42	14.0	B	14.0	0.46	15.7	C
	NB Left/Thru/Right	37.8	0.72	20.8	C	237.3	1.41	179.4	F
	SB Left/Thru/Right	179.9	1.16	114.0	F	200.9	1.35	150.7	F
	Overall			69.7	F			147.9	F
Access B /Applewood lane & Waverley [84] (Unsignalized)	EB Left/Thru/Right	0.0	0.00	11.6	B	0.0	0.00	12.9	B
	WB Left/Thru/Right	14.0	0.44	14.9	B	14.0	0.48	16.2	C
	NB Left/Thru/Right	70.0	0.92	36.5	E	291.9	1.59	236.3	F
	SB Left/Thru/Right	225.4	1.27	158.7	F	280.0	1.56	229.4	F
	Overall			95.9	F			209.7	F
Access A & Waverley [87] (Unsignalized)	WB Left/Right	58.8	0.98	40.9	E	54.6	1.05	41.9	E
	NB Thru/Right	162.4	1.37	144.7	F	376.6	2.22	412.0	F
	SB Left/Thru	354.9	1.76	342.0	F	490.0	2.38	533.3	F
	Overall			209.5	F			401.8	F
Forest Hills Ext Access [89] (Unsignalised)	EB Right	2.1	0.11	10.2	B	9.1	0.31	25.3	D
	NB thru				A				A
	SB Thru				A				A
	SB Thru/Right				A				A
	Overall			0.4	A			0.8	A

Notes:
Analysis by CBCL Limited using Synchro 9.0
1. 95% Queue - 95th percentile queue [highlighted if >100m or if available storage is exceeded]
2. V/C Ratio - Volume-to-Capacity ratio [highlighted if >0.85]
3. Average Delay - average total delay per vehicle [highlighted for LOS E or F]
4. LOS - Level of Service [highlighted for LOS E or F]

Table 6 - Synchro Analysis Results: 2047, 0.75% growth, Opt 2, 100% build-out, 10% NAMC, 7% Nth

Intersection [Synchro Node No.]	Lane / Movement	AM Peak Hour				PM Peak Hour			
		95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]	95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]
Montague Rd & Ramp Terminal (North) [5] (Unsignalized)	EB Left/Thru	128.1	0.99	46.4	E	18.2	0.47	9.7	A
	WB Thru/Right				A				A
	NB Left/Thru/Right	1.4	0.07	9.1	A	68.6	2.64	1005.5	F
	Overall			26.3	D			67.5	F
Montague Rd & Ramp Terminal (South) [6] (Unsignalized)	EB Thru/Right				A				A
	WB Left/Thru	0.7	0.04	10.8	B	0.7	0.02	9.4	A
	SB Left/Thru/Right	70.7	0.88	40.1	E	823.2	2.52	705.9	F
	Overall			12.1	B			433.3	F
Montague/Charles Keating & Waverley [12] (Unignalized)	EB Left/Thru/Right	16.8	0.53	78.9	F	2.8	0.11	21.0	C
	WB Left/Thru	396.9	6.33	2502.3	F	629.3	4.35	1551.2	F
	WB Right	2.1	0.09	11.7	B	18.9	0.49	18.8	C
	NB Left/Thru/Right	0.0	0.00	7.7	A	0.0	0.01	7.5	A
	SB Left	8.4	0.29	11.6	B	2.8	0.18	10.5	B
	SB Thru/Right				A				A
	Overall			658.0	F			603.2	F
Breeze & Waverley [18] (Unsignalized)	WB Left/Right	46.2	0.81	54.2	F	58.1	1.04	140.7	F
	NB Thru/Right				A				A
	SB Left/Thru	2.1	0.09	8.3	A	5.6	0.21	10.7	B
	Overall			10.7	B			15.1	C
Montebello & Waverley [24] (Signalized)	WB Left	206.9	1.03	79.3	E	62.0	0.75	50.0	D
	WB Right	9.7	0.10	9.0	A	9.2	0.16	9.8	A
	NB Thru/Right	98.0	0.64	17.0	B	442.8	1.27	146.0	F
	SB Left	9.9	0.17	11.8	B	25.5	0.58	43.3	D
	SB Thru	202.5	0.93	36.2	D	88.8	0.54	9.8	A
	Overall			41.1	D			96.2	F
Main & Forest Hills [56] (Signalized)	EB Left	81.4	0.89	74.8	E	14.2	0.20	20.7	C
	EB Thru	93.2	0.47	35.6	D	379.0	1.53	273.3	F
	EB Right	0.0	0.14	0.2	A	0.0	0.31	0.5	A
	WB Left	22.8	0.24	22.3	C	83.2	0.87	62.8	E
	WB Thru	320.3	1.18	129.9	F	114.0	0.59	34.3	C
	WB Right	0.0	0.49	1.1	A	0.0	0.21	0.3	A
	NB Left	90.7	0.60	49.0	D	52.6	0.62	59.3	E
	NB Thru	320.9	1.34	205.7	F	143.3	1.13	144.3	F
	NB Right	0.0	0.08	0.1	A	0.0	0.19	0.3	A
	SB Left	41.0	0.49	62.3	E	231.0	1.31	185.9	F
	SB Thru	82.0	0.80	85.6	F	298.6	1.42	236.5	F
	SB Right	0.0	0.05	0.1	A	0.0	0.09	0.1	A
	Overall			82.6	F			145.9	F
Main & Caledonia/ Woodlawn [71] (Signalized)	EB Left	176.8	1.77	389.2	F	324.7	1.41	217.5	F
	EB Thru	68.2	0.38	23.1	C	347.0	1.01	55.9	E
	EB Right	0.0	0.15	0.2	A	0.0	0.14	0.2	A
	WB Left	40.1	0.52	17.2	B	19.5	0.48	26.1	C
	WB Thru	285.6	1.02	61.0	E	99.6	0.57	34.8	C
	WB Right	0.0	0.20	0.3	A	0.0	0.17	0.2	A
	NB Left	122.3	0.97	81.0	F	58.3	0.78	57.6	E
	NB Thru	53.5	0.29	34.1	C	77.2	0.67	59.4	E
	NB Right	0.0	0.04	0.1	A	0.0	0.07	0.1	A
	SB Left	158.1	1.32	212.5	F	188.6	1.20	243.5	F
	SB Thru	90.2	0.69	59.1	E	86.3	0.75	64.3	E
	SB Right	0.0	0.40	0.8	A	0.0	0.34	0.6	A
	Overall			71.1	E			77.4	E
Montebello/Avenue Du Portage & Caledonia/ Breeze [30] (Unsignalized)	EB Left/Thru/Right	43.4	1.43	62.1	F	105.0	2.17	180.7	F
	WB Left/Thru/Right	432.6	2.78	647.1	F	249.2	2.70	439.4	F
	NB Left/Thru/Right	261.1	2.44	403.2	F	424.2	2.94	627.2	F
	SB Left/Thru/Right	35.7	1.32	55.3	F	23.1	1.15	46.1	E
	Overall			410.6	F			425.0	F
Access C/ Meadow Walk & Waverley [81] (Unsignalized)	EB Left/Thru/Right	0.0	0.00	10.6	B	0.0	0.00	11.9	B
	WB Left/Thru/Right	10.5	0.36	12.8	B	11.2	0.40	14.4	B
	NB Left/Thru/Right	31.5	0.65	17.7	C	206.5	1.30	145.0	F
	SB Left/Thru/Right	143.5	1.06	80.6	F	164.5	1.22	111.9	F
	Overall			51.2	F			116.5	F
Access B /Applewood lane & Waverley [84] (Unignalized)	EB Left/Thru/Right	0.0	0.00	11.0	B	0.0	0.00	12.3	B
	WB Left/Thru/Right	11.2	0.37	13.4	B	11.2	0.41	14.8	B
	NB Left/Thru/Right	52.5	0.82	26.2	D	252.7	1.45	191.2	F
	SB Left/Thru/Right	179.9	1.15	113.5	F	229.6	1.41	174.7	F
	Overall			69.8	F			166.2	F
Access A & Waverley [87] (Unsignalized)	WB Left/Right	43.4	0.83	29.3	D	39.9	0.90	30.6	D
	NB Thru/Right	123.2	1.19	92.7	F	334.6	1.92	336.0	F
	SB Left/Thru	301.7	1.56	268.3	F	422.1	2.08	426.4	F
	Overall			159.2	F			326.0	F
Forest Hills Ext Access [89] (Unsignalised)	EB Right				A				A
	NB thru				A				A
	SB Thru				A				A
	SB Thru/Right				A				A
	Overall				A				A

Notes:
Analysis by CBCL Limited using Synchro 9.0
1. 95% Queue - 95th percentile queue [highlighted if >100m or if available storage is exceeded]
2. V/C Ratio - Volume-to-Capacity ratio [highlighted if >0.85]
3. Average Delay - average total delay per vehicle [highlighted for LOS E or F]
4. LOS - Level of Service [highlighted for LOS E or F]

Level of Service Table - HCM 2010

Level of Service	Average Delay per Vehicle (sec)	
	Signalized	Unsignalized
A	<10	<10
B	>10 and <20	>10 and <15
C	>20 and <35	>15 and <25
D	>35 and <55	>25 and <35
E	>55 and <80	>35 and <50
F	>80	>50

Legend

- Queue Length > 100m (blue)
- V/C > 0.85 (yellow)
- LOS E (orange)
- LOS F (red)

Port Wallace Master Plan-Infrastructure Study
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2-Aug-17

Table 1 - Synchro Analysis Results: 2017 Baseline Volumes & Existing Street Network

Intersection [Synchro Node No.]	Lane / Movement	AM Peak Hour				PM Peak Hour			
		95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]	95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]
Montague Rd & Ramp Terminal (North) [5] (Unsignalized)	EB Left/Thru	9.1	0.30	9.7	A	1.4	0.07	7.6	A
	WB Thru/Right				A				A
	NB Left/Thru/Right	5.6	0.21	22.6	C	4.2	0.16	15.1	C
	Overall			**4.7**	**A**			**2.7**	**A**
Montague Rd & Ramp Terminal (South) [6] (Unsignalized)	EB Thru/Right								
	WB Left/Thru	0.7	0.02	8.2	A	0.0	0.01	7.6	A
	SB Left/Thru/Right	4.2	0.16	12.1	B	70.7	0.85	29.0	D
	Overall			**2.2**	**A**			**20.0**	**C**
Montague/Charles Keating & Waverley [12] (Unsignalized)	EB Left/Thru/Right	2.8	0.13	18.1	C	0.7	0.04	11.6	B
	WB Left/Thru	9.8	0.33	23.8	C	17.5	0.48	20.7	C
	WB Right	1.4	0.05	9.3	A	7.0	0.25	11.1	B
	NB Left/Thru/Right	0.0	0.00	7.6	A	0.0	0.01	7.4	A
	SB Left	3.5	0.14	8.2	A	1.4	0.06	8.0	A
	SB Thru/Right				A				A
	Overall			**6.1**	**A**			**8.2**	**A**
Breeze & Waverley [18] (Unsignalized)	WB Left/Right	9.8	0.33	14.2	B	9.1	0.31	17.5	C
	NB Thru/Right				A				A
	SB Left/Thru	1.4	0.06	7.7	A	2.8	0.12	8.7	A
	Overall			**4.8**	**A**			**3.8**	**A**
Montebello & Waverley [24] (Signalized)	WB Left	86.8	0.68	21.0	C	50.0	0.60	38.0	D
	WB Right	5.7	0.07	4.9	A	8.1	0.13	10.8	B
	NB Thru/Right	47.9	0.52	14.5	B	234.2	0.89	22.1	C
	SB Left	8.5	0.12	13.4	B	9.1	0.29	12.9	B
	SB Thru	91.5	0.78	24.9	C	38.3	0.30	6.8	A
	Overall			**20.2**	**C**			**20.0**	**B**
Main & Forest Hills [56] (Signalized)	EB Left	49.6	0.69	42.6	D	11.8	0.11	19.3	B
	EB Thru	51.3	0.25	29.7	C	226.8	1.02	74.3	E
	EB Right	0.0	0.11	0.7	A	0.0	0.25	0.4	A
	WB Left	19.1	0.13	20.4	C	54.2	0.76	48.5	D
	WB Thru	176.5	0.79	44.6	D	69.3	0.38	30.0	C
	WB Right	0.0	0.37	0.7	A	0.0	0.13	0.2	A
	NB Left	71.8	0.48	46.2	D	42.8	0.50	56.3	E
	NB Thru	237.5	1.07	109.1	F	107.4	0.92	94.1	F
	NB Right	0.0	0.06	0.1	A	0.0	0.15	0.2	A
	SB Left	23.6	0.28	59.3	E	151.6	0.97	73.0	E
	SB Thru	62.9	0.71	79.5	E	223.5	1.12	124.6	F
	SB Right	0.0	0.04	0.1	A	0.0	0.07	0.1	A
	Overall			**43.2**	**D**			**58.5**	**E**
Main & Caledonia/ Woodlawn [71] (Signalized)	EB Left	22.2	0.52	20.1	C	40.8	0.45	12.3	B
	EB Thru	53.6	0.28	19.5	B	210.9	0.75	25.7	C
	EB Right	0.0	0.12	0.2	A	0.0	0.11	0.1	A
	WB Left	32.4	0.33	12.1	B	12.8	0.35	15.2	B
	WB Thru	184.2	0.73	28.1	C	70.3	0.33	20.6	C
	WB Right	0.0	0.06	0.1	A	0.0	0.05	0.1	A
	NB Left	76.4	0.82	58.8	E	47.7	0.60	46.6	D
	NB Thru	43.5	0.27	36.5	D	64.1	0.62	59.8	E
	NB Right	0.0	0.03	0.0	A	0.0	0.06	0.1	A
	SB Left	40.5	0.53	60.4	E	40.1	0.46	40.9	D
	SB Thru	72.1	0.70	65.2	E	71.4	0.70	64.3	E
	SB Right	0.0	0.13	0.2	A	0.0	0.11	0.1	A
	Overall			**26.9**	**C**			**25.3**	**C**
Montebello/Avenue Du Portage & Caledonia/ Breeze [30] (Unsignalized)	EB Left/Thru/Right	2.5	0.47	14.7	B	35.7	0.67	19.2	C
	WB Left/Thru/Right	3.9	0.60	18.6	C	9.8	0.32	12.4	B
	NB Left/Thru/Right	3.5	0.57	17.6	C	21.0	0.52	15.6	C
	SB Left/Thru/Right	2.2	0.44	14.6	B	9.8	0.32	12.3	B
	Overall			**16.6**	**C**			**15.9**	**C**
Access C/ Meadow Walk & Waverley [81] (Unsignalized)	EB Left/Thru/Right				A				A
	WB Left/Thru/Right				A				A
	NB Left/Thru/Right				A				A
	SB Left/Thru/Right				A				A
	Overall				**A**				**A**
Access B /Applewood lane & Waverley [84] (Unsignalized)	EB Left/Thru/Right				A				A
	WB Left/Thru/Right				A				A
	NB Left/Thru/Right				A				A
	SB Left/Thru/Right				A				A
	Overall				**A**				**A**
Access A & Waverley [87] (Unsignalized)	WB Left/Right				A				A
	NB Thru/Right				A				A
	SB Left/Thru				A				A
	Overall				**A**				**A**
Forest Hills Ext Access [89] (Unsignalised)	EB Right				A				A
	NB thru				A				A
	SB Thru				A				A
	SB Thru/Right				A				A
	Overall				**A**				**A**

Notes:
Analysis by CBCL Limited using Synchro 9.0
1. 95% Queue - 95th percentile queue [highlighted if >100m or if available storage is exceeded]
2. V/C Ratio - Volume-to-Capacity ratio [highlighted if >0.85]
3. Average Delay - average total delay per vehicle [highlighted for LOS E or F]
4. LOS - Level of Service [highlighted for LOS E or F]

Table 7 - Synchro Analysis Results: 2047, 0.75% growth, Opt 1, 100% build-out, 20% NAMC, 7% Nth

Intersection [Synchro Node No.]	Lane / Movement	AM Peak Hour				PM Peak Hour			
		95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]	95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]
Montague Rd & Ramp Terminal (North) [5] (Unsignalized)	EB Left/Thru	137.9	1.01	51.3	F	18.9	0.48	9.9	A
	WB Thru/Right				A				A
	NB Left/Thru/Right	1.4	0.07	9.1	A	70.7	2.91	1149.0	F
	Overall			**29.3**	**D**			**75.6**	**F**
Montague Rd & Ramp Terminal (South) [6] (Unsignalized)	EB Thru/Right				A				A
	WB Left/Thru	0.7	0.04	10.9	B	0.7	0.02	9.4	A
	SB Left/Thru/Right	76.3	0.90	43.8	E	835.8	2.52	706.1	F
	Overall			**13.3**	**B**			**438.2**	**F**
Montague/Charles Keating & Waverley [12] (Unignalized)	EB Left/Thru/Right	17.5	0.54	81.0	F	2.8	0.11	21.0	C
	WB Left/Thru	410.2	6.67	2654.3	F	652.4	4.54	1639.9	F
	WB Right	2.1	0.10	11.8	B	18.9	0.50	19.2	C
	NB Left/Thru/Right	0.0	0.00	7.7	A	0.0	0.01	7.5	A
	SB Left	8.4	0.30	11.7	B	2.8	0.12	10.6	B
	SB Thru/Right				A				A
	Overall			**704.0**	**F**			**641.7**	**F**
Breeze & Waverley [18] (Unsignalized)	WB Left/Right	47.6	0.83	56.9	F	60.2	1.08	153.4	F
	NB Thru/Right				A				A
	SB Left/Thru	2.1	0.09	8.3	A	5.6	0.21	10.7	B
	Overall			**11.1**	**B**			**16.2**	**C**
Montebello & Waverley [24] (Signalized)	WB Left	206.9	1.04	81.6	F	62.0	0.75	50.0	D
	WB Right	9.7	0.10	9.0	A	9.2	0.16	9.8	A
	NB Thru/Right	99.5	0.64	17.0	B	446.3	1.28	149.1	F
	SB Left	10.0	0.17	11.8	B	25.5	0.58	43.3	D
	SB Thru	208.7	0.94	36.7	D	90.7	0.55	9.9	A
	Overall			**41.8**	**D**			**98.0**	**F**
Main & Forest Hills [56] (Signalized)	EB Left	81.4	0.89	74.8	E	14.2	0.20	20.7	C
	EB Thru	92.6	0.45	35.6	D	378.1	1.52	272.2	F
	EB Right	0.0	0.14	0.2	A	0.0	0.31	0.5	A
	WB Left	22.8	0.24	22.3	C	83.2	0.87	62.8	E
	WB Thru	318.7	1.18	128.7	F	113.4	0.59	34.3	C
	WB Right	0.0	0.46	1.0	A	0.0	0.16	0.2	A
	NB Left	90.7	0.60	49.0	D	52.6	0.62	59.3	E
	NB Thru	320.9	1.34	205.7	F	143.3	1.13	144.3	F
	NB Right	0.0	0.08	0.1	A	0.0	0.19	0.3	A
	SB Left	28.1	0.32	58.8	E	211.3	1.22	153.1	F
	SB Thru	82.0	0.80	85.6	F	298.6	1.42	236.5	F
	SB Right	0.0	0.05	0.1	A	0.0	0.09	0.1	A
	Overall			**83.2**	**F**			**141.6**	**F**
Main & Caledonia/ Woodlawn [71] (Signalized)	EB Left	175.7	1.76	384.9	F	320.9	1.39	212.1	F
	EB Thru	68.2	0.38	23.1	C	347.0	1.01	55.9	E
	EB Right	0.0	0.15	0.2	A	0.0	0.14	0.2	A
	WB Left	40.1	0.52	17.2	B	19.5	0.48	26.1	C
	WB Thru	285.6	1.02	61.0	E	99.6	0.57	34.8	C
	WB Right	0.0	0.20	0.3	A	0.0	0.17	0.2	A
	NB Left	122.3	1.00	81.0	F	58.3	0.78	57.6	E
	NB Thru	53.5	0.29	34.1	C	77.2	0.67	59.4	E
	NB Right	0.0	0.04	0.1	A	0.0	0.07	0.1	A
	SB Left	156.0	1.30	206.0	F	186.5	1.41	237.7	F
	SB Thru	90.2	0.69	59.1	E	86.3	0.75	64.3	E
	SB Right	0.0	0.40	0.8	A	0.0	0.34	0.6	A
	Overall			**70.3**	**E**			**76.0**	**E**
Montebello/Avenue Du Portage & Caledonia/ Breeze [30] (Unsignalized)	EB Left/Thru/Right	43.4	1.41	61.7	F	105.7	2.13	180.2	F
	WB Left/Thru/Right	428.4	2.78	638.5	F	245.7	2.70	430.9	F
	NB Left/Thru/Right	259.0	2.44	397.4	F	419.3	2.86	618.3	F
	SB Left/Thru/Right	36.4	1.30	54.9	F	23.1	1.14	45.8	E
	Overall			**404.3**	**F**			**418.0**	**F**
Access C/ Meadow Walk & Waverley [81] (Unsignalized)	EB Left/Thru/Right	0.0	0.00	10.7	B	0.0	0.00	12.0	B
	WB Left/Thru/Right	11.2	0.38	13.2	B	11.9	0.41	14.7	B
	NB Left/Thru/Right	35.0	0.69	19.8	C	213.5	1.32	152.9	F
	SB Left/Thru/Right	155.4	1.10	91.0	F	173.6	1.25	121.5	F
	Overall			**57.4**	**F**			**124.0**	**F**
Access B /Applewood lane & Waverley [84] (Unignalized)	EB Left/Thru/Right	0.0	0.00	11.2	B	0.0	0.00	12.5	B
	WB Left/Thru/Right	11.9	0.39	13.7	B	11.9	0.43	15.2	C
	NB Left/Thru/Right	55.3	0.84	27.9	D	276.5	1.52	222.2	F
	SB Left/Thru/Right	191.8	1.18	124.4	F	240.8	1.45	188.4	F
	Overall			**75.9**	**F**			**186.1**	**F**
Access A & Waverley [87] (Unsignalized)	WB Left/Right	46.2	0.87	31.1	D	43.4	0.94	33.1	D
	NB Thru/Right	133.0	1.23	105.2	F	346.5	2.00	355.7	F
	SB Left/Thru	315.7	1.59	286.4	F	440.3	2.17	453.7	F
	Overall			**171.2**	**F**			**345.4**	**F**
Forest Hills Ext Access [89] (Unsignalised)	EB Right				A				A
	NB thru				A				A
	SB Thru				A				A
	SB Thru/Right				A				A
	Overall				**A**				**A**

Notes:
Analysis by CBCL Limited using Synchro 9.0
1. 95% Queue - 95th percentile queue [highlighted if >100m or if available storage is exceeded]
2. V/C Ratio - Volume-to-Capacity ratio [highlighted if >0.85]
3. Average Delay - average total delay per vehicle [highlighted for LOS E or F]
4. LOS - Level of Service [highlighted for LOS E or F]

Table 8 - Synchro Analysis Results: 2047, 0.75% growth, Opt 1A, 100% build-out, 20% NAMC, 7% Nth

Intersection [Synchro Node No.]	Lane / Movement	AM Peak Hour				PM Peak Hour			
		95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]	95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]
Montague Rd & Ramp Terminal (North) [5] (Unsignalized)	EB Left/Thru	123.9	0.98	44.3	E	17.5	0.46	9.7	A
	WB Thru/Right				A				A
	NB Left/Thru/Right	1.4	0.07	9.1	A	67.9	2.56	963.5	F
	Overall			**25.0**	**C**			**65.2**	**F**
Montague Rd & Ramp Terminal (South) [6] (Unsignalized)	EB Thru/Right				A				A
	WB Left/Thru	0.7	0.04	10.8	B	0.7	0.02	9.4	A
	SB Left/Thru/Right	67.9	0.86	38.1	E	812.7	2.50	694.5	F
	Overall			**11.5**	**B**			**426.6**	**F**
Montague/Charles Keating & Waverley [12] (Unignalized)	EB Left/Thru/Right	16.1	0.52	75.0	F	2.8	0.11	21.0	C
	WB Left/Thru	388.5	6.02	2360.1	F	620.2	4.28	1519.9	F
	WB Right	2.1	0.09	11.7	B	18.9	0.49	18.7	C
	NB Left/Thru/Right	0.0	0.00	7.7	A	0.0	0.01	7.5	A
	SB Left	8.4	0.29	11.5	B	2.8	0.12	10.5	B
	SB Thru/Right				A				A
	Overall			**617.6**	**F**			**589.3**	**F**
Breeze & Waverley [18] (Unsignalized)	WB Left/Right	45.5	0.80	52.6	F	57.4	1.03	138.3	F
	NB Thru/Right				A				A
	SB Left/Thru	2.1	0.09	8.3	A	5.6	0.21	10.7	B
	Overall			**10.4**	**B**			**14.9**	**B**
Montebello & Waverley [24] (Signalized)	WB Left	206.9	1.03	77.9	E	62.0	0.75	50.0	D
	WB Right	9.7	0.10	9.0	A	9.2	0.16	9.8	A
	NB Thru/Right	97.4	0.64	17.0	B	441.3	1.26	144.6	F
	SB Left	9.9	0.17	11.9	B	25.5	0.58	43.3	D
	SB Thru	200.4	0.93	36.0	D	88.5	0.54	9.7	A
	Overall			**40.7**	**D**			**95.4**	**F**
Main & Forest Hills [56] (Signalized)	EB Left	81.4	0.89	74.8	E	14.2	0.20	20.6	C
	EB Thru	91.2	0.46	35.5	D	375.0	1.51	268.1	F
	EB Right	0.0	0.14	0.2	A	0.0	0.31	0.5	A
	WB Left	22.8	0.24	22.2	C	83.2	0.87	62.8	E
	WB Thru	317.5	1.14	127.2	F	112.3	0.59	34.1	C
	WB Right	0.0	0.46	1.0	A	0.0	0.16	0.2	A
	NB Left	90.7	0.60	49.0	D	52.6	0.62	59.3	E
	NB Thru	320.9	1.34	205.7	F	143.3	1.13	144.3	F
	NB Right	0.0	0.08	0.1	A	0.0	0.19	0.3	A
	SB Left	40.5	0.48	62.1	E	230.4	1.30	184.9	F
	SB Thru	82.0	0.80	85.6	F	298.6	1.42	236.5	F
	SB Right	0.0	0.05	0.1	A	0.0	0.09	0.1	A
	Overall			**82.6**	**F**			**146.0**	**F**
Main & Caledonia/ Woodlawn [71] (Signalized)	EB Left	170.3	1.71	363.3	F	307.4	1.35	194.6	F
	EB Thru	68.2	0.38	23.1	C	347.0	1.01	55.9	E
	EB Right	0.0	0.15	0.2	A	0.0	0.14	0.2	A
	WB Left	40.1	0.52	17.2	B	19.5	0.48	26.1	C
	WB Thru	285.6	1.02	61.0	E	99.6	0.57	34.8	C
	WB Right	0.0	0.19	0.3	A	0.0	0.16	0.2	A
	NB Left	122.3	0.97	81.0	F	58.3	0.78	57.6	E
	NB Thru	53.5	0.29	34.1	C	77.2	0.67	59.4	E
	NB Right	0.0	0.04	0.1	A	0.0	0.07	0.1	A
	SB Left	151.2	1.27	193.2	F	180.1	1.37	221.7	F
	SB Thru	90.2	0.69	59.1	E	86.3	0.75	64.3	E
	SB Right	0.0	0.39	0.7	A	0.0	0.33	0.6	A
	Overall			**67.7**	**E**			**72.1**	**E**
Montebello/Avenue Du Portage & Caledonia/ Breeze [30] (Unsignalized)	EB Left/Thru/Right	43.4	1.39	60.5	F	107.8	2.08	178.2	F
	WB Left/Thru/Right	413.0	2.70	608.0	F	234.5	2.56	402.0	F
	NB Left/Thru/Right	250.6	2.33	378.6	F	403.9	2.78	586.8	F
	SB Left/Thru/Right	36.4	1.27	53.7	F	23.1	1.10	44.3	E
	Overall			**382.9**	**F**			**393.8**	**F**
Access C/ Meadow Walk & Waverley [81] (Unsignalized)	EB Left/Thru/Right	0.0	0.00	10.5	B	0.0	0.00	11.8	B
	WB Left/Thru/Right	10.5	0.35	12.6	B	11.2	0.39	14.2	B
	NB Left/Thru/Right	30.8	0.65	17.4	C	202.3	1.28	140.5	F
	SB Left/Thru/Right	140.0	1.05	76.9	F	159.6	1.20	106.7	F
	Overall			**49.1**	**E**			**112.3**	**F**
Access B /Applewood lane & Waverley [84] (Unignalized)	EB Left/Thru/Right	0.0	0.00	11.0	B	0.0	0.00	12.1	B
	WB Left/Thru/Right	10.5	0.37	13.2	B	11.2	0.40	14.7	B
	NB Left/Thru/Right	51.1	0.81	25.4	D	247.8	1.43	186.1	F
	SB Left/Thru/Right	174.3	1.14	108.2	F	224.0	1.39	168.4	F
	Overall			**66.9**	**F**			**161.2**	**F**
Access A & Waverley [87] (Unsignalized)	WB Left/Right	42.0	0.81	28.4	D	38.5	0.88	29.5	D
	NB Thru/Right	119.0	1.18	88.0	F	329.0	1.92	326.6	F
	SB Left/Thru	295.4	1.54	260.4	F	412.3	2.04	412.9	F
	Overall			**154.0**	**F**			**316.5**	**F**
Forest Hills Ext Access [89] (Unsignalised)	EB Right	2.1	0.09	10.1	B	7.0	0.26	23.9	C
	NB thru				A				A
	SB Thru				A				A
	SB Thru/Right				A				A
	Overall			**0.3**	**A**			**0.6**	**A**

Notes:
Analysis by CBCL Limited using Synchro 9.0
1. 95% Queue - 95th percentile queue [highlighted if >100m or if available storage is exceeded]
2. V/C Ratio - Volume-to-Capacity ratio [highlighted if >0.85]
3. Average Delay - average total delay per vehicle [highlighted for LOS E or F]
4. LOS - Level of Service [highlighted for LOS E or F]

Table 9 - Synchro Analysis Results: 2047, 0.75% growth, Opt 2, 100% build-out, 20% NAMC, 7% Nth

Intersection [Synchro Node No.]	Lane / Movement	AM Peak Hour				PM Peak Hour			
		95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]	95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]
Montague Rd & Ramp Terminal (North) [5] (Unsignalized)	EB Left/Thru	94.5	0.91	31.9	D	14.7	0.42	9.3	A
	WB Thru/Right				A				A
	NB Left/Thru/Right	72.8	22.22	11879.2	F	58.8	1.80	567.5	F
	Overall			**496.2**	**F**			**41.8**	**E**
Montague Rd & Ramp Terminal (South) [6] (Unsignalized)	EB Thru/Right				A				A
	WB Left/Thru	0.7	0.04	10.4	B	0.7	0.02	9.2	A
	SB Left/Thru/Right	50.4	0.78	28.9	D	774.2	2.51	700.0	F
	Overall			**8.5**	**A**			**433.5**	**F**
Montague/Charles Keating & Waverley [12] (Unignalized)	EB Left/Thru/Right	14.0	0.47	63.0	F	2.1	0.10	19.0	C
	WB Left/Thru	338.1	4.81	1805.2	F	541.1	3.64	1232.8	F
	WB Right	2.1	0.09	11.4	B	17.5	0.47	17.6	C
	NB Left/Thru/Right	0.0	0.00	7.7	A	0.0	0.01	7.5	A
	SB Left	7.7	0.27	11.0	B	2.8	0.11	10.1	B
	SB Thru/Right				A				A
	Overall			**455.4**	**F**			**466.1**	**F**
Breeze & Waverley [18] (Unsignalized)	WB Left/Right	51.8	0.86	65.2	F	51.1	0.95	107.9	F
	NB Thru/Right				A				A
	SB Left/Thru	2.1	0.09	8.2	A	4.9	0.20	10.5	B
	Overall			**13.3**	**B**			**12.3**	**B**
Montebello & Waverley [24] (Signalized)	WB Left	206.9	1.00	68.8	E	62.0	0.75	50.0	D
	WB Right	9.7	0.10	8.8	A	9.2	0.16	9.8	A
	NB Thru/Right	92.4	0.64	17.1	B	428.3	1.24	133.0	F
	SB Left	9.9	0.17	12.1	B	25.5	0.58	43.3	D
	SB Thru	187.3	0.93	35.7	D	82.4	0.52	9.4	A
	Overall			**38.4**	**D**			**88.6**	**F**
Main & Forest Hills [56] (Signalized)	EB Left	81.4	0.89	74.8	E	14.2	0.19	20.6	C
	EB Thru	89.2	0.45	35.3	D	370.2	1.50	261.8	F
	EB Right	0.0	0.14	0.2	A	0.0	0.31	0.5	A
	WB Left	22.8	0.24	22.2	C	83.2	0.87	62.8	E
	WB Thru	312.2	1.16	122.1	F	110.1	0.58	33.9	C
	WB Right	0.0	0.49	1.1	A	0.0	0.20	0.3	A
	NB Left	90.7	0.60	49.0	D	52.6	0.62	59.3	E
	NB Thru	320.9	1.34	205.7	F	143.3	1.13	144.0	F
	NB Right	0.0	0.08	0.1	A	0.0	0.19	0.3	A
	SB Left	39.3	0.46	61.7	E	228.8	1.30	182.1	F
	SB Thru	82.0	0.80	85.6	F	298.6	1.42	236.5	F
	SB Right	0.0	0.05	0.1	A	0.0	0.09	0.1	A
	Overall			**80.4**	**F**			**142.1**	**F**
Main & Caledonia/ Woodlawn [71] (Signalized)	EB Left	160.6	1.62	328.9	F	287.4	1.29	167.5	F
	EB Thru	68.2	0.38	23.1	C	347.0	1.01	55.9	E
	EB Right	0.0	0.15	0.2	A	0.0	0.14	0.2	A
	WB Left	40.1	0.52	17.2	B	19.5	0.48	26.1	C
	WB Thru	285.6	1.02	61.0	E	99.6	0.57	34.8	C
	WB Right	0.0	0.18	0.3	A	0.0	0.15	0.2	A
	NB Left	122.3	0.97	81.0	F	58.3	0.78	57.6	E
	NB Thru	53.5	0.29	34.1	C	77.2	0.67	59.4	E
	NB Right	0.0	0.04	0.1	A	0.0	0.07	0.1	A
	SB Left	142.1	1.21	171.8	F	163.6	1.31	197.5	F
	SB Thru	90.2	0.69	59.1	E	86.3	0.75	64.3	E
	SB Right	0.0	0.37	0.7	A	0.0	0.32	0.5	A
	Overall			**63.6**	**E**			**66.2**	**E**
Montebello/Avenue Du Portage & Caledonia/ Breeze [30] (Unsignalized)	EB Left/Thru/Right	44.1	1.33	58.5	F	111.3	1.96	175.2	F
	WB Left/Thru/Right	389.9	2.56	563.2	F	216.3	2.38	357.7	F
	NB Left/Thru/Right	238.7	2.22	350.2	F	380.1	2.56	538.3	F
	SB Left/Thru/Right	36.4	1.22	52.0	F	23.1	1.04	42.0	E
	Overall			**351.5**	**F**			**357.1**	**F**
Access C/ Meadow Walk & Waverley [81] (Unsignalized)	EB Left/Thru/Right	0.0	0.00	10.3	B	0.0	0.00	11.4	B
	WB Left/Thru/Right	8.4	0.30	11.9	B	9.1	0.33	13.3	B
	NB Left/Thru/Right	27.3	0.60	16.0	C	177.1	1.19	114.1	F
	SB Left/Thru/Right	111.3	0.99	54.4	F	130.9	1.11	78.4	F
	Overall			**36.6**	**E**			**88.6**	**F**
Access B /Applewood lane & Waverley [84] (Unignalized)	EB Left/Thru/Right	0.0	0.00	10.7	B	0.0	0.00	11.8	B
	WB Left/Thru/Right	9.1	0.31	12.4	B	9.1	0.35	13.7	B
	NB Left/Thru/Right	44.8	0.76	23.0	C	213.5	1.32	149.1	F
	SB Left/Thru/Right	141.4	1.07	78.7	F	183.4	1.27	126.0	F
	Overall			**51.1**	**F**			**126.3**	**F**
Access A & Waverley [87] (Unsignalized)	WB Left/Right	30.1	0.69	21.9	C	29.4	0.75	23.8	C
	NB Thru/Right	89.6	1.03	55.3	F	289.1	1.70	264.8	F
	SB Left/Thru	249.9	1.37	201.9	F	348.6	1.82	325.6	F
	Overall			**117.0**	**F**			**254.5**	**F**
Forest Hills Ext Access [89] (Unsignalised)	EB Right				A				A
	NB thru				A				A
	SB Thru				A				A
	SB Thru/Right				A				A
	Overall				**A**				**A**

Notes:
Analysis by CBCL Limited using Synchro 9.0
1. 95% Queue - 95th percentile queue [highlighted if >100m or if available storage is exceeded]
2. V/C Ratio - Volume-to-Capacity ratio [highlighted if >0.85]
3. Average Delay - average total delay per vehicle [highlighted for LOS E or F]
4. LOS - Level of Service [highlighted for LOS E or F]

Level of Service Table - HCM 2010

Level of Service	Average Delay per Vehicle (sec)	
	Signalized	Unisignalized
A	<10	<10
B	>10 and <20	>10 and <15
C	>20 and <35	>15 and <25
D	>35 and <55	>25 and <35
E	>55 and <80	>35 and <50
F	>80	>50

Legend

- Queue Length > 100m
- V/C > 0.85
- LOS E
- LOS F

Port Wallace Master Plan-Infrastructure Study
CBCL Limited 171013.00
2-Aug-17

Table 1 - Synchro Analysis Results: 2017 Baseline Volumes & Existing Street Network

Intersection [Synchro Node No.]	Lane / Movement	AM Peak Hour				PM Peak Hour			
		95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]	95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]
Montague Rd & Ramp Terminal (North) [5] (Unsignalized)	EB Left/Thru	9.1	0.30	9.7	A	1.4	0.07	7.6	A
	WB Thru/Right				A				A
	NB Left/Thru/Right	5.6	0.21	22.6	C	4.2	0.16	15.1	C
	Overall			**4.7**	**A**			**2.7**	**A**
Montague Rd & Ramp Terminal (South) [6] (Unsignalized)	EB Thru/Right								
	WB Left/Thru	0.7	0.02	8.2	A	0.0	0.01	7.6	A
	SB Left/Thru/Right	4.2	0.16	12.1	B	70.7	0.85	29.0	D
	Overall			**2.2**	**A**			**20.0**	**C**
Montague/Charles Keating & Waverley [12] (Unsignalized)	EB Left/Thru/Right	2.8	0.13	18.1	C	0.7	0.04	11.6	B
	WB Left/Thru	9.8	0.33	23.8	C	17.5	0.48	20.7	C
	WB Right	1.4	0.05	9.3	A	7.0	0.25	11.1	B
	NB Left/Thru/Right	0.0	0.00	7.6	A	0.0	0.01	7.4	A
	SB Left	3.5	0.14	8.2	A	1.4	0.06	8.0	A
	SB Thru/Right				A				A
	Overall			**6.1**	**A**			**8.2**	**A**
Breeze & Waverley [18] (Unsignalized)	WB Left/Right	9.8	0.33	14.2	B	9.1	0.31	17.5	C
	NB Thru/Right				A				A
	SB Left/Thru	1.4	0.06	7.7	A	2.8	0.12	8.7	A
	Overall			**4.8**	**A**			**3.8**	**A**
Montebello & Waverley [24] (Signalized)	WB Left	86.8	0.68	21.0	C	50.0	0.60	38.0	D
	WB Right	5.7	0.07	4.9	A	8.1	0.13	10.8	B
	NB Thru/Right	47.9	0.52	14.5	B	234.2	0.89	22.1	C
	SB Left	8.5	0.12	13.4	B	9.1	0.29	12.9	B
	SB Thru	91.5	0.78	24.9	C	38.3	0.30	6.8	A
	Overall			**20.2**	**C**			**20.0**	**B**
Main & Forest Hills [56] (Signalized)	EB Left	49.6	0.69	42.6	D	11.8	0.11	19.3	B
	EB Thru	51.3	0.25	29.7	C	226.8	1.02	74.3	E
	EB Right	0.0	0.11	0.7	A	0.0	0.25	0.4	A
	WB Left	19.1	0.13	20.4	C	54.2	0.76	48.5	D
	WB Thru	176.5	0.79	44.6	D	69.3	0.38	30.0	C
	WB Right	0.0	0.37	0.7	A	0.0	0.13	0.2	A
	NB Left	71.8	0.48	46.2	D	42.8	0.50	56.3	E
	NB Thru	237.5	1.07	109.1	F	107.4	0.92	94.1	F
	NB Right	0.0	0.06	0.1	A	0.0	0.15	0.2	A
	SB Left	23.6	0.28	59.3	E	151.6	0.97	73.0	E
	SB Thru	62.9	0.71	79.5	E	223.5	1.12	124.6	F
	SB Right	0.0	0.04	0.1	A	0.0	0.07	0.1	A
	Overall			**43.2**	**D**			**58.5**	**E**
Main & Caledonia/ Woodlawn [71] (Signalized)	EB Left	22.2	0.52	20.1	C	40.8	0.45	12.3	B
	EB Thru	53.6	0.28	19.5	B	210.9	0.75	25.7	C
	EB Right	0.0	0.12	0.2	A	0.0	0.11	0.1	A
	WB Left	32.4	0.33	12.1	B	12.8	0.35	15.2	B
	WB Thru	184.2	0.73	28.1	C	70.3	0.33	20.6	C
	WB Right	0.0	0.06	0.1	A	0.0	0.05	0.1	A
	NB Left	76.4	0.82	58.8	E	47.7	0.60	46.6	D
	NB Thru	43.5	0.27	36.5	D	64.1	0.62	59.8	E
	NB Right	0.0	0.03	0.0	A	0.0	0.06	0.1	A
	SB Left	40.5	0.53	60.4	E	40.1	0.46	40.9	D
	SB Thru	72.1	0.70	65.2	E	71.4	0.70	64.3	E
	SB Right	0.0	0.13	0.2	A	0.0	0.11	0.1	A
	Overall			**26.9**	**C**			**25.3**	**C**
Montebello/Avenue Du Portage & Caledonia/ Breeze [30] (Unsignalized)	EB Left/Thru/Right	2.5	0.47	14.7	B	35.7	0.67	19.2	C
	WB Left/Thru/Right	3.9	0.60	18.6	C	9.8	0.32	12.4	B
	NB Left/Thru/Right	3.5	0.57	17.6	C	21.0	0.52	15.6	C
	SB Left/Thru/Right	2.2	0.44	14.6	B	9.8	0.32	12.3	B
	Overall			**16.6**	**C**			**15.9**	**C**
Access C/ Meadow Walk & Waverley [81] (Unsignalized)	EB Left/Thru/Right				A				A
	WB Left/Thru/Right				A				A
	NB Left/Thru/Right				A				A
	SB Left/Thru/Right				A				A
	Overall				**A**				**A**
Access B /Applewood lane & Waverley [84] (Unsignalized)	EB Left/Thru/Right				A				A
	WB Left/Thru/Right				A				A
	NB Left/Thru/Right				A				A
	SB Left/Thru/Right				A				A
	Overall				**A**				**A**
Access A & Waverley [87] (Unsignalized)	WB Left/Right				A				A
	NB Thru/Right				A				A
	SB Left/Thru				A				A
	Overall				**A**				**A**
Forest Hills Ext Access [89] (Unsignalised)	EB Right				A				A
	NB thru				A				A
	SB Thru				A				A
	SB Thru/Right				A				A
	Overall				**A**				**A**

Notes:
Analysis by CBCL Limited using Synchro 9.0
1. 95% Queue - 95th percentile queue [highlighted if >100m or if available storage is exceeded]
2. V/C Ratio - Volume-to-Capacity ratio [highlighted if >0.85]
3. Average Delay - average total delay per vehicle [highlighted for LOS E or F]
4. LOS - Level of Service [highlighted for LOS E or F]

Table 10 - Synchro Analysis Results: 2047, 0.75% growth, Opt 3A, 100% build-out, 10% NAMC, 10% Nth

Intersection [Synchro Node No.]	Lane / Movement	AM Peak Hour				PM Peak Hour			
		95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]	95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]
Montague Rd & Ramp Terminal (North) [5] (Unsignalized)	EB Left/Thru	191.1	1.10	80.1	F	24.5	0.55	10.5	B
	WB Thru/Right				A				A
	NB Left/Thru/Right	1.4	0.07	9.1	A	78.4	4.97	2236.4	F
	Overall			**47.2**	**E**			**134.6**	**F**
Montague Rd & Ramp Terminal (South) [6] (Unsignalized)	EB Thru/Right				A				A
	WB Left/Thru	0.7	0.05	11.4	B	0.7	0.02	9.9	A
	SB Left/Thru/Right	113.4	1.03	73.4	F	958.3	2.88	866.3	F
	Overall			**22.8**	**C**			**525.7**	**F**
Montague/Charles Keating & Waverley [12] (Unignalized)	EB Left/Thru/Right	20.3	0.64	105.0	F	2.8	0.13	24.0	C
	WB Left/Thru	479.5	9.43	3918.9	F	761.6	5.59	2114.8	F
	WB Right	2.1	0.10	12.3	B	21.0	0.53	21.0	C
	NB Left/Thru/Right	0.0	0.00	7.7	A	0.0	0.01	7.5	A
	SB Left	9.8	0.32	12.6	B	2.8	0.13	11.1	B
	SB Thru/Right				A				A
	Overall			**1080.7**	**F**			**851.1**	**F**
Breeze & Waverley [18] (Unsignalized)	WB Left/Right	56.0	0.91	75.7	F	70.0	1.23	215.1	F
	NB Thru/Right				A				A
	SB Left/Thru	2.1	0.10	8.4	A	5.6	0.22	11.0	B
	Overall			**13.8**	**B**			**21.3**	**C**
Montebello & Waverley [24] (Signalized)	WB Left	206.9	1.07	93.2	F	62.0	0.75	50.0	D
	WB Right	9.7	0.11	9.0	A	9.2	0.16	9.8	A
	NB Thru/Right	107.2	0.65	17.2	B	463.4	1.31	164.2	F
	SB Left	10.1	0.18	11.8	B	25.5	0.58	43.3	D
	SB Thru	248.1	0.95	38.5	D	99.1	0.58	10.4	B
	Overall			**45.2**	**D**			**106.8**	**F**
Main & Forest Hills [56] (Signalized)	EB Left	81.4	0.89	74.8	E	14.2	0.21	20.8	C
	EB Thru	97.5	0.49	36.0	D	388.3	1.55	285.9	F
	EB Right	0.0	0.14	0.2	A	0.0	0.31	0.5	A
	WB Left	22.8	0.25	22.4	C	83.2	0.87	62.8	E
	WB Thru	328.0	1.20	137.7	F	117.8	0.61	34.7	C
	WB Right	0.0	0.46	1.0	A	0.0	0.16	0.2	A
	NB Left	90.7	0.60	49.0	D	52.6	0.62	59.3	E
	NB Thru	320.9	1.34	205.7	F	143.3	1.13	144.3	F
	NB Right	0.0	0.08	0.1	A	0.0	0.19	0.2	A
	SB Left	28.1	0.32	58.8	E	211.3	1.22	153.1	F
	SB Thru	82.0	0.80	85.6	F	298.6	1.42	236.5	F
	SB Right	0.0	0.05	0.1	A	0.0	0.09	0.1	A
	Overall			**86.0**	**F**			**145.8**	**F**
Main & Caledonia/ Woodlawn [71] (Signalized)	EB Left	194.7	1.92	454.7	F	363.6	1.53	270.7	F
	EB Thru	68.2	0.38	23.1	C	347.0	1.01	55.9	E
	EB Right	0.0	0.15	0.2	A	0.0	0.14	0.2	A
	WB Left	40.1	0.52	17.2	B	19.5	0.48	26.1	C
	WB Thru	285.6	1.02	61.0	E	99.6	0.57	34.8	C
	WB Right	0.0	0.21	0.3	A	0.0	0.18	0.3	A
	NB Left	122.3	0.97	81.0	F	58.3	0.78	57.6	E
	NB Thru	53.5	0.29	34.1	C	77.2	0.67	59.4	E
	NB Right	0.0	0.04	0.1	A	0.0	0.07	0.1	A
	SB Left	173.0	1.43	254.2	F	207.7	1.54	292.6	F
	SB Thru	90.2	0.69	59.1	E	86.3	0.75	64.3	E
	SB Right	0.0	0.44	0.9	A	0.0	0.37	0.7	A
	Overall			**110.6**	**F**			**90.3**	**F**
Montebello/Avenue Du Portage & Caledonia/ Breeze [30] (Unsignalized)	EB Left/Thru/Right	42.0	1.54	66.1	F	99.4	2.38	185.7	F
	WB Left/Thru/Right	476.0	3.12	735.6	F	282.1	3.13	525.7	F
	NB Left/Thru/Right	284.2	2.70	459.6	F	466.2	3.22	718.2	F
	SB Left/Thru/Right	35.0	1.41	58.9	F	23.1	1.27	50.3	F
	Overall			**474.3**	**F**			**497.5**	**F**
Access C/ Meadow Walk & Waverley [81] (Unsignalized)	EB Left/Thru/Right	0.0	0.00	11.2	B	0.0	0.00	12.6	B
	WB Left/Thru/Right	14.7	0.45	14.6	B	15.4	0.49	16.3	C
	NB Left/Thru/Right	40.6	0.74	22.2	C	252.0	1.12	196.0	F
	SB Left/Thru/Right	197.4	1.21	130.9	F	217.0	1.39	169.0	F
	Overall			**79.0**	**F**			**162.7**	**F**
Access B /Applewood lane & Waverley [84] (Unignalized)	EB Left/Thru/Right	0.0	0.00	11.8	B	0.0	0.00	13.2	B
	WB Left/Thru/Right	15.4	0.47	15.5	C	15.4	0.51	16.9	C
	NB Left/Thru/Right	77.0	0.96	41.7	E	308.7	1.64	256.9	F
	SB Left/Thru/Right	246.4	1.32	180.1	F	300.3	1.64	253.4	F
	Overall			**108.2**	**F**			**229.0**	**F**
Access A & Waverley [87] (Unsignalized)	WB Left/Right	67.9	1.05	48.6	E	59.5	1.12	46.8	E
	NB Thru/Right	178.5	1.45	169.2	F	396.2	2.32	446.6	F
	SB Left/Thru	375.9	1.85	374.6	F	520.1	2.56	580.9	F
	Overall			**232.5**	**F**			**435.8**	**F**
Forest Hills Ext Access [89] (Unsignalised)	EB Right				A				A
	NB thru				A				A
	SB Thru				A				A
	SB Thru/Right				A				A
	Overall				**A**				**A**

Notes:
Analysis by CBCL Limited using Synchro 9.0
1. 95% Queue - 95th percentile queue [highlighted if >100m or if available storage is exceeded]
2. V/C Ratio - Volume-to-Capacity ratio [highlighted if >0.85]
3. Average Delay - average total delay per vehicle [highlighted for LOS E or F]
4. LOS - Level of Service [highlighted for LOS E or F]

Table 11 - Synchro Analysis Results: 2047, 0.75% growth, Opt 3B, 100% build-out, 10% NAMC, 10% Nth

Intersection [Synchro Node No.]	Lane / Movement	AM Peak Hour				PM Peak Hour			
		95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]	95th % Q[1] (m)	V/C Ratio[2]	Average Delay[3] (s)	LOS[4]
Montague Rd & Ramp Terminal (North) [5] (Unsignalized)	EB Left/Thru	89.6	0.90	30.3	D	15.4	0.43	9.4	A
	WB Thru/Right				A				A
	NB Left/Thru/Right	72.8	22.22	11879.2	F	62.3	2.01	677.6	F
	Overall			**498.7**	**F**			**48.4**	**E**
Montague Rd & Ramp Terminal (South) [6] (Unsignalized)	EB Thru/Right				A				A
	WB Left/Thru	0.7	0.04	10.4	B	0.7	0.02	9.2	A
	SB Left/Thru/Right	39.2	0.70	25.0	C	756.0	2.36	631.1	F
	Overall			**6.7**	**A**			**389.9**	**F**
Montague/Charles Keating & Waverley [12] (Unignalized)	EB Left/Thru/Right	14.0	0.46	61.7	F	2.1	0.10	20.1	C
	WB Left/Thru	280.7	4.01	1444.0	F	566.3	3.85	1327.6	F
	WB Right	2.1	0.09	11.3	B	17.5	0.48	17.9	C
	NB Left/Thru/Right	0.0	0.00	7.7	A	0.0	0.01	7.5	A
	SB Left	7.7	0.27	10.9	B	2.8	0.11	10.2	B
	SB Thru/Right				A				A
	Overall			**328.2**	**F**			**506.0**	**F**
Breeze & Waverley [18] (Unsignalized)	WB Left/Right	37.1	0.72	39.6	E	53.2	0.97	117.0	F
	NB Thru/Right				A				A
	SB Left/Thru	2.1	0.09	8.1	A	4.9	0.20	10.5	B
	Overall			**8.6**	**A**			**13.1**	**B**
Montebello & Waverley [24] (Signalized)	WB Left	206.9	0.99	67.2	E	62.0	0.75	50.0	D
	WB Right	9.7	0.10	8.7	A	9.2	0.16	9.8	A
	NB Thru/Right	85.7	0.61	16.4	B	431.6	1.25	136.1	F
	SB Left	9.7	0.16	11.8	B	25.5	0.58	43.3	D
	SB Thru	185.5	0.93	35.7	D	84.3	0.52	9.5	A
	Overall			**38.0**	**D**			**90.4**	**F**
Main & Forest Hills [56] (Signalized)	EB Left	81.4	0.89	74.8	E	14.2	0.20	20.7	C
	EB Thru	137.6	0.65	40.1	D	379.0	1.53	273.3	F
	EB Right	0.0	0.14	0.2	A	0.0	0.31	0.5	A
	WB Left	22.8	0.34	24.4	C	83.2	0.87	62.8	E
	WB Thru	320.3	1.18	129.9	F	114.0	0.59	34.3	C
	WB Right	0.0	0.50	1.1	A	0.0	0.23	0.3	A
	NB Left	90.7	0.60	49.0	D	52.6	0.62	59.3	E
	NB Thru	320.9	1.34	205.7	F	143.3	1.13	144.3	F
	NB Right	0.0	0.08	0.1	A	0.0	0.19	0.3	A
	SB Left	45.2	0.54	63.7	E	237.9	1.34	197.8	F
	SB Thru	82.0	0.80	85.6	F	298.6	1.42	236.5	F
	SB Right	0.0	0.05	0.1	A	0.0	0.09	0.1	A
	Overall			**81.0**	**F**			**147.5**	**F**
Main & Caledonia/ Woodlawn [71] (Signalized)	EB Left	176.8	1.77	389.2	F	324.7	1.41	217.5	F
	EB Thru	68.2	0.38	23.1	C	347.0	1.01	55.9	E
	EB Right	0.0	0.15	0.2	A	0.0	0.14	0.2	A
	WB Left	40.1	0.52	17.2	B	19.5	0.48	26.1	C
	WB Thru	285.6	1.02	61.0	E	99.6	0.57	34.8	C
	WB Right	0.0	0.20	0.3	A	0.0	0.17	0.2	A
	NB Left	122.3	0.97	81.0	F	58.3	0.78	57.6	E
	NB Thru	53.5	0.29	34.1	C	77.2	0.67	59.4	E
	NB Right	0.0	0.04	0.1	A	0.0	0.07	0.1	A
	SB Left	158.1	1.32	212.5	F	18.6	1.42	243.5	F
	SB Thru	90.2	0.69	59.1	E	86.3	0.75	64.3	E
	SB Right	0.0	0.40	0.8	A	0.0	0.34	0.6	A
	Overall			**71.1**	**E**			**77.4**	**E**
Montebello/Avenue Du Portage & Caledonia/ Breeze [30] (Unsignalized)	EB Left/Thru/Right	43.4	1.43	62.1	F	105.0	2.17	180.7	F
	WB Left/Thru/Right	432.6	2.78	647.1	F	249.2	2.70	439.4	F
	NB Left/Thru/Right	261.1	2.44	403.2	F	424.2	2.94	627.2	F
	SB Left/Thru/Right	35.7	1.32	55.3	F	23.1	1.15	46.1	E
	Overall			**410.6**	**F**			**425.0**	**F**
Access C/ Meadow Walk & Waverley [81] (Unsignalized)	EB Left/Thru/Right	0.0	0.00	10.1	B	0.0	0.00	11.5	B
	WB Left/Thru/Right	8.4	0.29	11.5	B	9.8	0.35	13.6	B
	NB Left/Thru/Right	23.1	0.55	14.6	B	187.6	1.22	124.2	F
	SB Left/Thru/Right	96.6	0.94	44.3	E	139.3	1.14	86.4	F
	Overall			**30.8**	**D**			**96.6**	**F**
Access B /Applewood lane & Waverley [84] (Unignalized)	EB Left/Thru/Right	0.0	0.00	10.4	B	0.0	0.00	11.9	B
	WB Left/Thru/Right	8.4	0.30	12.1	B	9.8	0.36	13.9	B
	NB Left/Thru/Right	38.5	0.69	19.6	C	223.3	1.35	159.4	F
	SB Left/Thru/Right	114.1	1.00	57.3	F	195.3	1.30	138.0	F
	Overall			**38.5**	**E**			**136.1**	**F**
Access A & Waverley [87] (Unsignalized)	WB Left/Right	28.7	0.65	20.5	C	32.2	0.79	25.3	D
	NB Thru/Right	80.5	0.97	46.7	E	301.7	1.75	283.4	F
	SB Left/Thru	197.4	1.25	148.5	F	367.5	1.89	350.9	F
	Overall			**87.5**	**F**			**272.8**	**F**
Forest Hills Ext Access [89] (Unsignalised)	EB Right				A				A
	NB thru				A				A
	SB Thru				A				A
	SB Thru/Right				A				A
	Overall				**A**				**A**

Notes:
Analysis by CBCL Limited using Synchro 9.0
1. 95% Queue - 95th percentile queue [highlighted if >100m or if available storage is exceeded]
2. V/C Ratio - Volume-to-Capacity ratio [highlighted if >0.85]
3. Average Delay - average total delay per vehicle [highlighted for LOS E or F]
4. LOS - Level of Service [highlighted for LOS E or F]

Level of Service Table - HCM 2010

Level of Service	Average Delay per Vehicle (sec)	
	Signalized	Unisignalized
A	<10	<10
B	>10 and <20	>10 and <15
C	>20 and <35	>15 and <25
D	>35 and <55	>25 and <35
E	>55 and <80	>35 and <50
F	>80	>50

Legend

Queue Length > 100m
V/C > 0.85
LOS E
LOS F

APPENDIX E – Cost Estimate

CBCL LIMITED
Consulting Engineers

OPINION PROBABLE CONSTRUCTION COST
MASTER PLAN PORT WALLACE
1.0 - WATER SERVICE
Halifax / Dartmouth, NS

DATE:	18/01/2017
CBCL FILE No.:	171013.00
EST. DESCRIPTION:	Class D
PREPARED BY:	CBCL

						Cost Sharing Mechanism				Notes
						HRM/HW Charges Area Portion		Developer Charge Area Portion		
1.0 WATER SYSTEM INFRASTRUCTURE		**Unit**	**Est Qty**	**Unit Rate**	**Total**	**%**	**$**	**%**	**$**	
1.2a	400mm Diameter Primary Watermain Upsize	m	2,700	$ 300	$ 810,000	0%		100%	$ 810,000	Shared Cost Among Developers
1.2b	400mm Diameter Watermain to Conrad Lands Upsize	m	420	$ 300	$ 126,000	0%		100%	$ 126,000	Shared Cost Among Developers
1.2c	400mm Diameter Watermain from Caledonia Rd to parallel existing 300 mm	m	770	$ 1,300	$ 1,001,000	0%		100%	$ 1,001,000	Shared Cost Among Developers
1.3a	300mm Diameter Mains from Waverly Road			Base Cost						Base Cost not evaluated
1.4a	300mm Diameter Watermain within Conrad Lands			Base Cost						Base Cost not evaluated
1.4b	300mm Diameter Watermain off Waverly Rd			Base Cost						Base Cost not evaluated
1.5	300mm Diameter Watermain Connection to Spider Lake			Base Cost						Base Cost not evaluated
ESTIMATED TOTAL CONSTRUCTION COST (Including General Conditions & Contingencies)					**$ 2,000,000**		**$ -**		**$ 2,000,000**	
11.0	**CONTINGENCIES and ALLOWANCES**			Included in Units						
A	Design Development Contingency - **Note 2**			Included in Units						
B	Construction Contingency - **Note 3**			Included in Units						
C	Escalation / Inflation **(Based on 2017 Dollars)**			Included in Units						
D	Location Factor - **Note 4**			Included in Units						
ESTIMATED TOTAL CONSTRUCTION COST without HST					**$ 2,000,000**					

Note 1 The summary only provide costs, allowances, contingencies & factors related to construction. Engineering fees not included.
Note 2 A Design Development Cont. is to allow so that the necessary design changes can be made as the design is developed.
Note 3 A Construction Contingency is to allow for the cost of additional work that is over and above the original contract price.
Note 4 Location Factor is to account for difference in costs at project location and location of historical cost data.

Form CBCL 034.Rev 0

CBCL LIMITED
Consulting Engineers

OPINION PROBABLE CONSTRUCTION COST
MASTER PLAN PORT WALLACE
2.0 - WASTEWATER SERVICES
Halifax / Dartmouth, NS

DATE:	30/10/2017
CBCL FILE No.:	171013.00
EST. DESCRIPTION:	Class D
PREPARED BY:	CBCL

						Cost Sharing Mechanism				Notes
						HRM/HW Charges Area Portion		Developer Charge Area Portion		
2.0 WASTEWATER INFRASTRUCTURE		**Unit**	**Est Qty**	**Unit Rate**	**Total**	**%**	**$**	**%**	**$**	
2.1	Forcemain- Sanitary Line c/w Rd Reinstatement from 390 Waverly Rd PS to North Dartmouth - Wright Ave	m	3,200	$ 1,616	$ 5,180,000	30%	$ 1,554,000	70%	$ 3,626,000	Shared between developer and HW
	Shubie Canal & Highway 118 Crossing not included see Item 3.0 Below									
2.2	**390 Waverly Road Pump Station**	Ea	1	$ 3,407,801	$ 3,410,000	30%	$ 1,023,000	70%	$ 2,387,000	Shared between developer and HW
	.1 Civil Earthworks, Excavation, Site Finishes	LS	1	$ 611,566						
	.2 Concrete Work	LS	1	$ 802,364						
	.3 Building Structure	LS	1	$ 242,494						
	.4 Pump Equipment & Piping3	LS	1	$ 1,194,336						
	.5 Building Mechanical & Piping	m2	125	$ 177,206						
	.6 Building Electrical & Instrumentation	LS	1	$ 359,040						
3.1 & 3.2	Crossing of canal and highway	LS	1	$ 4,700,000	$ 4,700,000	30%	$ 1,410,000	70%	$ 3,290,000	
	See separate broken out cost estimate									
ESTIMATED TOTAL CONSTRUCTION COST (Including General Conditions & Contingencies)					**$ 13,300,000**		**$ 4,000,000**		**$ 9,400,000**	
11.0	**CONTINGENCIES and ALLOWANCES**			Included in Units						
A	Design Development Contingency - **Note 2**			Included in Units						
B	Construction Contingency - **Note 3**			Included in Units						
C	Escalation / Inflation **(Based on 2017 Dollars)**			Included in Units						
D	Location Factor - **Note 4**			Included in Units						
ESTIMATED TOTAL CONSTRUCTION COST without HST					**$ 13,300,000**					

Note 1 The summary only provide costs, allowances, contingencies & factors related to construction. Engineering fees not included.
Note 2 A Design Development Cont. is to allow so that the necessary design changes can be made as the design is developed.
Note 3 A Construction Contingency is to allow for the cost of additional work that is over and above the original contract price.
Note 4 Location Factor is to account for difference in costs at project location and location of historical cost data.

THIS OPINION OF PROBABLE COSTS IS PRESENTED ON THE BASIS OF EXPERIENCE, QUALIFICATIONS AND BEST JUDGEMENT. IT HAS BEEN PREPARED IN ACCORDANCE WITH ACCEPTABLE PRINCIPLES AND PRACTICES. MARKET TRENDS, NON-COMPETITIVE BIDDING SITUATIONS, UNFORESEEN LABOUR AND MATERIAL ADJUSTMENTS AND THE LIKE ARE BEYOND THE CONTROL OF CBCL LIMITED. AS SUCH WE CANNOT WARRANT OR GUARANTEE THAT ACTUAL COSTS WILL NOT VARY FROM THE OPINION PROVIDED.

Form CBCL 034.Rev 0

CBCL LIMITED
Consulting Engineers

OPINION PROBABLE CONSTRUCTION COST
MASTER PLAN PORT WALLACE
3.0 - JOINT UTILITY TRENCHLESS CROSSINGS
Halifax / Dartmouth, NS

DATE:	30/10/2017
CBCL FILE No.:	171013.00
EST. DESCRIPTION:	Class D
PREPARED BY:	CBCL

						Cost Sharing Mechanism				Notes
						Water portion of costs		Sanitary Portion of Costs		
3.0 JOINT UTILITY CROSSINGS - TRENCHLESS		**Unit**	**Est Qty**	**Unit Rate**	**Total**	**%**	**$**	**%**	**$**	
3.1	Trenchless Shubie Canal Crossing (1 x600mm Dia Water & 2 x 525mm Dia Sanitary Joint Crossing)*	m	40	$ 40,500	$ 1,620,000	33%	$ 534,600	67%	$ 1,085,400	
3.2	Trenchless Highway 118 Crossing (1 x600mm Dia Water & 2 x 525mm Dia Sanitary Joint Crossing)*	m	150	$ 35,000	$ 5,250,000	33%	$ 1,732,500	67%	$ 3,517,500	
ESTIMATED TOTAL CONSTRUCTION COST (Including General Conditions & Contingencies)					**$ 6,900,000**		**$ 2,300,000**		**$ 4,700,000**	
11.0	**CONTINGENCIES and ALLOWANCES**			Included in Units						
A	Design Development Contingency - **Note 2**			Included in Units						
B	Construction Contingency - **Note 3**			Included in Units						
C	Escalation / Inflation **(Based on 2017 Dollars)**			Included in Units						
D	Location Factor - **Note 4**			Included in Units						
ESTIMATED TOTAL CONSTRUCTION COST without HST					**$ 6,900,000**					

Note 1 The summary only provide costs, allowances, contingencies & factors related to construction. Engineering fees not included.
Note 2 A Design Development Cont. is to allow so that the necessary design changes can be made as the design is developed.
Note 3 A Construction Contingency is to allow for the cost of additional work that is over and above the original contract price.
Note 4 Location Factor is to account for difference in costs at project location and location of historical cost data.

CBCL LIMITED
Consulting Engineers

OPINION PROBABLE CONSTRUCTION COST

MASTER PLAN PORT WALLACE
4.0 - TRANSPORTATION
Halifax / Dartmouth, NS

DATE:	10/01/2018
CBCL FILE No.:	171013.00
EST. DESCRIPTION:	Class D
PREPARED BY:	CBCL

						Cost Sharing Mechanism				Notes
						HRM/HW Charges Area Portion		Developer Charge Area Portion		
4.0	**INTERSECTIONS - PROPOSED UPGRADES**	**Unit**	**Est Qty**	**Unit Rate**	**Total**	**%**	**$**	**%**	**$**	
4.1	Cono Drive (Access F)	LS	1	$ 2,404,000	$ 2,404,000	55%	$ 1,322,200	45%	$ 1,081,800	
4.2	Montague Rd & Ramp Terminal (North)	LS	1	$ 2,404,000	$ 2,404,000	55%	$ 1,322,200	45%	$ 1,081,800	
4.3	Montague Rd & Ramp Terminal (South)	LS	1	$ 2,404,000	$ 2,404,000	65%	$ 1,562,600	35%	$ 841,400	
4.4	Montague/ Charles Keating & Waverley	LS	1	$ 2,404,000	$ 2,404,000	60%	$ 1,442,400	40%	$ 961,600	
5.1	Breeze & Waverly	LS	1	$ 680,000	$ 680,000	50%	$ 340,000	50%	$ 340,000	
5.2	Montebello & Waverley	LS	1	$ 344,000	$ 344,000	70%	$ 240,800	30%	$ 103,200	
6.1	Main & Forest	LS	1	$ 10,044,000	$ 10,044,000	95%	$ 9,541,800	5%	$ 502,200	
7.1	Montebello/ Avenue du Portage	LS	1	$ 350,000	$ 350,000	55%	$ 192,500	45%	$ 157,500	
8.1	Main and Caledonia	LS	1	$ 20,000	$ 20,000	75%	$ 15,000	25%	$ 5,000	
	ESTIMATED TOTAL CONSTRUCTION COST (Including General Conditions & Contingencies)				**$ 21,100,000**		**$ 16,000,000**		**$ 5,100,000**	
11.0	**CONTINGENCIES and ALLOWANCES**									
A	Design Development Contingency - **Note 2**			Included in Units						
B	Construction Contingency - **Note 3**			Included in Units						
C	Escalation / Inflation **(Based on 2017 Dollars)**			Included in Units						
D	Location Factor - **Note 4**			Included in Units						

ESTIMATED TOTAL CONSTRUCTION COST without HST $ 21,100,000

Note 1	The summary only provide costs, allowances, contingencies & factors related to construction. Engineering fees not included.
Note 2	A Design Development Cont. is to allow so that the necessary design changes can be made as the design is developed.
Note 3	A Construction Contingency is to allow for the cost of additional work that is over and above the original contract price.
Note 4	Location Factor is to account for difference in costs at project location and location of historical cost data.

Form CBCL 034.Rev 1

APPENDIX F – Sanitary Calculations

200 Waverley Road PS Drawdown Test

Pump Station Dimension 1 (m):	6.6
Pump Station Dimension 2 (m):	3.88
Pump Station Inside Area (m^2):	25.608

Action	Time (s)	Start WL (m)	End WL (m)	Change in WL (m)	Flow (L/s)
Pumps OFF	850	1.250	2.200	+0.950	28.6
P1 ON	230	2.200	1.250	-0.950	**134.4**
Pumps OFF	905	1.250	2.268	+1.018	28.8
P2 ON	230	2.268	1.250	-1.018	**142.1**
Pumps OFF	855	1.250	2.200	+0.950	28.5
P3 ON	215	2.200	1.250	-0.950	**141.6**
Pumps OFF	850	1.250	2.200	+0.950	28.6
P1 & P2 ON	125	2.200	1.250	-0.950	**223.2**

Automatic Controls

P1 startup depth @ 2.20m

P1 & P2 startup depth @ 2.50m

Pumps off @ 1.25m

Notes

-Drawdown test started on 19/Jun/2017 at approximately 11:30am and ended at approximately 12:45pm.

-All three pumps are used in rotation.

390 Waverley Road PS System

Existing Conditions

Pipe	U/S Manhole	D/S Manhole	Area (ha)	Total Area (ha)	Single Unit Houses (units)	Town Houses (units)	Multi-Unit Houses (units)	Population (people)	Total Population (people)	Average DWF (L/s)	Peaking Factor	I/I Allowance (L/s)	Design Flow (L/s)	Total Design Flow: Res (L/s)	Total Design Flow: ICI (L/s)	Total Design Flow (L/s)	Pipe Capacity (Percent Full)	Ramaining Capacity (L/s)
P46816	MH20743	MH20744	8.866	8.866	54	0	0	180.9	180.9	0.628	4.16	2.48	5.75	5.75	0.00	**5.75**	**12.5%**	**168**
P46817	MH20744	MH19872	0.494	9.361	2	0	0	6.7	187.6	0.651	4.16	2.62	6.01	6.007	0.000	**6.01**	**12.5%**	**173**
P45255	MH19872	MH19873	3.214	12.575	21	0	0	70.35	257.95	0.896	4.11	3.52	8.12	8.117	0.000	**8.12**	**15.9%**	**141**
P45256	MH19873	MH19874	0.108	12.683	1	0	0	3.35	261.3	0.907	4.10	3.55	8.20	8.205	0.000	**8.20**	**16.3%**	**134**
P45257	MH19874	MH19875	1.006	13.688	1	0	0	3.35	264.65	0.919	4.10	3.83	8.54	8.544	0.000	**8.54**	**18.1%**	**111**
P45258	MH19875	MH19876	1.892	15.580	11	0	0	36.85	301.5	1.047	4.08	4.36	9.70	9.698	0.000	**9.70**	**13.6%**	**233**
P45259	MH19876	MH19877	0.060	15.640	0	0	0	0	301.5	1.047	4.08	4.38	9.71	9.715	0.000	**9.71**	**13.7%**	**231**
P45260	MH19877	MH19878	1.625	17.265	10	0	0	33.5	335	1.163	4.06	4.83	10.73	10.734	0.000	**10.73**	**14.5%**	**226**
P45261	MH19878	MH19879	1.662	18.927	11	0	0	36.85	371.85	1.291	4.04	5.30	11.81	11.815	0.000	**11.81**	**15.2%**	**226**
P45262	MH19879	MH19880	0.872	19.798	0	0	0	0	371.85	1.291	4.04	5.54	12.06	12.059	0.000	**12.06**	**15.4%**	**224**
P45288	MH19880	MH19896	1.607	21.405	10	0	0	33.5	405.35	1.407	4.02	5.99	13.06	13.065	0.000	**13.06**	**15.9%**	**225**
P47186	MH19896	MH20896	1.680	23.085	8	0	0	26.8	432.15	1.501	4.01	6.46	13.98	13.978	0.000	**13.98**	**18.5%**	**173**
P47187	MH20896	MH19897	0.840	23.925	5	0	0	16.75	448.9	1.559	4.00	6.70	14.49	14.488	0.000	**14.49**	**15.3%**	**271**
P45290	MH19897	MH19901	20.165	44.090	140	0	0	469	917.9	3.187	3.82	12.35	27.58	27.579	0.000	**27.58**	**23.5%**	**200**
P45291	MH19901	MH19902	1.312	45.403	7	0	0	23.45	941.35	3.269	3.82	12.71	28.31	28.307	0.000	**28.31**	**23.7%**	**202**
P45301	MH19902	MH19904	6.536	51.938	51	0	0	170.85	1112.2	3.862	3.77	14.54	32.74	32.740	0.000	**32.74**	**25.2%**	**203**
P45302	MH19904	MH19905	0.332	52.270	3	0	0	10.05	1122.25	3.897	3.77	14.64	32.98	32.985	0.000	**32.98**	**23.7%**	**235**
P45303	MH19905	MH19906	0.663	52.932	5	0	0	16.75	1139	3.955	3.76	14.82	33.42	33.423	0.000	**33.42**	**26.2%**	**189**
P45304	MH19906	MH19907	1.170	54.102	7	0	0	23.45	1162.45	4.036	3.76	15.15	34.10	34.103	0.000	**34.10**	**25.3%**	**209**
P45305	MH19907	MH19908	0.909	55.012	4	0	0	13.4	1175.85	4.083	3.75	15.40	34.56	34.559	0.000	**34.56**	**25.5%**	**208**
P45306	MH19908	MH19909	4.256	59.267	25	0	0	83.75	1259.6	4.374	3.73	16.59	37.00	37.004	0.000	**37.00**	**26.4%**	**205**
P45307	MH19909	MH19910	0.583	59.850	1	0	0	3.35	1262.95	4.385	3.73	16.76	37.22	37.217	0.000	**37.22**	**27.1%**	**195**
P45308	MH19910	MH19911	1.986	61.836	10	0	0	33.5	1296.45	4.502	3.72	17.31	38.27	38.272	0.000	**38.27**	**26.5%**	**210**
P45309	MH19911	MH19912	0.873	62.710	6	0	0	20.1	1316.55	4.571	3.72	17.56	38.81	38.814	0.000	**38.81**	**19.0%**	**455**
P45310	MH19912	MH19913	0.196	62.906	1	0	0	3.35	1319.9	4.583	3.72	17.61	38.92	38.919	0.000	**38.92**	**19.0%**	**457**
P45311	MH19913	MH19914	0.897	63.803	4	0	0	13.4	1333.3	4.630	3.72	17.86	39.37	39.369	0.000	**39.37**	**24.3%**	**265**
P45312	MH19914	MH19915	0.390	64.193	0	0	0	0	1333.3	4.630	3.72	17.97	39.48	39.478	0.000	**39.48**	**24.0%**	**273**
P45313	MH19915	MH19916	0.699	64.891	1	0	0	3.35	1336.65	4.641	3.72	18.17	39.72	39.723	0.000	**39.72**	**19.0%**	**461**
P517347	MH19916	MH23876	0.910	65.802	2	0	0	6.7	1343.35	4.664	3.71	18.42	40.08	40.077	0.000	**40.08**	**19.2%**	**456**
P517348	MH23876	MH23875	0.264	66.065	1	0	0	3.35	1346.7	4.676	3.71	18.50	40.20	40.201	0.000	**40.20**	**19.5%**	**445**
P5173427	MH23875	MH23874	0.383	66.449	3	0	0	10.05	1356.75	4.711	3.71	18.61	40.46	40.456	0.000	**40.46**	**18.9%**	**480**
P517326	MH23874	MH23873	0.234	66.683	2	0	0	6.7	1363.45	4.734	3.71	18.67	40.62	40.621	0.000	**40.62**	**19.3%**	**456**
P517324	MH23873	MH23872	0.451	67.133	5	0	0	16.75	1380.2	4.792	3.71	18.80	40.99	40.994	0.000	**40.99**	**19.7%**	**444**
P517325	MH23872	MH23871	0.319	67.453	3	0	0	10.05	1390.25	4.827	3.70	18.89	41.23	41.232	0.000	**41.23**	**19.5%**	**455**
P517334	MH23871	Waverley Ro	9.878	77.331	78	0	0	261.3	1651.55	5.735	3.65	21.65	47.81	47.809	0.000	**47.81**	**12.5%**	**1394**
390 Waverley Road PS														47.809	0.000	**47.81**	**FULL**	**0**

205 68 420

200 Waverley Road PS System

Pipe	U/S Manhole	D/S Manhole	Area (ha)	Total Area (ha)	Single Unit Houses (units)	Town Houses (units)	Multi-Unit Houses (units)	Population (people)	Total Population (people)	Average DWF (L/s)	Peaking Factor	I/I Allowance (L/s)	Design Flow (L/s)	Total Design Flow: Res (L/s)	Total Design Flow: ICI (L/s)	Total Design Flow (L/s)	Pipe Capacity (Percent Full)	Ramaining Capacity (L/s)
P518354	MH19605	MH19599	37.547	114.878	195	0	0	653.25	2304.8	8.003	3.54	32.17	33.77	33.774	0.000	**33.77**	**47.0%**	**41**
P45427	MH19599	MH19600	0.000	114.878	0	0	0	0	2304.8	8.003	3.54	32.17	33.77	34.541	0.000	**34.54**	**41.8%**	**60**
			1.374	1.374	6	0	0	20.1	20.1	0.070	4.38	0.38	0.77					
P518355	MH19600	MH28701	0.000	114.878	0	0	0	0	2304.8	8.003	3.54	32.17	33.77	36.090	0.000	**36.09**	**42.8%**	**58**
			1.576	2.950	18	0	0	60.3	80.4	0.279	4.27	0.83	2.32					
P518356	MH28701	MH28702	0.000	114.878	0	0	0	0	2304.8	8.003	3.54	32.17	33.77	79.166	0.000	**79.17**	**68.9%**	**17**
			59.263	62.213	457	0	74	1697.45	1777.85	6.173	3.62	17.42	45.39					
P518370	MH28702	MH28710	0.000	114.878	0	0	0	0	2304.8	8.003	3.54	32.17	33.77	79.436	0.000	**79.44**	**59.2%**	**41**
			0.623	62.836	2	0	0	6.7	1784.55	6.196	3.62	17.59	45.66					
P518371	MH28710	MH28703	0.656	178.370	1	0	0	3.35	4092.7	14.211	3.32	49.94	109.00	108.997	0.000	**109.00**	**61.7%**	**47**
P518357	MH28703	MH19573	2.845	181.215	5	0	0	16.75	4109.45	14.269	3.32	50.74	110.01	110.006	0.000	**110.01**	**52.8%**	**91**
P518375	MH19573	MH28712	13.576	194.791	28	44	38	326.7	4436.15	15.403	3.29	54.54	117.94	117.940	2.272	**120.21**	**59.7%**	**60**
			2.438	2.438	-	-	-	212	212	0.848	1.50	0.68	2.27					
P518376	MH28712	MH19557	22.449	217.240	202	0	0	676.7	5112.85	17.753	3.24	60.83	132.64	132.638	2.272	**134.91**	**65.0%**	**43**
P518358	MH19557	MH28704	0.625	217.865	4	0	0	13.4	5126.25	17.799	3.23	61.00	132.98	132.978	2.272	**135.25**	**59.1%**	**71**
P518359	MH28704	MH28705	0.728	218.593	6	0	0	20.1	5146.35	17.869	3.23	61.21	133.43	133.428	2.272	**135.70**	**59.0%**	**72**
P518360	MH28705	MH19567	0.957	219.550	5	0	0	16.75	5163.1	17.927	3.23	61.47	133.90	133.902	2.272	**136.17**	**43.0%**	**218**
P518361	MH19567	MH28706	3.370	222.920	16	0	0	53.6	5216.7	18.114	3.23	62.42	135.50	135.503	2.272	**137.78**	**42.7%**	**226**
P518362	MH28706	MH19208	1.671	224.591	5	0	0	16.75	5233.45	18.172	3.23	62.89	136.18	136.176	2.272	**138.45**	**46.1%**	**180**
P47672	MH19208	MH20986	54.529	279.120	342	242	0	1956.4	7189.85	24.965	3.10	78.15	174.75	174.748	13.467	**188.21**	**38.4%**	**415**
			5.220	5.220	-	-	-	660	660	2.634	1.50	1.46	6.40					
			5.940	5.940	-	-	-	418	418	1.670	1.50	1.66	4.79					
P47452	MH20986	MH20987	0.342	279.461	2	0	0	6.7	7196.55	24.988	3.09	78.25	174.92	174.921	13.653	**188.57**	**29.8%**	**787**
			0.291	0.291	-	-	-	40	40	0.042	2.00	0.08	0.19					
P47453	MH20987	MH20988	0.267	279.728	0	0	0	0	7196.55	24.988	3.09	78.32	175.00	174.996	15.309	**190.30**	**44.6%**	**274**
			0.183	0.183	-	-	-	50	50	0.052	2.00	0.05	0.18					
			0.641	0.641	-	-	-	130	130	0.518	2.00	0.18	1.47					
P47454	MH20988	MH20989	0.160	279.888	1	0	0	3.35	7199.9	25.000	3.09	78.37	175.08	175.079	15.309	**190.39**	**50.2%**	**188**
P47455	MH20989	MH20990	22.343	302.231	136	6	50	588.2	7788.1	27.042	3.06	84.62	188.12	188.116	16.120	**204.24**	**59.4%**	**104**
			1.966	1.966	-	-	-	100	100	0.104	2.00	0.55	0.81					
P47456	MH20990	MH20991	1.402	303.633	1	0	0	3.35	7791.45	27.054	3.06	85.02	188.55	188.547	16.120	**204.67**	**57.7%**	**119**
P47457	MH20991	MH20992	1.814	305.447	17	0	0	56.95	7848.4	27.251	3.06	85.53	189.71	189.706	16.822	**206.53**	**73.8%**	**24**
			0.646	0.646	-	-	-	200	200	0.208	2.00	0.18	0.70					
P47458	MH20992	MH20993	0.176	305.623	0	0	0	0	7848.4	27.251	3.06	85.57	189.76	189.755	16.822	**206.58**	**57.6%**	**121**
P47459	MH20993	MH20972	1.301	306.924	1	0	0	3.35	7851.75	27.263	3.06	85.94	190.16	190.158	16.822	**206.98**	**65.0%**	**67**
P455700	MH20972	MH40500	38.859	345.783	366	0	0	1226.1	9077.85	31.520	3.00	96.82	214.87	214.875	20.144	**235.02**	**65.2%**	**75**
			1.784	1.784	-	-	-	377	377	1.505	1.50	0.50	3.32					
P455701	MH40500	MH40501	1.703	347.486	2	0	0	6.7	9084.55	31.544	3.00	97.30	215.43	215.426	24.947	**240.37**	**68.5%**	**55**
			0.252	0.252	-	-	-	96	96	0.756	4.00	0.07	3.85					
			1.085	1.085	-	-	-	250	250	0.260	2.00	0.30	0.95					

P455702	MH40501	MH40502	0.308	347.794	1	0	0	3.35	9087.9	31.555	3.00	97.38	215.55	215.550	25.407	**240.96**	**54.4%**	**178**
			0.452	0.452	-	-	-	288	288	0.067	4.00	0.13	0.46					
P455703	MH40502	Waverley Ro	0.287	348.080	0	0	0	0	9087.9	31.555	3.00	97.46	215.63	215.630	25.407	**241.04**	**55.5%**	**164**
200 Waverley Road PS			0.000	348.080	0	0	0	0	9087.9	31.555	3.00	97.46	215.63	215.630	25.407	**241.04**	**FULL**	**0**
P518366	MH19605	MH28707	0.000	114.878	0	0	0	0	2304.8	8.003	3.54	32.17	33.77	33.774	0.000	**33.77**	**45.3%**	**46**
P518367	MH28707	MH28708	0.000	114.878	0	0	0	0	2304.8	8.003	3.54	32.17	33.77	33.774	0.000	**33.77**	**42.7%**	**55**
P518368	MH28708	MH28709	0.000	114.878	0	0	0	0	2304.8	8.003	3.54	32.17	33.77	33.774	0.000	**33.77**	**42.8%**	**55**
P518369	MH28709	MH28710	0.000	114.878	0	0	0	0	2304.8	8.003	3.54	32.17	33.77	33.774	0.000	**33.77**	**45.7%**	**45**

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Nova Scotia: Halifax, Sydney
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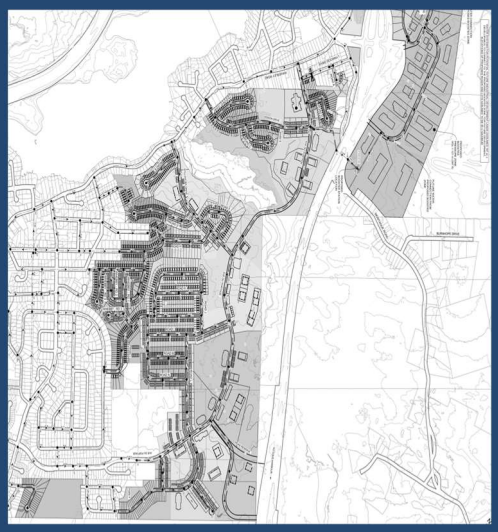
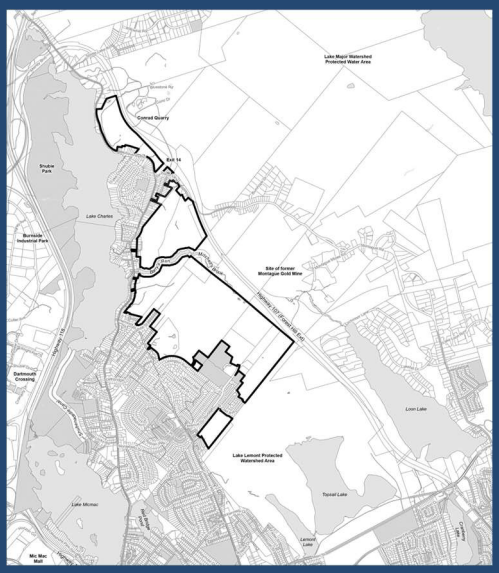
New Brunswick: Saint John, Fredericton, Moncton
Newfoundland & Labrador: St. John's, Happy Valley-Goose Bay





PRE-DESIGN REPORT

DATE: August 22, 2023

Port Wallace Pre-Design Report - Water Servicing

SUBMITTED BY:

DesignPoint Engineering & Surveying Ltd.

90 Western Parkway, Suite 500
Bedford, NS B4B 2J3

SUBMITTED TO:

Port Wallace Holdings Ltd.

90 Western Parkway, Suite 200
Bedford, NS B4B 2J3

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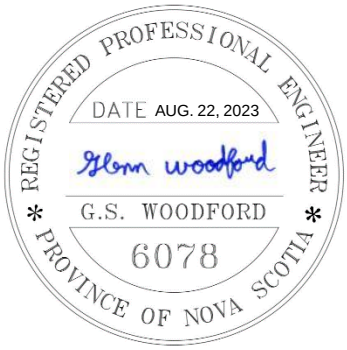
Port Wallace Pre-Design Report

Water Servicing

Issued For	By	Date
Draft Report	LAK	August 9, 2023
Issued for Review	LAK	August 22, 2023

Review Engineer
Glenn Woodford, P. Eng.



Design Engineer
Logan King, P. Eng.

This report was prepared by DesignPoint Engineering & Surveying Ltd. for Port Wallace Holdings Limited using the care and skill ordinarily exercised by members of the engineering profession currently practicing under similar circumstances on similar projects in Nova Scotia.

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TABLE OF CONTENTS

1.0 INTRODUCTION

Port Wallace is a proposed large-scale mixed-use development located along Waverley Road in Dartmouth, Nova Scotia. This development will be constructed in multiple phases and fully serviced with water and wastewater. The development includes a large residential and commercial area southwest of Highway 107 and approximately 242 acres of industrial land northeast of Highway 107 and adjacent to the Conrad Quarry.

Port Wallace is one of six sites identified for potential greenfield development over the life of the Regional Plan (2016 to 2031) and is currently nearing the end of the planning process. As part of that process, Port Wallace Holdings Limited (PWHL) has retained DesignPoint Engineering & Surveying Limited (DesignPoint) to complete a pre-design analysis of the proposed development as it relates to municipal water servicing. The following report has been prepared to identify the existing and proposed municipal water infrastructure requirements to service this development with potable water and fire protection.

2.0 WATER SERVICING

2.1 EXISTING SYSTEM

Currently, municipal water is mainly supplied to the existing Montebello area via an existing 350 mm diameter water main located along Waverly Road that extends from Breeze Drive to the Spider Lake subdivision. This 350 mm water main is supplied by an existing 600 mm diameter transmission main that runs east to west from Main Street in Dartmouth to Shubie Park. This transmission main also runs across Highway 118 to Dartmouth Crossing. Within the existing Montebello subdivision itself, water is supplied through a network of primarily 200 mm diameter water main.

The areas included in this study are supplied from the existing water reservoirs on Mount Edward Road in Dartmouth. The location of the reservoirs has been noted on the attached water schematic in Appendix B. The Mount Edward reservoirs are ultimately supplied with water from the Lake Major Water Treatment Plant, which draws water from Lake Major.

In order to more accurately represent the existing system in our hydraulic model, seven (7) hydrant flow tests were completed at various locations within the existing subdivision and along Waverley Road. The results of the hydrant flow testing can be found in Appendix A. The static pressures measured at each test site suggest that the static pressures within the existing Montebello subdivision range from approximately 34-91 psi, and higher along Waverley Road where the ground elevations are lower and closer to that of Lake Charles.

2.2 MODEL SCHEMATIC

The hydraulic water model was developed using Haestad Methods' WaterCAD in accordance with Halifax Water requirements and was prepared based on existing record information provided by Halifax Water. The proposed water network for the development was incorporated into the model as per the proposed street and lot fabric, and unit types and counts provided by PWHL. A schematic of the water model is attached in Appendix B.

The model was constructed by placing junctions at key locations throughout the study area (i.e. intersections, high/low points) complete with elevations based on the preliminary finished grade road profiles. They were then connected with pipes and each pipe was assigned a diameter, length, and roughness coefficient.

2.2.1 Connections to Existing

Port Wallace will be developed as an extension to the existing Montebello subdivision. Based on the most recent concept plan provided by PWHL, the proposed system will connect to the existing 350 mm water main on Waverly Road at four (4) locations. There will also be one (1) connection to the existing 300 mm dead-end water main on Avenue du Portage, one (1) connection to an existing 300 mm water main near Lynwood Drive, and five (5) connections to the existing network of 200 mm water mains in the existing Montebello subdivision area. The proposed industrial lands will also connect to the existing 300 mm water main near the northernmost extent of the water network that provides service to the Spider Lake subdivision. The existing water pipes adjacent to the development can be seen on the attached schematic in Appendix B.

2.2.2 Pressure Zones

The existing developed area adjacent to the project is serviced within the Burnside High-pressure zone, with an approximate hydraulic grade line (HGL) ranging from 375-400 ft (114-122 m). Due to the location and topography of the proposed development, the residential and commercial area of the development is proposed to be serviced from the Burnside High zone.

Water servicing for the proposed industrial lands in the Conrad Quarry area presents some additional challenges compared to other areas of the development. Surface elevations of the industrial lands (both existing and proposed) range from approximately 55 m to 80 m, which is higher than most of the development and surrounding area. As elevations increase, static pressure in the water main decreases, and the Burnside High-pressure zone will only be capable of providing water service up to a maximum elevation before pressures are lower than the acceptable minimum. The proposed industrial lands are also a significant distance from the existing reservoirs on Mount Edward Road. Due to the friction losses encountered over this distance, there will be a decrease in the hydraulic grade line of the water main once flow reaches the industrial lands, with friction losses increasing during high-flow scenarios such as fire flow.

2.2.3 Proposed Boosted Zone

To service the proposed industrial lands at acceptable pressures, it is recommended to establish a new boosted pressure zone. The preliminary site for the proposed booster station is located within the industrial lands near Montague Road and Highway 107 and has been noted on the attached water schematic in Appendix B. Detailed design for this booster station will be required to be designed to the most recent Halifax Water Design Specification. The proposed boosted zone has been incorporated into the water model for the development.

The hydraulic grade line of the proposed boosted zone has been set to be approximately 397 ft (121 m). The boundary between the existing Burnside High-pressure zone and proposed boosted zone has been defined at an approximate finished grade elevation of 68 m. Model results indicate that this hydraulic grade line will provide acceptable pressures to the boosted part of the industrial lands within the expected elevation range.

We are recommending incorporating pressure reducing valves (PRVs) at the proposed pressure zone boundaries. Based on model results for full buildout, it was found that PRVs are necessary to meet fire flow requirements for the proposed industrial lands within the Burnside High zone. To prevent unnecessary energy expenditure and wear on pumps in the proposed booster station, the PRVs at the pressure zone boundary have

been set in the hydraulic model to only engage during fire flow conditions. During domestic demand scenarios, the pressure downstream of the PRVs is high enough that the valve will close. This is acceptable, as during domestic demand scenarios the water network can provide adequate flow to the industrial lands in each zone separately and no flow through the PRVs is required.

2.3 DOMESTIC ANALYSIS

Domestic demands for both existing and future development were added to each junction and calculated as per the Halifax Water Design Specifications (2023). Junction locations and pipe information are included in the schematic in Appendix B.

Since the applicable guidelines and specifications (Halifax Water Design Specifications, ACWWA Water Supply Guidelines) do not explicitly specify water demands to be used for the design of commercial, industrial, and institutional land uses, water demands were estimated based on wastewater flow allowances.

The domestic demands used for the industrial lands assumed light industrial land use. As per the ACWWA Wastewater Design Guidelines (2022), the average daily wastewater generation for light industrial applications can be estimated as 35 m^3/ha/day. Based on the ACWWA Wastewater Design Guidelines section on peaking factors (Section 3.3.4.4), this flow was factored accordingly based on the assumption that once developed, all facilities will only be in use for part of the day. To account for an assumed 12-hour operation period for industrial land use, the estimated wastewater generation was scaled up by a factor of 2. It was also assumed that for industrial facilities, water usage is equivalent to wastewater generation. Therefore, the average daily water demand used for light industrial use was estimated to be 70 m^3/ha/day. Peaking factors for maximum daily demand and peak hourly demand were then applied to this as per the Halifax Water specifications for each scenario.

A similar process was used for commercial and institutional land uses to estimate water demand. Based on the ACWWA Wastewater Design Guidelines, wastewater generation for commercial buildings can be estimated based on gross floor area at 6 L/day per m^2 of gross floor area. For institutional land use, in this case, both proposed and existing schools, the ACWWA Wastewater Design Guidelines estimate wastewater generation on a per-person basis at 70 L/day per person in a school with a cafeteria. Estimated wastewater generation for both commercial and institutional land uses was scaled by a factor of 3 to calculate the average daily water demand, under the assumption that commercial and institutional buildings are occupied for approximately 8 hours a day. Peaking factors for maximum daily demand and peak hourly demand were then applied as per the Halifax Water specifications for each scenario.

Domestic demands were added to each junction based on the existing demands and anticipated future demands as per the Halifax Water requirements listed in Table 2-1 below:

Table 2-1: Water Requirements

Criteria	Maximum Daily Demand	Peak Hourly Demand
Low-Density Residential (Single Family)	2,073 L/unit/day (548 USG/unit/day)	3,141 L/unit/day (830 USG/unit/day)
High-Density Residential (Multi-Unit)	1,097 L/unit/day (290 USG/unit/day)	2,109 L/unit/day (557 USG/unit/day)
Commercial (per m^2 of Gross Floor Area)	19.8 L/day/m^2 (5.2 USG/day/m^2)	21.6 L/day/m^2 (5.7 USG/day/m^2)
Industrial (per Hectare)	77 m^3/ha/day (20,341 USG/day/ha)	63 m^3/ha/day (16,643 USG/day/ha)
Institutional (per Student)	231 L/student/day (61 USG/day/m^2)	189 L/student/day (50 USG/day/m^2)
Minimum allowable pressure = 175 kPa (40 psi), maximum allowable pressure = 620 kPa (90 psi)		

Existing developments in the vicinity of the Port Wallace site (Montebello, Keystone Village, Craigwood Estates) were also added to the water model. These developments are not expected to significantly affect system pressures in Port Wallace but were included in the model to determine available fire flow before exceeding maximum pipe velocities.

2.4 FIRE FLOW ANALYSIS

A scenario was run in the model which applied a fire flow demand to each junction during the maximum day demand scenario. The fire flow analysis applies the fire demand to a junction, checks all the remaining junctions for available pressure, and then repeats this process for each junction until all the junctions have been analyzed. The requirements for fire flow for this type of development are as follows in Table 2-2 in accordance with Halifax Water Specifications:

Table 2-2: Fire Flow Requirements

Development Type	Fire Flow
Single/Double Family Homes	3,300 L/min (870 USGPM)
Townhouse	4,542 L/min (1,200 USGPM)
Multi-Unit, Industrial, Commercial, Institutional Use	13,620 L/min (3,600 USGPM)
Minimum residual pressure in system = 150 kPa (22 psi)	

Under the fire flow scenario, the minimum allowable residual and system pressure is 150 kPa (22 psi) and the maximum allowable pipe velocity in the system is 2.4 m/s.

2.5 RESULTS

The water model and prepared water schematic are based on the most recent concept plan for the Port Wallace development as provided by PWHL. At this time, the development has been separated into 12 phases plus proposed industrial lands. Project phasing has been incorporated into the water model and water model results were reviewed for each development phase, as well as at completion of the project (full buildout). Due to the current uncertainty regarding the phasing of the industrial lands, analysis for the industrial lands has been completed at full buildout only. Once phasing is determined, the model and report can be updated accordingly.

2.5.1 Full Buildout

The proposed water system for the development has been designed to meet Halifax Water Design Specifications upon full buildout of the development.

Peak Hourly Demand Scenario

The model was run using peak hourly demands at full buildout, and the results of the analysis, including the junction input data, are shown in Appendix C. The minimum pressure at the junctions listed in the appendix are above the required 40 psi.

The model results indicated several junctions exceeding 90 psi, which is the maximum pressure specified by Halifax Water under standard conditions. The maximum anticipated pressure within the development is approximately 105 psi. These exceedances are a function of the varying topography throughout the proposed development, with junctions in low-lying areas experiencing high pressures. Based on the model results, junctions in the Burnside High zone with an elevation less than approximately 45 m experience pressures in excess of 90 psi.

It is recommended to use individual pressure reducing valves for water services in high-pressure areas. Using individual pressure reducing valves for building services should be taken into consideration during detailed design.

Maximum Daily Demand + Fire Flow Scenario

As shown in the results in Appendix D, all calculated zone pressures and residual pressures are above the minimum of 22 psi. For the proposed pipe network, no pipe velocities exceed the maximum of 2.4 m/s.

During fire flow scenarios for junctions within the proposed industrial lands, pipe velocities in the existing 400 mm water main crossing Highway 118 exceed the maximum of 2.4 m/s. Based on the model results, this stretch of pipe will exhibit a maximum velocity of 3.4 m/s. This pipe velocity also exceeds 3.0 m/s, which is the maximum fire flow velocity specified in the *Atlantic Canada Guidelines for the Supply, Treatment, Storage, Distribution and Operation of Drinking Water Supply Systems*. This pipe run is represented in the model and attached schematic as P-168.

The water model was also run with a scenario where the existing 400 mm water main crossing Highway 118 is upsized to 500 mm, which is the size of water main being proposed for the pipe run that supplies the proposed booster pumps. If the existing 400 mm pipe is upsized to 500 mm, model results show that all zone pressures, residual pressures, and pipe velocities will meet Halifax Water fire flow requirements at full buildout.

2.5.2 Interim Phasing

Peak Hourly Demand Scenario

For each phase, the model was run with peak hourly demands. The minimum pressure at the junctions listed in the appendix are above the required 40 psi.

Similar to the full buildout analysis, the model results indicated junctions exceeding 90 psi. The recommendations for full buildout are also applicable to interim phasing design and construction – during detailed design, PRVs for individual services should be incorporated as needed in high pressure areas.

Maximum Daily Demand + Fire Flow Scenario

For each phase, the model was run with maximum daily demands and fire flow demands applied to each junction for all proposed developments active in each phase.

For all interim phases, pipe velocities during fire flow scenarios exceeded the maximum of 2.4 m/s as set forth by Halifax Water. In most cases, maximum velocities during partial buildout ranged from 2.6 m/s to 3.0 m/s and typically occurred in the existing 350 mm water main along Waverly Road (specifically P-6 and P-179(2) in the water model and attached model schematic). These pipe velocities do not exceed 3.0 m/s, which is the maximum fire flow velocity specified in the *Atlantic Canada Guidelines for the Supply, Treatment, Storage, Distribution and Operation of Drinking Water Supply Systems*. As discussed previously, upon full buildout of the development, all fire flow scenario specifications set forth by Halifax Water will be met (with the exception of the existing 400 mm water main crossing Highway 118, which was discussed previously in full buildout results).

In some cases where pipe velocities exceed 2.4 m/s, the issue can be resolved by making changes to the proposed phasing plan. Recommended changes to the project phasing plan based on fire flow results are discussed in more detail in Section 2.5.3, Construction Phasing.

Industrial Lands

As detailed previously, linear sizing and design for the industrial lands was based on full buildout of the development.

The proposed pressure reducing valves in the industrial lands have been set to only engage during fire flow conditions in the hydraulic model. This is an important aspect of meeting requirements during fire flow scenarios for industrial junctions in the existing Burnside High zone. It is assumed that construction phasing of the industrial lands will consist of separate buildout within each pressure zone, with the connection between zones only being made once the boosted zone has been built out completely. To account for this potential construction phasing scenario, the model was checked with the industrial lands being built out almost entirely, except for the proposed PRV connections on Industrial Road 1 and 2 (i.e., boosted zone is only built up to J-333).

For this scenario, pipe velocities during fire flow scenarios exceeded the maximum of 2.4 m/s as set forth by Halifax Water. The fire flow velocity exceedances for this scenario range from 2.6 m/s to 2.8 m/s, occurring in pipe P-6 (existing 350 mm water main on Waverly Road). These pipe velocities are still below 3.0 m/s, which is the maximum fire flow velocity specified in the *Atlantic Canada Guidelines for the Supply, Treatment, Storage, Distribution and Operation of Drinking Water Supply Systems*. As discussed previously, upon full buildout of the development, all fire flow scenario specifications set forth by Halifax Water will be met (subject to upsizing of the existing 400 mm water main crossing Highway 118).

2.5.3 Construction Phasing

To provide adequate fire flow to the proposed development, the 300 mm water main loop proposed for the Conrad Residential lands (located at the northwest extents of the proposed development, adjacent Highway 118) must be completed as part of a single phase. Connection of the water main from both ends is required to provide adequate fire flow to this portion of the development, which based on the most recent phasing plan provided by PWHL will be completed from Phases 3-5. If this water main is not completed in one phase, there will be inadequate fire flow for the proposed multi-unit buildings in this area.

For similar reasons stated above, it is also recommended that the proposed 300 mm water main loop at Jonquil Lane and St. Clair Avenue be completed in a single phase. If the water main is not completed in one phase, there will be inadequate fire flow for the proposed multi-unit buildings in this area.

Additionally, initial phasing of the proposed industrial lands should occur either in conjunction with or following the completion of the proposed Avenue du Portage water main (both the 300 mm and 400 mm sections). Based on the most recent phasing plan provided by PWHL, the completion of this section of water main (400 mm water main along Ave du Portage to Lynwood Drive) corresponds with Phase 4 of the development. If construction of the proposed industrial lands, including the proposed 400 mm water main crossing for Highway 118, precedes the Ave du Portage connection to Lynwood Drive, model results show that there will be inadequate fire flow for the industrial lands.

Based on model results during interim phasing, it is recommended to complete the final phases of the Burnside High industrial lands (J-329, J-330, J-331 in the water model and attached schematic) during or following the construction of Phase 6. If the industrial lands corresponding to these junctions are completed prior to Phase 5, model results show there to be inadequate flow available to the industrial lands during fire flow scenarios, resulting in pressures lower than the required minimum of 22 psi.

3.0 SUMMARY

Based on the model prepared as summarized in this report, the proposed and existing water systems at full buildout have the capacity to service the proposed development. The Halifax Water Standards and Specifications are generally met, with the exception of pressures at some junctions exceeding the maximum 90 psi during domestic demand scenarios. It is recommended that PRVs be implemented for individual services as needed to meet the Halifax Water specifications for these higher-pressure junctions. During fire flow scenarios for the proposed industrial lands, the existing 400 mm water main that crosses Highway 118 experiences velocities in excess of 3.0 m/s. If this pipe is upsized to 500 mm, no pipe velocities exceed the maximum of 2.4 m/s.

In the interim phases, the system can supply adequate flow, however maximum pipe velocities during fire flow exceed the maximum allowable velocity set forth by Halifax Water. However, these results generally meet the requirements set forth by the ACWWA *Atlantic Canada Guidelines for the Supply, Treatment, Storage, Distribution, and Operation of Drinking Water Supply Systems.* In order to meet fire flow requirements, it is recommended to make modifications to the project phasing plan based on the Construction Phasing section of this report.

It is recommended that the water system for the proposed development is designed as per the layout and pipe sizing as shown in the schematic in Appendix B.

APPENDIX A – HYDRANT FLOW TEST RESULTS

SCM Risk Management Services Inc.
238 Brownlow Avenue
Suite 300
Dartmouth, NS
B3B 1Y2
Tel. (800) 639-4528
Fax. (902) 423-7376

3 MAY 2016

DESIGN POINT ENGINEERING & SERVEYING LTD
200 WATERFRONT DRIVE, SUITE 100
BEDFORD, NOVA SCOTIA, B4A 4J4

ATTENTION: LINDSAY REIMER P. ENG., SENIOR CIVIL ENGINEER

RE: FLOW TESTING, PORT WALLACE AREA
DARTMOUTH, NOVA SCOTIA
RMS FILE NO. 2005048

DEAR LINDSAY:

Please find enclosed the results of the seven flow tests conducted during the week of May 2 – 6, 2016 as per your request. If you have any questions, please contact this office or the writer.

Yours Truly

James T. Burbridge, CD, AIIC
SCM Risk Management Services Inc.
JTB: pjb
Enclosures

TEST # **1**

WATER SUPPLY TEST

Name of Risk: **Design Point Engineering** File No.: **2005048 A (1 of 2)**
Address: **200 Water Front Dr** Test By: **R M S (J. T. B.)**
Municipality: **Bedford, N. S., B4A 4J4** Date: **3 May 2016**

SYSTEM DATA:

Size of Main: **6'** Dead End: ☐ Two Ways: ☒ Loop: ☐
Source Reliable: ☒ Yes ☐ No If not explain:
Comments: **H R M Dartmouth near Wilcot Ln @ Lynwood Dr**

TEST DATA:

Location of test hydrants: Residual: **Lynwood Dr @ (Hyd 16306)**
Flow: **Lynwood Dr @ (Hyd 16307)**
Static Pressure: **100 psi** Time: _____ A.M. 10:30 P.M.

Test No.	No. of Outlets	Orifice Size (in.)	Pitot Reading (psig)	Equivalent Flow gpm (U.S.)	Total Flow gpm (U.S.)	Residual Pressure (psig)	Comments
1	**1**	**1 3/4**	**90**		**862**	**93**	
2	**2**	**2 1/4**	**38 & 40**	**1149 + 1167=**	**2311**	**76**	

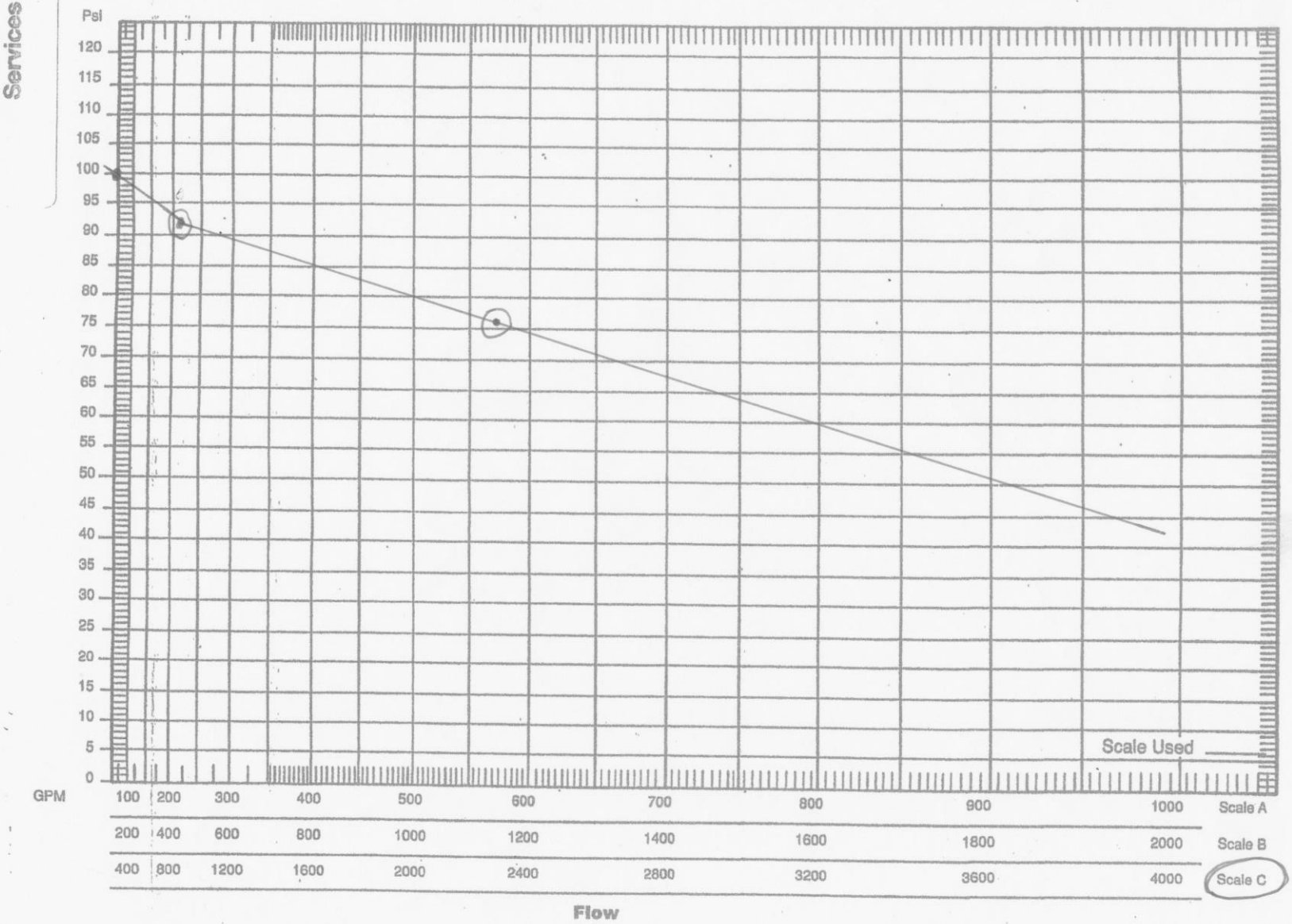
Additional information/sketch/etc.:

Name and address of municipal authority that should receive a copy:

SCM Risk Management Services Inc.

Water Flow Test Summary

File # 2005048A2/2 Location Lynwood Dr. Municipality Dartmouth N.S. Date 3 MAY 2016



TEST # **2**

WATER SUPPLY TEST

Name of Risk: **Design Point Engineering** File No.: **2005048 B (1 of 2)**
Address: **200 Water Front Dr** Test By: **R M S (J. T. B.)**
Municipality: **Bedford, N. S., B4A 4J4** Date: **6 May 2016**

SYSTEM DATA:
Size of Main: **14"** Dead End: ☒ Two Ways: ☐ Loop: ☐
Source Reliable: ☒ Yes ☐ No If not explain:
Comments: **H R M Dartmouth**

TEST DATA:
Location of test hydrants: Residual: **Waverly Rd @ Lakewood Ct (16297)**
Flow: **Next Hyd North on Waverly Rd @ Hyd 16296 (House # 457)**
Static Pressure: **108** Time: _____ A.M. 11;00 P.M.

Test No.	No. of Outlets	Orifice Size (in.)	Pitot Reading (psig)	Equivalent Flow gpm (U.S.)	Total Flow gpm (U.S.)	Residual Pressure (psig)	Comments
1	**1**	**1 3/4**	**90**		**862**	**102**	
2	**2**	**1 3/4, 2 1/4**	**40 50**	**575 + 1065 =**	**1640**	**99**	

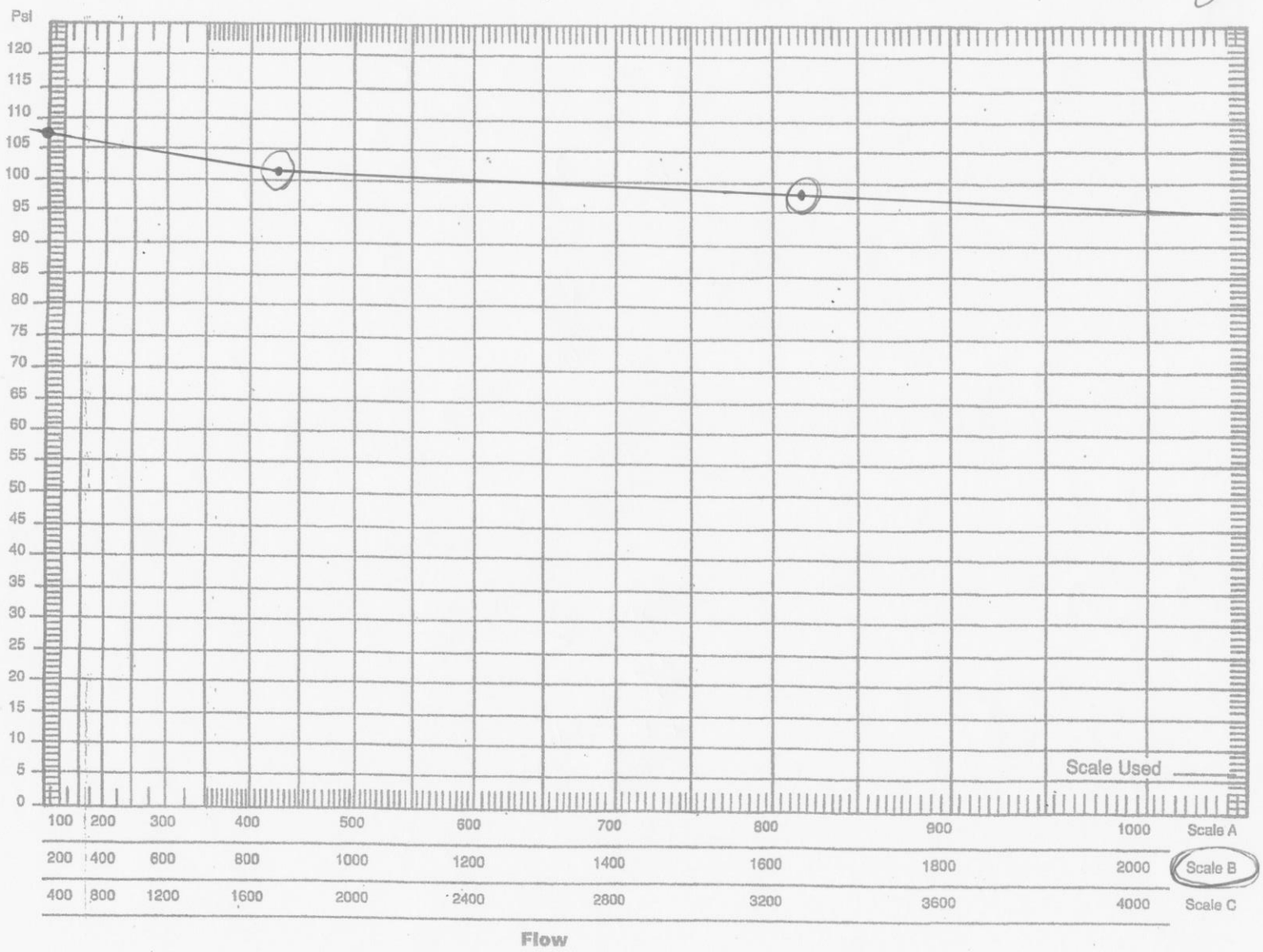
Additional information/sketch/etc.:

Name and address of municipal authority that should receive a copy:

SCM Risk Management Services Inc.

Water Flow Test Summary

File # 2005048 B (2 of 2) Location Waverly Road Municipality Dartmouth N.S. Date 6 May 2016



TEST # **3**

WATER SUPPLY TEST

Name of Risk: **Design Point Engineering** File No.: **2005048 C (1 of 2)**
Address: **200 Water Front Dr** Test By: **R M S (J. T. B.)**
Municipality: **Bedford, N. S., B4A 4J4** Date: **3 May 2016**

SYSTEM DATA:

Size of Main: **6"** Dead End: ☐ Two Ways: ☐ Loop: ☒
Source Reliable: ☒ Yes ☐ No If not explain:
Comments: **H R M Dartmouth Gertrude Dr & Hemlock St**

TEST DATA:

Location of test hydrants: Residual: **Gertrude Dr @ Forest Ct.**
Flow: **Gertrude Dr @ Hemlock St**
Static Pressure: **100** Time: _____ A.M. 11;00 P.M.

Test No.	No. of Outlets	Orifice Size (in.)	Pitot Reading (psig)	Equivalent Flow gpm (U.S.)	Total Flow gpm (U.S.)	Residual Pressure (psig)	Comments
1	**1**	**1 3/4**	**90**		**862**	**94**	
2	**1**	**3 7/8**	**15**		**1560**	**85**	

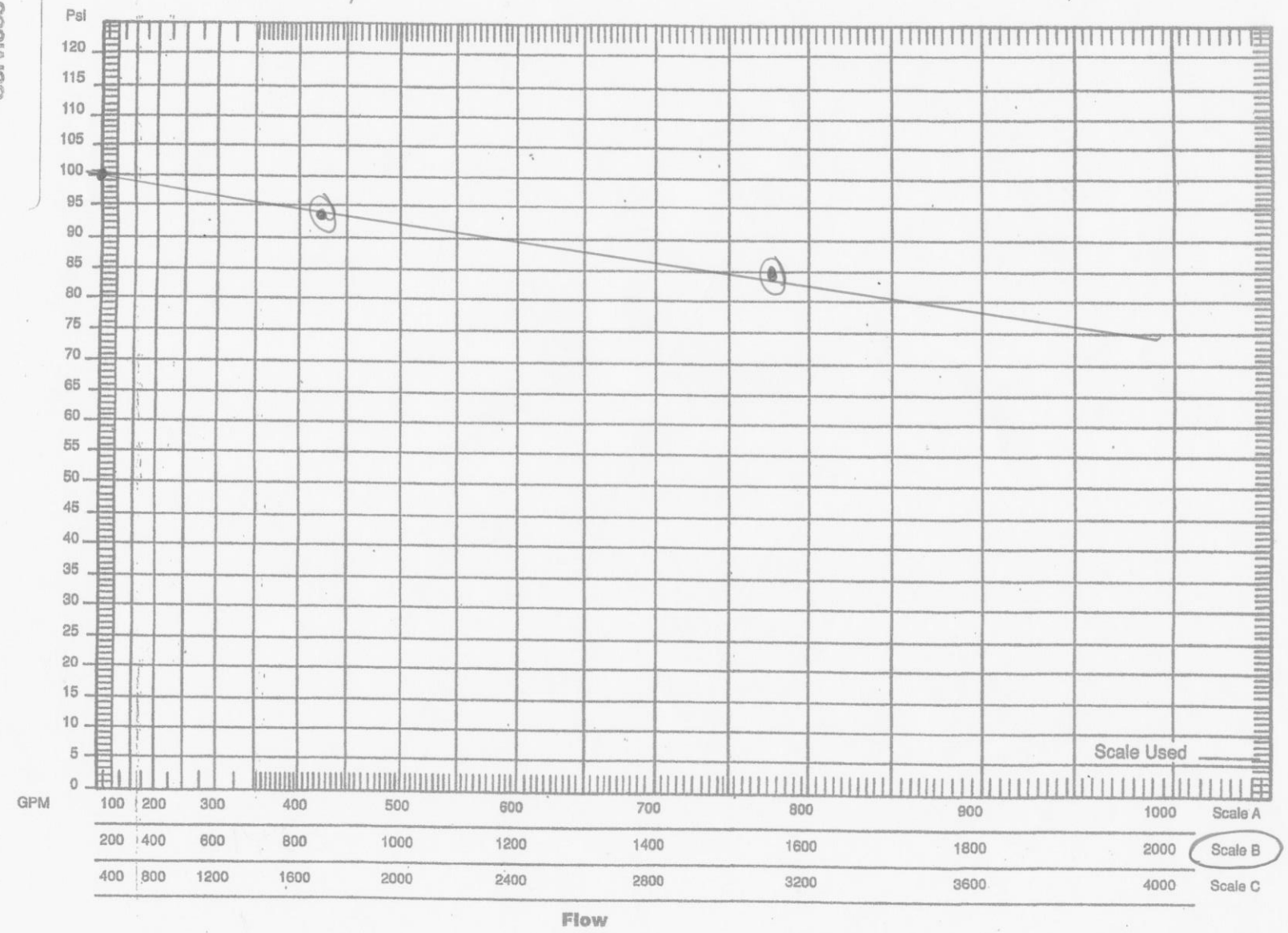
Additional information/sketch/etc.:

Name and address of municipal authority that should receive a copy:

SCM Risk Management Services Inc.

Water Flow Test Summary

File # 2005048 C2/2 Location GERTRUDE DR. Municipality Dartmouth N.S Date 3 MAY 2016



TEST # **4**

WATER SUPPLY TEST

Name of Risk: **Design Point Engineering** File No.: **2005048 D (1 of 2)**
Address: **200 Water Point Dr** Test By: **R M S (J. T. B.)**
Municipality: **Bedford, N. S., B4A 4J4** Date: **4 May 2016**

SYSTEM DATA:
Size of Main: **8'** Dead End: ☒ Two Ways: ☐ Loop: ☐
Source Reliable: ☒ Yes ☐ No If not explain:
Comments: **H R M Dartmouth**

TEST DATA:
Location of test hydrants: Residual: **White Street @ Hydrant 16187**
Flow: **White Street @ Hydrant 16190 (Last Hydrant on Street)**
Static Pressure: **67 psi** Time: _____ A.M. 11:00 P.M.

Test No.	No. of Outlets	Orifice Size (in.)	Pitot Reading (psig)	Equivalent Flow gpm (U.S.)	Total Flow gpm (U.S.)	Residual Pressure (psig)	Comments
1	**1**	**2 1/4**	**50**		**1065**	**60**	
2	**1**	**3 7/8**	**20**		**1800**	**50**	

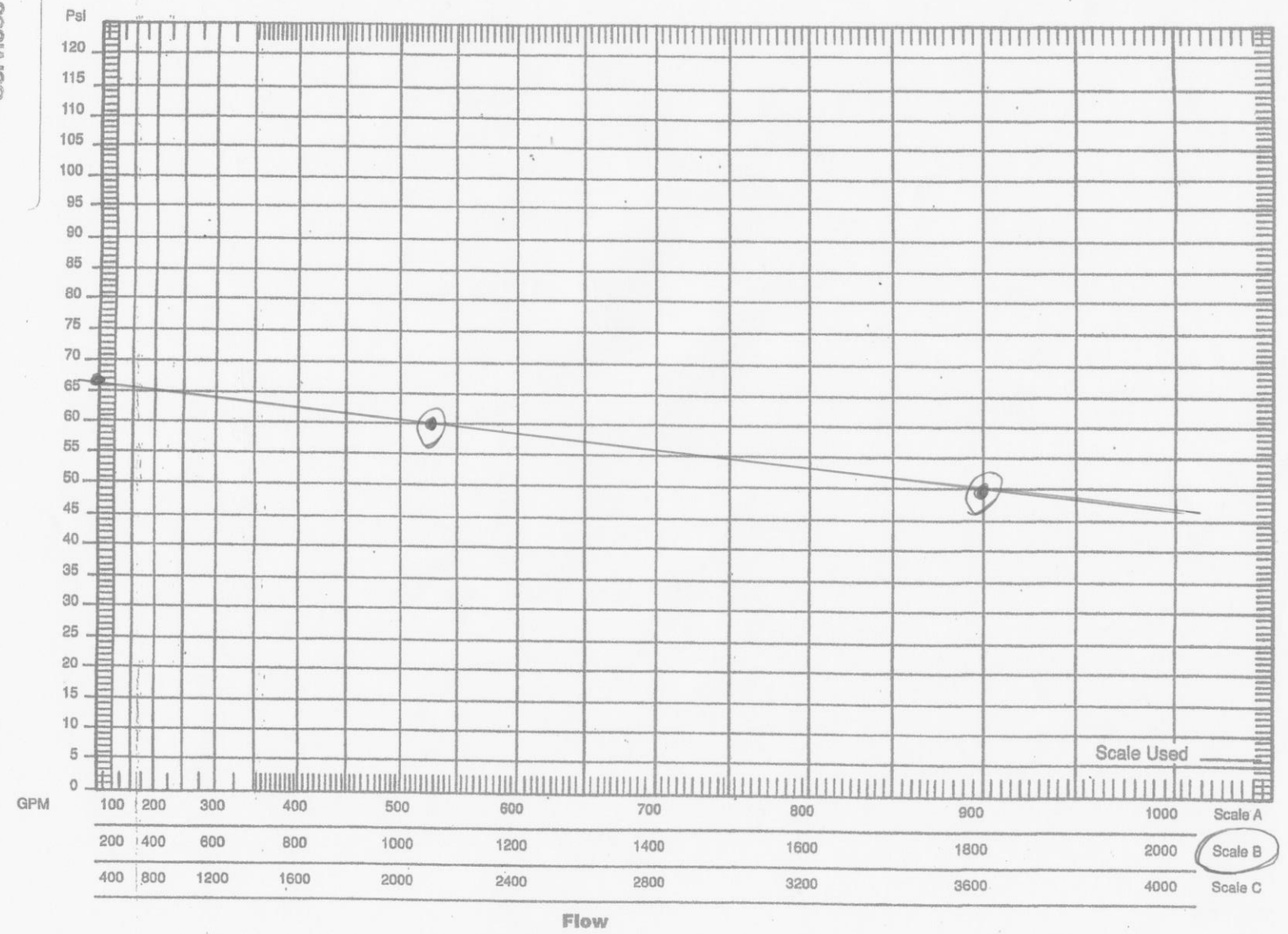
Additional information/sketch/etc.:

Name and address of municipal authority that should receive a copy:

SCM Risk Management Services Inc.

Water Flow Test Summary

File # 2005048 D(2012) Location White St Municipality Dartmouth NS Date 4 MAY 2016



TEST # **5**

WATER SUPPLY TEST

Name of Risk: **Design Point Engineering** File No.: **2005048 E (1 of 2)**
Address: **200 Water Front Dr** Test By: **R M S (J. T. B.)**
Municipality: **Bedford, N. S., B4A 4J4** Date: **4 May 2016**

SYSTEM DATA:
Size of Main: **8"** Dead End: ☒ Two Ways: ☐ Loop: ☐
Source Reliable: ☒ Yes ☐ No If not explain:
Comments: **H R M Dartmouth**

TEST DATA:
Location of test hydrants: Residual: **Belvedere Dr @ Hemlock St**
Flow: **Belvedere Dr @ 16231 (Last Hydrant on Street North)**
Static Pressure: **70 psi** Time: _____ A.M. 10:30 P.M.

Test No.	No. of Outlets	Orifice Size (in.)	Pitot Reading (psig)	Equivalent Flow gpm (U.S.)	Total Flow gpm (U.S.)	Residual Pressure (psig)	Comments
1	**1**	**3 7/8**	**10**		**1280**	**62**	
2	**1**	**3 7/8**	**18**		**1780**	**56**	

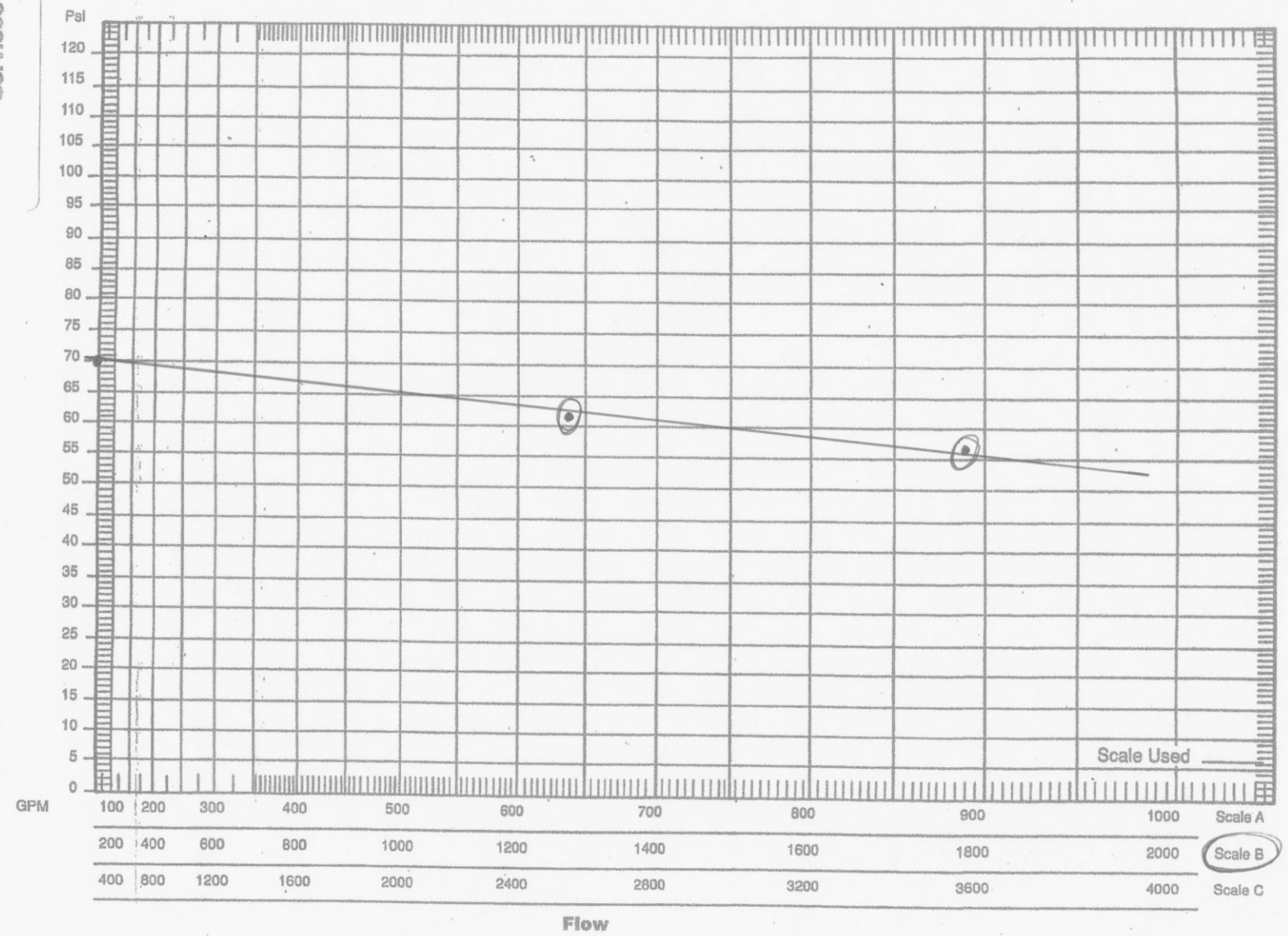
Additional information/sketch/etc.:

Name and address of municipal authority that should receive a copy:

SCM Risk Management Services Inc.

Water Flow Test Summary

File # 2005048 E (2 of 2) Location BELVEDERE DR. Municipality DARTMOUTH NS Date 4 MAY 2016



TEST # **6**

WATER SUPPLY TEST

Name of Risk: **Design Point Engineering** File No.: **2005048 F (1 of 2)**
Address: **200 Water Front Dr** Test By: **R M S (J. T. B.)**
Municipality: **Bedford, N S, B4A 4J4** Date: **4 May 2016**

SYSTEM DATA:
Size of Main: **8"** Dead End: ☐ Two Ways: ☒ Loop: ☐
Source Reliable: ☒ Yes ☐ No If not explain:
Comments: **H R M Dartmouth**

TEST DATA:
Location of test hydrants: Residual: **Lexington Ave @ Rosecraft Dr**
Flow: **Lexington Ave @ Hyd 16463 (Next One East)**
Static Pressure: **68 psi** Time: _____ A.M. 11:00 P.M.

Test No.	No. of Outlets	Orifice Size (in.)	Pitot Reading (psig)	Equivalent Flow gpm (U.S.)	Total Flow gpm (U.S.)	Residual Pressure (psig)	Comments
1	**1**	**3 7/8**	**10**		**1280**	**58**	
2	**1**	**3 7/8**	**20**		**1800**	**52**	

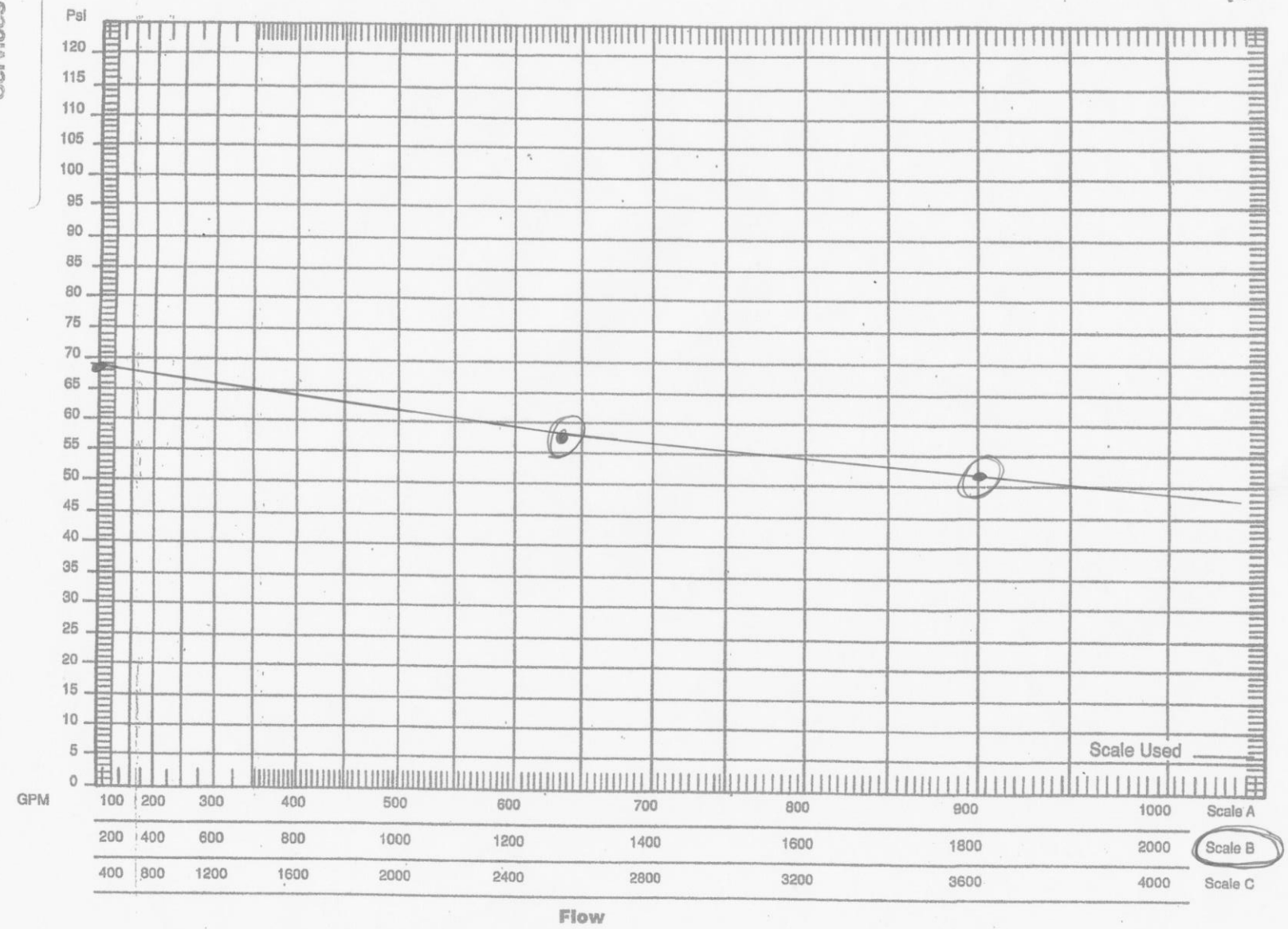
Additional information/sketch/etc.:

Name and address of municipal authority that should receive a copy:

SCM Risk Management Services Inc.

Water Flow Test Summary

File # 2005048 F.(292) Location Lexington Ave. Municipality Dartmouth N.S. Date 4 May 2016



TEST # 7

WATER SUPPLY TEST

Name of Risk: **Design Point Engineering** File No.: **2005048 G (1 of 2)**
Address: **200 Water Front Dr** Test By: **R M S (J. T. B.)**
Municipality: **Bedford, N. S., B4A 4J4** Date: **6 May 2016**

SYSTEM DATA:
Size of Main: **12"** Dead End: ☒ Two Ways: ☐ Loop: ☐
Source Reliable: ☒ Yes ☐ No If not explain:
Comments: **H R M Dartmouth**

TEST DATA:
Location of test hydrants: Residual: **Portage Ave @ Hyd 16481 (In Front of House # 156)**
Flow: **Portage Ave @ Hyd 16462 (North to Rd to School Building # 199)**
Static Pressure: **50 psi** Time: _____ A.M. 10:00 P.M.

Test No.	No. of Outlets	Orifice Size (in.)	Pitot Reading (psig)	Equivalent Flow gpm (U.S.)	Total Flow gpm (U.S.)	Residual Pressure (psig)	Comments
1	**1**	**1 3/4**	**56**		**680**	**46**	
2	**2**	**2 1/4**	**30 & 32**	**826 + 850 =**	**1676**	**42**	

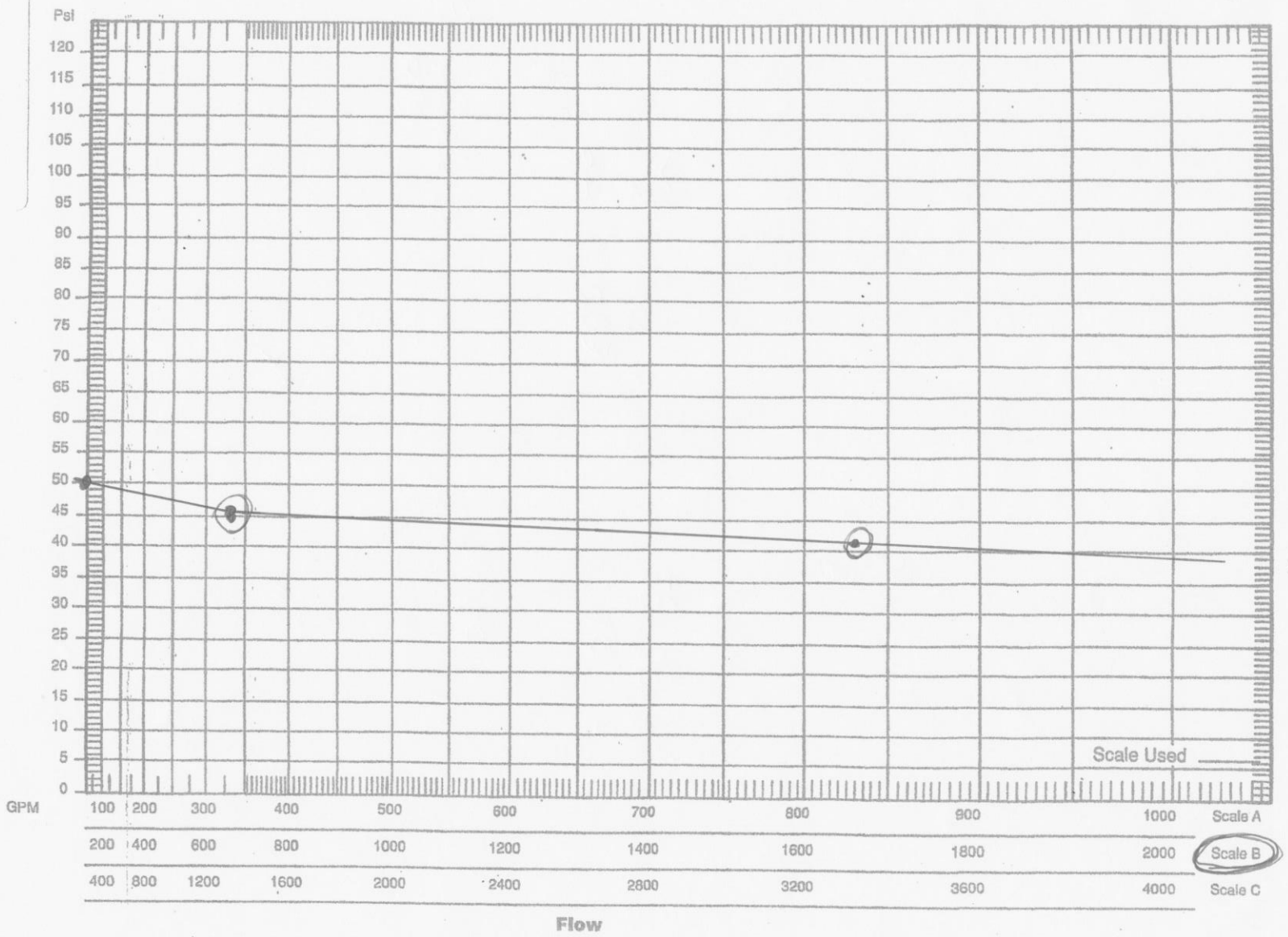
Additional information/sketch/etc.:

Name and address of municipal authority that should receive a copy:

SCM Risk Management Services Inc.

Water Flow Test Summary

File # 2005048 G(2012) Location PORTAGE AVE Municipality Dartmouth, N.S Date 6 May 2016



APPENDIX B – WATER SYSTEM SCHEMATIC

BURNSIDE HIGH PRESSURE ZONE
APPROX. HGL = 114 m (375 ft)

PROPOSED
BOOSTED
PRESSURE ZONE
HGL = 121 m (397 ft)

PROPOSED PRESSURE
REDUCING VALVE

PROPOSED
BOOSTER STATION
LOCATION

BURNSIDE HIGH PRESSURE ZONE
APPROX. HGL = 114 m (375 ft)

SPIDER LAKE ROAD
ANDREA LYNN AVENUE
MAJORIE ANN DRIVE
TO HIGHWAY 118
HIGHWAY 107
WAVERLEY ROAD
LAKE CHARLES DRIVE
LAKE CHARLES
LYNWOOD DRIVE
ROAD A
ROAD D
ROAD C
AVE DU PORTAGE
PARK B
EDSON DRIVE
BURNHOPE DRIVE
MONTAGUE ROAD
TO COLE HARBOUR
ROAD J
ROAD L
ROAD RESERVE
STILLWATER DRIVE
ROAD G
ROAD H
ROAD K
ROAD M
ROAD N
PARK F
PWGBC1
WHEBBY - RD 1
WHEBBY - RD 2
WHEBBY - RD 3
WHEBBY - RD 4

EXTENTS OF HYDRAULIC MODEL

1:15,000

TOPSAIL LAKE
LEMONT LAKE
MAIN STREET
HIGHWAY 107
EX. 900 mm TRANSMISSION MAIN
EX. 750 mm TRANSMISSION MAIN
EX. 1,050 mm TRANSMISSION MAIN
EX. MOUNT EDWARD RESERVOIR
SHELLING LANE
FADEN STREET
METRES

LEGEND

PROPOSED 200 mm PIPE	PW1 PW2 PW3 PW4 PW5
PROPOSED 250 mm PIPE	PW1 PW2 PW3 PW4 PW5
PROPOSED 300 mm PIPE	PW1 PW2 PW3 PW4 PW5
PROPOSED 400 mm PIPE	PW1 PW2 PW3 PW4 PW5
PROPOSED 600 mm PIPE	PW1 PW2 PW3 PW4 PW5
EXISTING 150 mm PIPE	WAT-E WAT-E WAT-E WAT-E
EXISTING 200 mm PIPE	WAT-E WAT-E WAT-E WAT-E
EXISTING 250 mm PIPE	WAT-E WAT-E WAT-E WAT-E
EXISTING 300 mm PIPE	WAT-E WAT-E WAT-E WAT-E
EXISTING 350 mm PIPE	WAT-E WAT-E WAT-E WAT-E
EXISTING 400 mm PIPE	WAT-E WAT-E WAT-E WAT-E
EXISTING 600 mm PIPE	WAT-E WAT-E WAT-E WAT-E

PHASING LEGEND

PHASE	COLOR CODE
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
INDUSTRIAL (BURNSIDE HIGH ZONE)	
INDUSTRIAL (BOOSTED ZONE)	

NOTES:

1. PROPOSED PIPE SIZES ARE PRELIMINARY AND SUBJECT TO DETAILED DESIGN.
2. CONTOUR DATA OBTAINED FROM HRM LIDAR. CONTOUR INTERVAL IS 5 m.

METRES
100 0 200 300
1:4000

ISSUE	DATE	DESCRIPTION
4	AUG. 22, 2023	ISSUED WITH REPORT
3	AUG. 9, 2023	ISSUED WITH DRAFT REPORT
2	MAY 3, 2023	REISSUED FOR REVIEW
1	FEB. 25, 2019	ISSUED FOR APPROVAL

CONSULTANT

DESIGNPOINT
engineering • surveying • solutions
902.832.5597
designpoint.ca

REGISTERED PROFESSIONAL ENGINEER
DATE AUG.22.2023
L. King
L. A. KING
20200507
PROVINCE OF NOVA SCOTIA

REGISTERED PROFESSIONAL SURVEYOR
DATE AUG.22.2023
G.S. WOODFORD
6078
PROVINCE OF NOVA SCOTIA

CLIENT

PORT WALLACE HOLDINGS LTD.

PROJECT DESCRIPTION

PORT WALLACE

DARTMOUTH, NOVA SCOTIA

SHEET DESCRIPTION

WATER MASTER PLAN

Drawn	Engineer	Project No.	Drawing No.
L. KING	L. KING	15-001	C-WA01
Scale	Filename		1 of 1
1:4000	22-106 Water Schematic HRS.dwg		

P:\2022\22-106 Port Wallace Holdings - Port Wallace\05 - Technical\Models\Water\22-106 Water Schematic HRS.dwg, Plot Date: 2023-Aug-22, Plot Size: ISO FULL BLEED A0 (841.00 X 1189.00 MM)

APPENDIX C – FULL BUILDOUT RESULTS (DOMESTIC)

Water Model Results

Peak Hourly Demand Scenario

Full Build - Peak Hourly Demand

Junction	Elevation (m)	Demand (L/min)	Hydraulic Grade (m)	Pressure (psi)
J-106	53.0	0	107.0	77
J-130	74.5	0	108.7	49
J-131	71.1	215	108.6	53
J-132	69.1	0	108.5	56
J-133	71.0	454	108.5	53
J-135	35.2	0	108.1	104
J-136	40.9	107	108.1	95
J-137	42.2	138	108.1	94
J-138	50.8	117	108.0	81
J-147	49.8	11	108.0	83
J-148	50.9	24	108.0	81
J-149	51.7	24	108.0	80
J-150	50.6	0	107.9	81
J-151	59.0	769	108.0	70
J-152	42.4	89	108.0	93
J-153	53.5	72	108.0	77
J-154	62.5	499	108.1	65
J-155	66.2	502	108.2	60
J-156	67.5	199	108.3	58
J-161	42.0	13	107.5	93
J-162	41.0	52	107.3	94
J-163	42.2	44	107.2	92
J-164	42.0	89	107.5	93
J-165	39.9	74	107.3	96
J-171	41.1	92	107.1	94
J-172	42.0	22	107.1	92
J-173	43.0	52	107.1	91
J-174	44.6	20	107.1	89
J-175	45.9	11	107.0	87
J-176	40.3	830	107.3	95
J-177	46.5	141	107.8	87
J-180	41.7	141	107.1	93
J-182	56.0	55	108.5	75
J-183	58.4	98	108.5	71
J-184	64.5	31	108.8	63
J-185	62.2	31	108.8	66
J-186	64.4	72	109.3	64
J-187	57.6	96	108.3	72
J-188	52.1	22	109.8	82
J-189	52.3	15	108.3	79
J-190	79.0	116	108.9	43
J-191	75.6	0	108.7	47

Water Model Results

Peak Hourly Demand Scenario

Full Build - Peak Hourly Demand

Junction	Elevation (m)	Demand (L/min)	Hydraulic Grade (m)	Pressure (psi)
J-192	76.1	83	108.7	46
J-193	72.4	70	108.5	51
J-197	83.8	81	112.2	40
J-201	76.1	209	108.6	46
J-203	75.6	92	108.4	47
J-204	69.8	11	109.9	57
J-205	70.4	61	109.9	56
J-206	71.0	15	109.6	55
J-207	69.5	13	109.4	57
J-208	67.0	39	109.4	60
J-210	59.4	68	108.3	70
J-211	59.9	11	108.4	69
J-212	61.4	24	108.4	67
J-213	64.0	76	108.4	63
J-214	65.7	31	108.4	61
J-215	60.9	98	108.4	68
J-216	66.9	9	108.5	59
J-219	63.4	48	108.4	64
J-220	66.3	74	108.4	60
J-221	67.0	39	108.5	59
J-222	67.4	9	108.6	58
J-223	67.0	41	108.5	59
J-224	63.9	57	108.4	63
J-225	63.9	39	108.4	63
J-226	65.8	28	108.4	61
J-227	66.2	116	108.4	60
J-229	70.4	133	108.4	54
J-230	71.4	44	108.4	53
J-231	68.9	87	108.4	56
J-232	70.7	31	108.4	54
J-234	68.4	79	109.6	59
J-235	68.9	39	109.2	57
J-236	69.6	9	109.3	56
J-237	68.6	89	109.4	58
J-238	68.6	83	109.5	58
J-239	70.5	61	109.3	55
J-240	43.7	89	107.1	90
J-243	52.8	387	106.5	76
J-244	41.1	11	106.5	93
J-245	47.4	79	106.5	84
J-246	52.0	15	106.5	77
J-247	53.5	160	106.5	75

Water Model Results

Peak Hourly Demand Scenario

Full Build - Peak Hourly Demand

Junction	Elevation (m)	Demand (L/min)	Hydraulic Grade (m)	Pressure (psi)
J-248	51.1	44	106.5	79
J-249	43.6	46	106.5	89
J-256	68.2	65	109.4	59
J-311	68.0	353	108.3	57
J-312	47.6	0	106.5	84
J-325	55.4	130	106.5	73
J-326	56.9	320	106.5	70
J-327	58.3	127	106.5	68
J-328	61.8	730	106.5	63
J-329	60.2	255	106.5	66
J-330	60.0	131	106.5	66
J-331	60.0	359	106.5	66
J-332	68.0	281	121.0	75
J-333	72.9	151	121.0	68
J-334	79.7	492	121.0	59
J-335	77.1	369	121.0	62
J-336	68.6	315	121.0	74
J-337	65.3	325	121.0	79
J-338	60.0	124	106.5	66
J-339	74.9	84	121.0	66
J-342	68.0	92	121.0	75
J-343	55.7	0	106.5	72

APPENDIX D – FULL BUILDOUT RESULTS (MAXIMUM DAILY DEMAND + FIRE FLOW)

Fire Flow Results

Maximum Daily Demand Scenario

Full Build - Maximum Daily Demand + Fire Flow

Junction	Fire Flow (Needed) (L/min)	Fire Flow (Available) (L/min)	Pressure (Calculated Residual) (psi)	Junction w/ Minimum Pressure (Zone @ Total Flow Needed)	Pressure (Calculated Zone Lower Limit @ Total Flow Needed) (psi)	Velocity of Maximum Pipe (m/s)	Pipe w/ Maximum Velocity
J-106	3300	3300	75	J-257	27	1.07	P-344(2)
J-130	4542	4542	47	J-197	41	1.31	P-60(1)(1)
J-131	13620	13620	36	J-190	28	2.28	P-60(1)(1)
J-132	4542	4542	55	J-197	41	1.27	P-60(1)(1)
J-133	13620	13620	35	J-190	29	2.25	P-60(1)(1)
J-135	3300	3300	103	J-197	41	1.07	P-344(2)
J-136	3300	3300	88	J-197	41	1.79	P-210
J-137	13620	13620	78	J-190	35	1.90	P-2(2)
J-138	13620	13620	65	J-190	35	1.87	P-21
J-147	4542	4542	81	J-197	40	1.16	P-21
J-148	4542	4542	79	J-197	41	1.16	P-21
J-149	4542	4542	78	J-197	41	1.16	P-21
J-150	13620	13620	65	J-190	34	1.84	P-21
J-151	13620	13620	53	J-190	32	1.87	P-60(1)(1)
J-152	3300	3300	92	J-197	41	1.07	P-344(2)
J-153	13620	13620	60	J-190	33	1.78	P-60(1)(1)
J-154	13620	13620	46	J-190	31	1.99	P-60(1)(1)
J-155	13620	13620	41	J-190	30	2.08	P-60(1)(1)
J-156	13620	13620	41	J-190	30	2.16	P-60(1)(1)
J-161	3300	3300	90	J-197	41	1.39	P-235
J-162	3300	3300	90	J-197	41	1.07	P-344(2)
J-163	4542	4542	85	J-197	41	1.38	P-245
J-164	3300	3300	83	J-197	41	1.78	P-238
J-165	3300	3300	86	J-197	41	1.78	P-239
J-171	4542	4542	88	J-197	41	1.71	P-245
J-172	13620	13620	69	J-190	35	1.90	P-2(2)
J-173	13620	13620	68	J-190	35	1.90	P-2(2)
J-174	3300	3300	86	J-197	41	1.76	P-248
J-175	3300	3300	82	J-197	41	1.75	P-249
J-176	13620	13620	73	J-190	35	1.89	P-2(2)
J-177	13620	13620	69	J-190	35	2.07	P-252
J-180	3300	3300	92	J-197	41	1.07	P-344(2)
J-182	4542	4542	71	J-197	41	1.52	P-259
J-183	3300	3300	63	J-197	41	1.79	P-258
J-184	3300	3300	62	J-197	41	1.07	P-344(2)
J-185	3300	3300	65	J-197	41	1.08	P-262
J-186	3300	3300	63	J-197	41	1.07	P-344(2)
J-187	3300	3300	71	J-197	41	1.07	P-344(2)
J-188	3300	3300	73	J-197	41	1.77	P-35
J-189	4542	4542	76	J-197	41	1.30	P-257(1)
J-190	3300	3300	42	J-197	41	1.22	P-60(1)(1)
J-191	4542	4542	45	J-197	41	1.31	P-60(1)(1)
J-192	4542	4542	45	J-197	41	1.31	P-60(1)(1)
J-193	4542	4542	50	J-197	41	1.29	P-60(1)(1)
J-197	3300	3300	31	J-190	45	1.80	P-273
J-201	13620	13620	28	J-190	28	2.30	P-60(1)(1)

Fire Flow Results
Maximum Daily Demand Scenario

Full Build - Maximum Daily Demand + Fire Flow

Junction	Fire Flow (Needed) (L/min)	Fire Flow (Available) (L/min)	Pressure (Calculated Residual) (psi)	Junction w/ Minimum Pressure (Zone @ Total Flow Needed)	Pressure (Calculated Zone Lower Limit @ Total Flow Needed) (psi)	Velocity of Maximum Pipe (m/s)	Pipe w/ Maximum Velocity
J-203	4542	4542	44	J-197	41	1.27	P-60(1)(1)
J-204	3300	3300	56	J-197	41	1.31	P-282
J-205	3300	3300	50	J-197	41	1.77	P-283
J-206	4542	4542	52	J-197	41	1.34	P-282
J-207	4542	4542	54	J-197	41	1.25	P-282
J-208	3300	3300	59	J-197	41	1.07	P-344(2)
J-210	4542	4542	67	J-197	41	1.26	P-322
J-211	3300	3300	68	J-197	41	1.13	P-322
J-212	3300	3300	65	J-197	41	1.15	P-322
J-213	3300	3300	60	J-197	41	1.15	P-322
J-214	3300	3300	58	J-197	41	1.16	P-304
J-215	3300	3300	64	J-197	41	1.15	P-322
J-216	3300	3300	57	J-197	41	1.34	P-305
J-219	4542	4542	60	J-197	41	1.30	P-322
J-220	3300	3300	58	J-197	41	1.12	P-322
J-221	4542	4542	55	J-197	41	1.35	P-322
J-222	4542	4542	56	J-197	41	1.44	P-322
J-223	3300	3300	58	J-197	41	1.27	P-304
J-224	3300	3300	61	J-197	41	1.15	P-322
J-225	4542	4542	59	J-197	41	1.28	P-322
J-226	4542	4542	57	J-197	41	1.24	P-322
J-227	4542	4542	56	J-197	41	1.52	P-311
J-229	4542	4542	48	J-197	41	1.31	P-313
J-230	4542	4542	48	J-197	41	1.30	P-322
J-231	3300	3300	54	J-197	41	1.11	P-322
J-232	4542	4542	49	J-197	41	1.32	P-317
J-234	3300	3300	57	J-197	41	1.07	P-344(2)
J-235	3300	3300	56	J-197	41	1.07	P-344(2)
J-236	4542	4542	53	J-197	41	1.36	P-324
J-237	4542	4542	55	J-197	41	1.20	P-282
J-238	4542	4542	54	J-197	41	1.27	P-326
J-239	4542	4542	47	J-197	41	2.43	P-328
J-240	3300	3300	82	J-197	41	1.78	P-329
J-243	13620	13620	48	J-190	35	1.90	P-2(2)
J-244	3300	3300	91	J-197	41	1.07	P-344(2)
J-245	13620	13620	56	J-190	35	2.08	P-331
J-246	3300	3300	76	J-197	41	1.07	P-344(2)
J-247	3300	3300	73	J-197	41	1.07	P-344(2)
J-248	3300	3300	76	J-197	41	1.07	P-344(2)
J-249	3300	3300	84	J-197	41	1.77	P-338
J-256	4542	4542	55	J-197	41	1.30	P-347
J-311	13620	13620	33	J-203	28	2.20	P-60(1)(1)
J-312	3300	3300	82	J-197	41	1.07	P-344(2)
J-325	13620	13620	70	J-190	35	3.36	P-168
J-326	13620	13620	67	J-190	35	3.34	P-168
J-327	13620	13620	65	J-190	35	3.33	P-168

Fire Flow Results

Maximum Daily Demand Scenario

Full Build - Maximum Daily Demand + Fire Flow

Junction	Fire Flow (Needed) (L/min)	Fire Flow (Available) (L/min)	Pressure (Calculated Residual) (psi)	Junction w/ Minimum Pressure (Zone @ Total Flow Needed)	Pressure (Calculated Zone Lower Limit @ Total Flow Needed) (psi)	Velocity of Maximum Pipe (m/s)	Pipe w/ Maximum Velocity
J-328	13620	13620	58	J-190	35	3.28	P-168
J-329	13620	13620	63	J-190	35	3.34	P-168
J-330	13620	13620	61	J-190	35	3.34	P-168
J-331	13620	13620	65	J-190	35	3.38	P-168
J-332	13620	13620	60	J-190	35	3.38	P-168
J-333	13620	13620	56	J-190	35	3.38	P-168
J-334	13620	13620	48	J-190	35	3.38	P-168
J-335	13620	13620	56	J-190	35	3.38	P-168
J-336	13620	13620	71	J-190	35	3.38	P-168
J-337	13620	13620	76	J-190	35	3.38	P-168
J-338	13620	13620	65	J-190	35	3.38	P-168
J-339	13620	13620	53	J-190	35	3.38	P-168
J-342	13620	13620	60	J-190	35	3.38	P-168
J-343	3300	3300	71	J-197	41	1.07	P-344(2)

BURNSIDE HIGH PRESSURE ZONE
APPROX. HGL = 114 m (375 ft)

PROPOSED
BOOSTED
PRESSURE ZONE
HGL = 121 m (397 ft)

PROPOSED PRESSURE
REDUCING VALVE

PROPOSED
BOOSTER STATION
LOCATION

BURNSIDE HIGH PRESSURE ZONE
APPROX. HGL = 114 m (375 ft)

SPIDER LAKE ROAD
ANDREA LYNN AVENUE
MAJORIE ANN DRIVE
TO HIGHWAY 118
HIGHWAY 107
WAVERLEY ROAD
LAKE CHARLES DRIVE
LAKE CHARLES
LYNWOOD DRIVE
ROAD A
ROAD D
ROAD C
AVE DU PORTAGE
PARK B
EDSON DRIVE
BURNHOPE DRIVE
MONTAGUE ROAD
TO COLE HARBOUR
ROAD J
ROAD L
ROAD RESERVE
STILLWATER DRIVE
ROAD G
ROAD H
ROAD K
ROAD M
ROAD N
PARK F
PWGBC1
WHEBBY - RD 1
WHEBBY - RD 2
WHEBBY - RD 3
WHEBBY - RD 4

EXTENTS OF HYDRAULIC MODEL

1:15,000

TOPSAIL LAKE
LEMONT LAKE
MAIN STREET
HIGHWAY 107
EX. 900 mm TRANSMISSION MAIN
EX. 750 mm TRANSMISSION MAIN
EX. 1,050 mm TRANSMISSION MAIN
EX. MOUNT EDWARD RESERVOIR
SHELLING LANE
FADEN STREET
METRES

LEGEND

PROPOSED 200 mm PIPE	PW1 PW2 PW3 PW4 PW5
PROPOSED 250 mm PIPE	PW1 PW2 PW3 PW4 PW5
PROPOSED 300 mm PIPE	PW1 PW2 PW3 PW4 PW5
PROPOSED 400 mm PIPE	PW1 PW2 PW3 PW4 PW5
PROPOSED 600 mm PIPE	PW1 PW2 PW3 PW4 PW5
EXISTING 150 mm PIPE	WAT-E WAT-E WAT-E WAT-E
EXISTING 200 mm PIPE	WAT-E WAT-E WAT-E WAT-E
EXISTING 250 mm PIPE	WAT-E WAT-E WAT-E WAT-E
EXISTING 300 mm PIPE	WAT-E WAT-E WAT-E WAT-E
EXISTING 350 mm PIPE	WAT-E WAT-E WAT-E WAT-E
EXISTING 400 mm PIPE	WAT-E WAT-E WAT-E WAT-E
EXISTING 600 mm PIPE	WAT-E WAT-E WAT-E WAT-E

PHASING LEGEND

PHASE	COLOR CODE
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
INDUSTRIAL (BURNSIDE HIGH ZONE)	
INDUSTRIAL (BOOSTED ZONE)	

NOTES:

1. PROPOSED PIPE SIZES ARE PRELIMINARY AND SUBJECT TO DETAILED DESIGN.
2. CONTOUR DATA OBTAINED FROM HRM LIDAR. CONTOUR INTERVAL IS 5 m.

METRES
100 0 200 300
1:4000

ISSUE	DATE	DESCRIPTION
4	AUG. 22, 2023	ISSUED WITH REPORT
3	AUG. 9, 2023	ISSUED WITH DRAFT REPORT
2	MAY 3, 2023	REISSUED FOR REVIEW
1	FEB. 25, 2019	ISSUED FOR APPROVAL

CONSULTANT

DESIGNPOINT
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902.832.5597
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REGISTERED PROFESSIONAL ENGINEER
DATE AUG.22.2023
L. King
L. A. KING
20200507
PROVINCE OF NOVA SCOTIA

REGISTERED PROFESSIONAL SURVEYOR
DATE AUG.22.2023
G.S. WOODFORD
6078
PROVINCE OF NOVA SCOTIA

CLIENT

PORT WALLACE HOLDINGS LTD.

PROJECT DESCRIPTION

PORT WALLACE

DARTMOUTH, NOVA SCOTIA

SHEET DESCRIPTION

WATER MASTER PLAN

Drawn	Engineer	Project No.	Drawing No.
L. KING	L. KING	15-001	C-WA01
Scale	Filename		1 of 1
1:4000	22-106 Water Schematic HRS.dwg		

P:\2022\22-106 Port Wallace Holdings - Port Wallace\05 - Technical\Models\Water\22-106 Water Schematic HRS.dwg, Plot Date: 2023-Aug-22, Plot Size: ISO FULL BLEED A0 (841.00 X 1189.00 MM)

ATTACHMENT E

Port Wallace - Water Infrastructure Phase Costs

Original Item #	Year	Infrastructure	Unit	Quantity	Unit Rate	Subtotal Cost	10.00% Engineering	15.00% Contingency	4.286% Net HST	Total Costs	Escalation Factor	Escalated Costs	2.087% Con. Interest	Total CCC	29% Fire Protection	Net Escalated Costs	29.9% Benefit to Existing	Net Escalated Costs to CCC
1a	2025	Water Main Oversizing - 300mm to 400mm - Primary	m	373	$340.00	$126,820.00	$12,682.00	$19,023.00	$6,794.38	$165,319.38	1.0470	$173,089.39	$3,612.38	$176,701.77	$51,243.51	$125,458.26	$37,477.01	$87,981.24
1b	2025	Water Main Oversizing - 300mm to 400mm - Primary	m	283	$340.00	$96,220.00	$9,622.00	$14,433.00	$5,154.99	$125,429.99	1.0470	$131,325.20	$2,740.76	$134,065.95	$38,879.13	$95,186.83	$28,434.30	$66,752.52
	2025	**Subtotal**				**$223,040.00**	**$22,304.00**	**$33,456.00**	**$11,949.37**	**$290,749.37**		**$304,414.59**	**$6,353.13**	**$310,767.72**	**$90,122.64**	**$220,645.08**	**$65,911.32**	**$154,733.76**
C3R	2026	Water Main Oversizing - 300mm to 400mm - Conrads	m	306	$340.00	$104,040.00	$10,404.00	$15,606.00	$5,573.94	$135,623.94	1.0962	$148,670.97	$3,102.76	$151,773.73	$44,014.38	$107,759.35	$32,189.98	$75,569.37
	2026	**Subtotal**				**$104,040.00**	**$10,404.00**	**$15,606.00**	**$5,573.94**	**$135,623.94**		**$148,670.97**	**$3,102.76**	**$151,773.73**	**$44,014.38**	**$107,759.35**	**$32,189.98**	**$75,569.37**
2	2027	Water Main Oversizing - 300mm to 400mm - Primary	m	142	$340.00	$48,280.00	$4,828.00	$7,242.00	$2,586.60	$62,936.60	1.1477	$72,232.34	$1,507.49	$73,739.83	$21,384.55	$52,355.28	$15,639.62	$36,715.66
C2I	2027	Water Main Oversizing - 300mm to 400mm - Conrads	m	588	$340.00	$199,920.00	$19,992.00	$29,988.00	$10,710.71	$260,610.71	1.1477	$299,102.92	$6,242.28	$305,345.19	$88,550.11	$216,795.09	$64,761.24	$152,033.84
	2027	**Subtotal**				**$248,200.00**	**$24,820.00**	**$37,230.00**	**$13,297.32**	**$323,547.32**		**$371,335.25**	**$7,749.77**	**$379,085.02**	**$109,934.66**	**$269,150.36**	**$80,400.86**	**$188,749.50**
C3I	2028	Water Main Oversizing - 300mm to 400mm - Conrads	m	125	$340.00	$42,500.00	$4,250.00	$6,375.00	$2,276.94	$55,401.94	1.2016	$66,570.97	$1,389.34	$67,960.30	$19,708.49	$48,251.82	$14,413.83	$33,837.99
	2028	**Subtotal**				**$42,500.00**	**$4,250.00**	**$6,375.00**	**$2,276.94**	**$55,401.94**		**$66,570.97**	**$1,389.34**	**$67,960.30**	**$19,708.49**	**$48,251.82**	**$14,413.83**	**$33,837.99**
4	2029	Water Main Oversizing - 300mm to 400mm - Primary	m	1,097	$340.00	$372,980.00	$37,298.00	$55,947.00	$19,982.40	$486,207.40	1.2581	$611,697.53	$12,766.13	$624,463.66	$181,094.46	$443,369.20	$132,443.69	$310,925.51
4	2029	Water Main Oversizing - 300mm to 500mm - Primary	m	316	$810.00	$255,960.00	$25,596.00	$38,394.00	$13,713.06	$333,663.06	1.2581	$419,781.49	$8,760.84	$428,542.33	$124,277.28	$304,265.06	$90,890.36	$213,374.70
C4I	2029	Water Main Oversizing - 300mm to 400mm - Conrads	m	292	$340.00	$99,280.00	$9,928.00	$14,892.00	$5,318.93	$129,418.93	1.2581	$162,821.95	$3,398.09	$166,220.04	$48,203.81	$118,016.23	$35,253.93	$82,762.31
C4I	2029	Water Main Oversizing - 300mm to 500mm - Conrads	m	270	$810.00	$218,700.00	$21,870.00	$32,805.00	$11,716.85	$285,091.85	1.2581	$358,674.06	$7,485.53	$366,159.59	$106,186.28	$259,973.31	$77,659.48	$182,313.82
	2029	**Subtotal**				**$946,920.00**	**$94,692.00**	**$142,038.00**	**$50,731.24**	**$1,234,381.24**		**$1,552,975.04**	**$32,410.59**	**$1,585,385.63**	**$459,761.83**	**$1,125,623.79**	**$336,247.46**	**$789,376.34**
C6I	2031	Water Main Oversizing - 300mm to 500mm - Conrads	m	97	$810.00	$78,570.00	$7,857.00	$11,785.50	$4,209.39	$102,421.89	1.3791	$141,250.03	$2,947.89	$144,197.91	$41,817.39	$102,380.52	$30,583.21	$71,797.31
	2031	**Subtotal**				**$78,570.00**	**$7,857.00**	**$11,785.50**	**$4,209.39**	**$102,421.89**		**$141,250.03**	**$2,947.89**	**$144,197.91**	**$41,817.39**	**$102,380.52**	**$30,583.21**	**$71,797.31**
C7I	2032	Water Main Oversizing - 300mm to 400mm - Conrads	m	234	$340.00	$79,560.00	$7,956.00	$11,934.00	$4,262.43	$103,712.43	1.4439	$149,750.37	$3,125.29	$152,875.66	$44,333.94	$108,541.72	$32,423.69	$76,118.03
C7I	2032	Water Main Oversizing - 300mm to 500mm - Conrads	m	314	$810.00	$254,340.00	$25,434.00	$38,151.00	$13,626.27	$331,551.27	1.4439	$478,726.87	$9,991.03	$488,717.90	$141,728.19	$346,989.71	$103,653.11	$243,336.60
	2032	**Subtotal**				**$333,900.00**	**$33,390.00**	**$50,085.00**	**$17,888.69**	**$435,263.69**		**$628,477.25**	**$13,116.32**	**$641,593.57**	**$186,062.13**	**$455,531.43**	**$136,076.80**	**$319,454.63**
C8I	2033	Water Main Oversizing - 300mm to 500mm - Conrads	m	150	$810.00	$121,500.00	$12,150.00	$18,225.00	$6,509.36	$158,384.36	1.5118	$239,445.48	$4,997.23	$244,442.71	$70,888.38	$173,554.32	$51,844.32	$121,710.00
	2033	**Subtotal**				**$121,500.00**	**$12,150.00**	**$18,225.00**	**$6,509.36**	**$158,384.36**		**$239,445.48**	**$4,997.23**	**$244,442.71**	**$70,888.38**	**$173,554.32**	**$51,844.32**	**$121,710.00**
C9I	2034	Water Main Oversizing - 300mm to 500mm - Conrads	m	1,336	$810.00	$1,082,160.00	$108,216.00	$162,324.00	$57,976.72	$1,410,676.72	1.5828	$2,232,819.12	$46,598.93	$2,279,418.05	$661,031.23	$1,618,386.82	$483,446.11	$1,134,940.70
	2034	**Subtotal**				**$1,082,160.00**	**$108,216.00**	**$162,324.00**	**$57,976.72**	**$1,410,676.72**		**$2,232,819.12**	**$46,598.93**	**$2,279,418.05**	**$661,031.23**	**$1,618,386.82**	**$483,446.11**	**$1,134,940.70**
C10I	2035	Water Main Oversizing - 300mm to 500mm - Conrads	m	278	$810.00	$225,180.00	$22,518.00	$33,777.00	$12,064.02	$293,539.02	1.6572	$486,452.86	$10,152.27	$496,605.13	$144,015.49	$352,589.64	$105,325.93	$247,263.72
	2035	**Subtotal**				**$225,180.00**	**$22,518.00**	**$33,777.00**	**$12,064.02**	**$293,539.02**		**$486,452.86**	**$10,152.27**	**$496,605.13**	**$144,015.49**	**$352,589.64**	**$105,325.93**	**$247,263.72**
Grand Total						**$3,406,010.00**	**$340,601.00**	**$510,901.50**	**$182,476.99**	**$4,439,989.49**		**$6,172,411.54**	**$128,818.23**	**$6,301,229.77**	**$1,827,356.63**	**$4,473,873.14**	**$1,336,439.82**	**$3,137,433.32**

ATTACHMENT F

Port Wallace - Utility Corridor Phase Costs

Original Item #	Year	Phase	Infrastructure	Unit	Quantity	Unit Rate	Subtotal Cost	0.00% Engineering	0.00% Contingency	4.286% Net HST	Total Costs	Escalation Factor	Escalated Costs	0.000% Con. Interest	Net Escalated Costs	Capital Project Benefit to Water Transmission %	Capital Project Benefit to Water Transmission $	Benefit to Exsiting Halifax Water Customer %	Benefit to Exsiting Halifax Water Customer $	Benefit to HRM %	Benefit to HRM $	Benefit to Eastward Energy %	Benefit to Eastward Energy $	Total CCC
1.01	2024	**Wright Avenue**	600mm Wright Waterline Connection and Reinstatement (Sta 0+00 to 0+20)	M	20	$5,710.00	$114,200.00	$0.00	$0.00	$4,894.61	$119,094.61	1.0000	$119,094.61	$0.00	$119,094.61	100.0%	$119,094.61	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	$0.00
1.02	2024	**Wright Avenue**	600mm Wright Waterline Extension (Sta 0+20 to 0+190)	M	170	$2,600.00	$442,000.00	$0.00	$0.00	$18,944.12	$460,944.12	1.0000	$460,944.12	$0.00	$460,944.12	100.0%	$460,944.12	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	$0.00
1.03	2024	**Wright Avenue**	600mm Wright Waterline Extension with Re-grading over twin 600mm Storm (Sta 0+190 to 0+205)	M	15	$5,650.00	$84,750.00	$0.00	$0.00	$3,632.39	$88,382.39	1.0000	$88,382.39	$0.00	$88,382.39	100.0%	$88,382.39	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	$0.00
1.04	2024	**Wright Avenue**	600mm Wright Waterline Extension with (Sta 0+205 to 0+578)	M	373	$2,525.00	$941,825.00	$0.00	$0.00	$40,366.62	$982,191.62	1.0000	$982,191.62	$0.00	$982,191.62	100.0%	$982,191.62	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	$0.00
1.05	2024	**Wright Avenue**	Existing Wright Avenue 300mm waterline removal and connection to new 600mm (Sta 0+244)	LS	1	$45,000.00	$45,000.00	$0.00	$0.00	$1,928.70	$46,928.70	1.0000	$46,928.70	$0.00	$46,928.70	100.0%	$46,928.70	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	$0.00
1.06	2024	**Wright Avenue**	Replacing twin 300mm Storm (Sta 0+337) - Water and Gas	M	16	$1,200.00	$19,200.00	$0.00	$0.00	$822.91	$20,022.91	1.0000	$20,022.91	$0.00	$20,022.91	100.0%	$20,022.91	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	$0.00
1.10	2024	**Wright Avenue**	150mm Wright Gasline Connection and Reinstatement (Sta 0+00 to 0+05)	M	5	$1,160.00	$5,800.00	$0.00	$0.00	$248.59	$6,048.59	1.0000	$6,048.59	$0.00	$6,048.59	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	100.0%	$6,048.59	$0.00
1.11	2024	**Wright Avenue**	150mm Wright Gasline Extension (Sta 0+05 to 0+240)	M	235	$375.00	$88,125.00	$0.00	$0.00	$3,777.04	$91,902.04	1.0000	$91,902.04	$0.00	$91,902.04	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	100.0%	$91,902.04	$0.00
1.12	2024	**Wright Avenue**	150mm Wright Gasline Extension (Sta 0+240 to 0+560)	M	320	$375.00	$120,000.00	$0.00	$0.00	$5,143.20	$125,143.20	1.0000	$125,143.20	$0.00	$125,143.20	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	100.0%	$125,143.20	$0.00
1.20	2024	**Wright Avenue**	Gravel Rd Reinstatement (Sta 0+250 to 0+578) 4.8m wide - Fine Grading	Sq.M	1,574	$8.00	$12,595.20	$0.00	$0.00	$539.83	$13,135.03	1.0000	$13,135.03	$0.00	$13,135.03	84.3%	$11,072.83	0.0%	$0.00	0.0%	$0.00	15.7%	$2,062.20	$0.00
1.21	2024	**Wright Avenue**	Swale Grading STA 0+560 to 0+578 & along Highway 118	Sq.M	50	$287.00	$14,350.00	$0.00	$0.00	$615.04	$14,965.04	1.0000	$14,965.04	$0.00	$14,965.04	84.3%	$12,615.53	0.0%	$0.00	0.0%	$0.00	15.7%	$2,349.51	$0.00
1.22	2024	**Wright Avenue**	Trench Rock	Sq.M	593	$150.00	$88,950.00	$0.00	$0.00	$3,812.40	$92,762.40	1.0000	$92,762.40	$0.00	$92,762.40	84.3%	$78,198.70	0.0%	$0.00	0.0%	$0.00	15.7%	$14,563.70	$0.00
1.23	2024	**Wright Avenue**	Playdium Power Feed to Transformer	LS	1	$15,000.00	$15,000.00	$0.00	$0.00	$642.90	$15,642.90	1.0000	$15,642.90	$0.00	$15,642.90	50.0%	$7,821.45	0.0%	$0.00	0.0%	$0.00	50.0%	$7,821.45	$0.00
1.24	2024	**Wright Avenue**	Erosion & Sediment Controls including slope stabilization	LS	1	$30,000.00	$30,000.00	$0.00	$0.00	$1,285.80	$31,285.80	1.0000	$31,285.80	$0.00	$31,285.80	50.0%	$15,642.90	0.0%	$0.00	0.0%	$0.00	50.0%	$15,642.90	$0.00
1.25	2024	**Wright Avenue**	Repair of concrete flume (Sta 0+540)	LS	1	$15,000.00	$15,000.00	$0.00	$0.00	$642.90	$15,642.90	1.0000	$15,642.90	$0.00	$15,642.90	84.3%	$13,186.96	0.0%	$0.00	0.0%	$0.00	15.7%	$2,455.94	$0.00
2.01	2024	**Hwy 118 to John B**	600mm Wright Waterline Extension from NDTS to HWY 118 Sleve (Sta 0+578 to 0+608)	M	30	$2,820.00	$84,600.00	$0.00	$0.00	$3,625.96	$88,225.96	1.0000	$88,225.96	$0.00	$88,225.96	100.0%	$88,225.96	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	$0.00
2.02	2024	**Hwy 118 to John B**	600mm Waterline with 750mm Steel Sleeve installed with phased / open trench (Sta. 0+608 to 0+668)	M	60	$7,125.00	$427,500.00	$0.00	$0.00	$18,322.65	$445,822.65	1.0000	$445,822.65	$0.00	$445,822.65	100.0%	$445,822.65	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	$0.00
2.03	2024	**Hwy 118 to John B**	600mm Wright Waterline Extension from HWY 118 Sleeve to DNR Lands (Sta 0+668 to 0+830)	M	162	$2,595.00	$420,390.00	$0.00	$0.00	$18,017.92	$438,407.92	1.0000	$438,407.92	$0.00	$438,407.92	100.0%	$438,407.92	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	$0.00
2.04	2024	**Hwy 118 to John B**	600mm Wright Waterline Extension from DNR Lands to Urecon insulated pipe (Sta 0+830 to 0+863)	M	33	$3,015.00	$99,495.00	$0.00	$0.00	$4,264.36	$103,759.36	1.0000	$103,759.36	$0.00	$103,759.36	100.0%	$103,759.36	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	$0.00
2.05	2024	**Hwy 118 to John B**	600mm Wright Waterline Extension through Bridge (Sta 0+863 to 0+890)	M	27	$7,650.00	$206,550.00	$0.00	$0.00	$8,852.73	$215,402.73	1.0000	$215,402.73	$0.00	$215,402.73	100.0%	$215,402.73	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	$0.00
2.08	2024	**Hwy 118 to John B**	600mm Wright Waterline Extension from bridge to campground parking (Sta 0+890 to 1+000)	M	110	$2,665.00	$293,150.00	$0.00	$0.00	$12,564.41	$305,714.41	1.0000	$305,714.41	$0.00	$305,714.41	100.0%	$305,714.41	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	$0.00
2.09	2024	**Hwy 118 to John B**	600mm Wright Waterline Extension from campground parking to Camp Driveway (Sta 1+000 to1+150)	M	150	$2,920.00	$438,000.00	$0.00	$0.00	$18,772.68	$456,772.68	1.0000	$456,772.68	$0.00	$456,772.68	100.0%	$456,772.68	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	$0.00
2.10	2024	**Hwy 118 to John B**	Twin 600mm Wright Waterline Ext. from Camp Driveway To John Brenton ROW (Sta 1+150 to 1+244)	M	94	$6,700.00	$629,800.00	$0.00	$0.00	$26,993.23	$656,793.23	1.0000	$656,793.23	$0.00	$656,793.23	100.0%	$656,793.23	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	$0.00
2.30	2024	**Hwy 118 to John B**	Twin 300mm PVC FM DR25 (Sta 0+585 to 0+605)	M	20	$4,500.00	$90,000.00	$0.00	$0.00	$3,857.40	$93,857.40	1.0000	$93,857.40	$0.00	$93,857.40	0.0%	$0.00	29.3%	$27,500.22	0.0%	$0.00	0.0%	$0.00	$66,357.18
2.31	2024	**Hwy 118 to John B**	Twin 300mm PVC FM DR25 with 450mm Steel Sleves and spacers (Sta 0+605 to 0+672)	M	67	$8,100.00	$542,700.00	$0.00	$0.00	$23,260.12	$565,960.12	1.0000	$565,960.12	$0.00	$565,960.12	0.0%	$0.00	29.3%	$165,826.32	0.0%	$0.00	0.0%	$0.00	$400,133.81
2.32	2024	**Hwy 118 to John B**	Twin 300mm PVC FM DR25 through Park to DNR Lands(Sta 0+672 to 0+830)	M	158	$2,665.00	$421,070.00	$0.00	$0.00	$18,047.06	$439,117.06	1.0000	$439,117.06	$0.00	$439,117.06	0.0%	$0.00	29.3%	$128,661.30	0.0%	$0.00	0.0%	$0.00	$310,455.76
2.33a	2024	**Hwy 118 to John B**	Twin 300mm PVC FM DR25 DNR Lands to Bebo Arch (Sta 0+830 to 0+863)	M	33	$2,625.00	$86,625.00	$0.00	$0.00	$3,712.75	$90,337.75	1.0000	$90,337.75	$0.00	$90,337.75	0.0%	$0.00	29.3%	$26,468.96	0.0%	$0.00	0.0%	$0.00	$63,868.79
2.33b	2024	**Hwy 118 to John B**	Twin 300mm PVC FM DR25 with DR18 Sleeve through Bebo Arch (Sta 0+863 to 0+890)	M	27	$4,450.00	$120,150.00	$0.00	$0.00	$5,149.63	$125,299.63	1.0000	$125,299.63	$0.00	$125,299.63	0.0%	$0.00	29.3%	$36,712.79	0.0%	$0.00	0.0%	$0.00	$88,586.84
2.34	2024	**Hwy 118 to John B**	Twin 300mm PVC FM DR25 Bebo Arch to Campground (Sta 0+890 to 1+000)	M	110	$3,100.00	$341,000.00	$0.00	$0.00	$14,615.26	$355,615.26	1.0000	$355,615.26	$0.00	$355,615.26	0.0%	$0.00	29.3%	$104,195.27	0.0%	$0.00	0.0%	$0.00	$251,419.99
2.35	2024	**Hwy 118 to John B**	Twin 300mm PVC FM DR25 Campground to John Brenton (Sta 1+000 to 1+244)	M	244	$1,925.00	$469,700.00	$0.00	$0.00	$20,131.34	$489,831.34	1.0000	$489,831.34	$0.00	$489,831.34	0.0%	$0.00	29.3%	$143,520.58	0.0%	$0.00	0.0%	$0.00	$346,310.76
2.50	2024	**Hwy 118 to John B**	150mm Gasline Extension Highway 118 (Sta 0+560 to 0+610)	M	50	$375.00	$18,750.00	$0.00	$0.00	$803.63	$19,553.63	1.0000	$19,553.63	$0.00	$19,553.63	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	100.0%	$19,553.63	$0.00
2.51	2024	**Hwy 118 to John B**	150mm Gasline Extension Highway 118 crossing including 250mm Steel Sleeve (Sta 0+610 to 0+666)	M	56	$1,910.00	$106,960.00	$0.00	$0.00	$4,584.31	$111,544.31	1.0000	$111,544.31	$0.00	$111,544.31	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	100.0%	$111,544.31	$0.00
2.52	2024	**Hwy 118 to John B**	150mm Gasline Extension Highway 118 to DNR Lands (Sta 0+666 to 0+830)	M	164	$375.00	$61,500.00	$0.00	$0.00	$2,635.89	$64,135.89	1.0000	$64,135.89	$0.00	$64,135.89	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	100.0%	$64,135.89	$0.00
2.53	2024	**Hwy 118 to John B**	150mm Gasline Extension DNR Lands to Bebo Arch (Sta 0+830 to 0+863)	M	33	$375.00	$12,375.00	$0.00	$0.00	$530.39	$12,905.39	1.0000	$12,905.39	$0.00	$12,905.39	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	100.0%	$12,905.39	$0.00
2.54	2024	**Hwy 118 to John B**	150mm Gasline Extension Bebo Arch c/w 250mm DR 18 (Sta 0+789 to 0+810)	M	33	$875.00	$28,875.00	$0.00	$0.00	$1,237.58	$30,112.58	1.0000	$30,112.58	$0.00	$30,112.58	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	100.0%	$30,112.58	$0.00
2.55	2024	**Hwy 118 to John B**	150mm Gasline Extension Bebo Arch to JB ROW (Sta 0+810 to 1+224)	M	414	$375.00	$155,250.00	$0.00	$0.00	$6,654.02	$161,904.02	1.0000	$161,904.02	$0.00	$161,904.02	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	100.0%	$161,904.02	$0.00
2.60a	2024	**Hwy 118 to John B**	3.5M Asphalt Trail (Existing HRM Switch-back to proposed Utility Corridor Trail	M	145	$550.00	$79,750.00	$0.00	$0.00	$3,418.09	$83,168.09	1.0000	$83,168.09	$0.00	$83,168.09	0.0%	$0.00	0.0%	$0.00	100.0%	$83,168.09	0.0%	$0.00	$0.00
2.60b	2024	**Hwy 118 to John B**	3.5M Asphalt Trail Flanks Reinstated with 3:1 slopes & mulch (Wye in Utility Corridor Trail to JB ROW)	M	158	$2,110.00	$333,380.00	$0.00	$0.00	$14,288.67	$347,668.67	1.0000	$347,668.67	$0.00	$347,668.67	0.0%	$0.00	0.0%	$0.00	100.0%	$347,668.67	0.0%	$0.00	$0.00
2.70	2024	**Hwy 118 to John B**	900mm Storm Culvert & Fill within Highway 118 ROW for corridor	M	20	$3,675.00	$73,500.00	$0.00	$0.00	$3,150.21	$76,650.21	1.0000	$76,650.21	$0.00	$76,650.21	41.7%	$31,963.14	12.2%	$9,351.33	0.0%	$0.00	16.6%	$12,723.93	$22,611.81
2.71	2024	**Hwy 118 to John B**	Bebo Arch C/W pre-cast footings, custom curb/handrail, benches, pavers, MSE Walls, Armour & backfill)	LS	1	$2,000,000.00	$2,000,000.00	$0.00	$0.00	$85,720.00	$2,085,720.00	1.0000	$2,085,720.00	$0.00	$2,085,720.00	24.5%	$511,001.40	7.2%	$150,171.84	40.0%	$834,288.00	11.0%	$229,429.20	$360,829.56
2.72	2024	**Hwy 118 to John B**	Demo of existing HRM Bridge and reinstatement (removal of Steel Bridge and removal of CIP Footings	LS	1	$65,000.00	$65,000.00	$0.00	$0.00	$2,785.90	$67,785.90	1.0000	$67,785.90	$0.00	$67,785.90	0.0%	$0.00	0.0%	$0.00	100.0%	$67,785.90	0.0%	$0.00	$0.00
2.73	2024	**Hwy 118 to John B**	HRM Park reinstatement (Grading, retaining walls, Plantings & Trail connections)	LS	1	$550,000.00	$550,000.00	$0.00	$0.00	$23,573.00	$573,573.00	1.0000	$573,573.00	$0.00	$573,573.00	27.9%	$160,026.87	8.1%	$46,719.82	33.2%	$190,426.24	11.1%	$63,666.60	$112,733.48
2.74	2024	**Hwy 118 to John B**	Guardrail along Highway 118	M	35	$300.00	$10,500.00	$0.00	$0.00	$450.03	$10,950.03	1.0000	$10,950.03	$0.00	$10,950.03	41.7%	$4,566.16	12.2%	$1,335.90	0.0%	$0.00	16.6%	$1,817.70	$3,230.26
2.75	2024	**Hwy 118 to John B**	Shubie Park Campground Gravel, removable bollard and chain link fence removal	LS	1	$150,000.00	$150,000.00	$0.00	$0.00	$6,429.00	$156,429.00	1.0000	$156,429.00	$0.00	$156,429.00	0.0%	$0.00	0.0%	$0.00	100.0%	$156,429.00	0.0%	$0.00	$0.00
2.76	2024	**Hwy 118 to John B**	Highway 118 Asphalt Removal & Reinstatement, Traffic Controls	LS	1	$300,000.00	$300,000.00	$0.00	$0.00	$12,858.00	$312,858.00	1.0000	$312,858.00	$0.00	$312,858.00	41.7%	$130,461.79	12.2%	$38,168.68	0.0%	$0.00	16.6%	$51,934.43	$92,293.11
2.77	2024	**Hwy 118 to John B**	HRWC Paved Access Road within HRM Park C/W Fill & Swing gate to Highway 118 (4.0M Wide asphalt)	M	117	$780.00	$91,260.00	$0.00	$0.00	$3,911.40	$95,171.40	1.0000	$95,171.40	$0.00	$95,171.40	41.7%	$39,686.48	12.2%	$11,610.91	0.0%	$0.00	16.6%	$15,798.45	$28,075.56
2.78	2024	**Hwy 118 to John B**	Erosion & Sediment Controls	LS	1	$80,000.00	$80,000.00	$0.00	$0.00	$3,428.80	$83,428.80	1.0000	$83,428.80	$0.00	$83,428.80	27.9%	$23,276.64	8.1%	$6,795.61	33.2%	$27,698.36	11.1%	$9,260.60	$16,397.60
2.79	2024	**Hwy 118 to John B**	Tree removal through Shubie Park & John Brenton	LS	1	$20,000.00	$20,000.00	$0.00	$0.00	$857.20	$20,857.20	1.0000	$20,857.20	$0.00	$20,857.20	27.9%	$5,819.16	8.1%	$1,698.90	33.2%	$6,924.59	11.1%	$2,315.15	$4,099.40
2.80	2024	**Hwy 118 to John B**	Relocation of Power Poles in Campground Parking Lot	LS	1	$75,000.00	$75,000.00	$0.00	$0.00	$3,214.50	$78,214.50	1.0000	$78,214.50	$0.00	$78,214.50	27.9%	$21,821.85	8.1%	$6,370.88	33.2%	$25,967.21	11.1%	$8,681.81	$15,372.75
2.81	2024	**Hwy 118 to John B**	Tree Reinstatement through Park	M	207	$950.00	$196,650.00	$0.00	$0.00	$8,428.42	$205,078.42	1.0000	$205,078.42	$0.00	$205,078.42	27.9%	$57,216.88	8.1%	$16,704.46	33.2%	$68,086.04	11.1%	$22,763.70	$40,307.34
2.82	2024	**Hwy 118 to John B**	Drainage Elements - Swale Grading and Drains	LS	1	$10,000.00	$10,000.00	$0.00	$0.00	$428.60	$10,428.60	1.0000	$10,428.60	$0.00	$10,428.60	27.9%	$2,909.58	8.1%	$849.45	33.2%	$3,462.30	11.1%	$1,157.57	$2,049.70
2.83	2024	**Hwy 118 to John B**	Wooden Post and Rail Fencing	M	320	$300.00	$96,000.00	$0.00	$0.00	$4,114.56	$100,114.56	1.0000	$100,114.56	$0.00	$100,114.56	27.9%	$27,931.96	8.1%	$8,154.73	33.2%	$33,238.03	11.1%	$11,112.72	$19,677.12
2.84	2024	**Hwy 118 to John B**	Boulder Walls	Sq.M	197	$350.00	$68,950.00	$0.00	$0.00	$2,955.20	$71,905.20	1.0000	$71,905.20	$0.00	$71,905.20	27.9%	$20,061.55	8.1%	$5,856.97	33.2%	$23,872.53	11.1%	$7,981.48	$14,132.68
2.85	2024	**Hwy 118 to John B**	New curb along campground parking lot	M	160	$150.00	$24,000.00	$0.00	$0.00	$1,028.64	$25,028.64	1.0000	$25,028.64	$0.00	$25,028.64	0.0%	$0.00	0.0%	$0.00	100.0%	$25,028.64	0.0%	$0.00	$0.00
2.86	2024	**Hwy 118 to John B**	Topsoil and Sod along MUP in parking lot	Sq.M	290	$20.00	$5,800.00	$0.00	$0.00	$248.59	$6,048.59	1.0000	$6,048.59	$0.00	$6,048.59	0.0%	$0.00	0.0%	$0.00	100.0%	$6,048.59	0.0%	$0.00	$0.00
2.87	2024	**Hwy 118 to John B**	Asphalt Removal and Reinstatement on John Brenton (Patch)	Sq.M	464	$34.00	$15,776.00	$0.00	$0.00	$676.16	$16,452.16	1.0000	$16,452.16	$0.00	$16,452.16	27.9%	$4,590.15	8.1%	$1,340.09	33.2%	$5,462.12	11.1%	$1,826.19	$3,233.61
2.88	2024	**Hwy 118 to John B**	Temporary Trail Access Allowance	LS	1	$30,000.00	$30,000.00	$0.00	$0.00	$1,285.80	$31,285.80	1.0000	$31,285.80	$0.00	$31,285.80	0.0%	$0.00	0.0%	$0.00	100.0%	$31,285.80	0.0%	$0.00	$0.00
2.89	2024	**Hwy 118 to John B**	Trench Rock	C.M	500	$150.00	$75,000.00	$0.00	$0.00	$3,214.50	$78,214.50	1.0000	$78,214.50	$0.00	$78,214.50	24.5%	$19,162.55	7.2%	$5,631.44	40.0%	$31,285.80	11.0%	$8,603.60	$13,531.11
2.90	2024	**Hwy 118 to John B**	Grubbing and Fill Material at Bebo Arch Bridge	CM.M	30	$580.00	$17,400.00	$0.00	$0.00	$745.76	$18,145.76	1.0000	$18,145.76	$0.00	$18,145.76	27.9%	$5,062.67	8.1%	$1,478.05	33.2%	$6,024.39	11.1%	$2,014.18	$3,566.48
2.91	2024	**Hwy 118 to John B**	Traffic Control and Pedestrian Management through Park	LS	1	$75,000.00	$75,000.00	$0.00	$0.00	$3,214.50	$78,214.50	1.0000	$78,214.50	$0.00	$78,214.50	27.9%	$21,821.85	8.1%	$6,370.88	33.2%	$25,967.21	11.1%	$8,681.81	$15,372.75
3.01	2024	**John B to Waverley Int.**	Twin 600mm Wright Waterline Extension from John B to Jaybe/Waverley Int. (Sta 1+245 to 1+530)	M	285	$5,200.00	$1,482,000.00	$0.00	$0.00	$63,518.52	$1,545,518.52	1.0000	$1,545,518.52	$0.00	$1,545,518.52	100.0%	$1,545,518.52	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	$0.00
3.07	2024	**John B to Waverley Int.**	Water Service Lateral Amendments and Connections	EACH	17	$5,000.00	$85,000.00	$0.00	$0.00	$3,643.10	$88,643.10	1.0000	$88,643.10	$0.00	$88,643.10	100.0%	$88,643.10	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	$0.00
3.08	2024	**John B to Waverley Int.**	Waterline decommision - 4" Jaybe Water	LS	1	$35,000.00	$35,000.00	$0.00	$0.00	$1,500.10	$36,500.10	1.0000	$36,500.10	$0.00	$36,500.10	100.0%	$36,500.10	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	$0.00
3.09	2024	**John B to Waverley Int.**	Existing 600mm Waterline decommision & Section Removals for new infrastructure (Jaybe & JB)	LS	1	$100,000.00	$100,000.00	$0.00	$0.00	$4,286.00	$104,286.00	1.0000	$104,286.00	$0.00	$104,286.00	100.0%	$104,286.00	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	$0.00
3.11	2024	**John B to Waverley Int.**	500mm TR Flex Transmission Main Temporary Water	M	220	$2,000.00	$440,000.00	$0.00	$0.00	$18,858.40	$458,858.40	1.0000	$458,858.40	$0.00	$458,858.40	100.0%	$458,858.40	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	$0.00
3.12	2024	**John B to Waverley Int.**	Temporary Water Connections to Existing	EACH	6	$10,000.00	$60,000.00	$0.00	$0.00	$2,571.60	$62,571.60	1.0000	$62,571.60	$0.00	$62,571.60	100.0%	$62,571.60	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	$0.00
3.13	2024	**John B to Waverley Int.**	Residential Temporary Water	LS	1	$75,000.00	$75,000.00	$0.00	$0.00	$3,214.50	$78,214.50	1.0000	$78,214.50	$0.00	$78,214.50	100.0%	$78,214.50	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	$0.00
3.20	2024	**John B to Waverley Int.**	Twin 300mm PVC FM John Brenton ROW to Waverley Int. (Sta 1+244 to 1+520)	M	276	$2,800.00	$772,800.00	$0.00	$0.00	$33,122.21	$805,922.21	1.0000	$805,922.21	$0.00	$805,922.21	0.0%	$0.00	29.3%	$236,135.21	0.0%	$0.00	0.0%	$0.00	$569,787.00
3.40	2024	**John B to Waverley Int.**	150mm Gasline Extension JB ROW to Jaybe/Waverley Int. (Sta 1+244 to 1+520)	M	276	$375.00	$103,500.00	$0.00	$0.00	$4,436.01	$107,936.01	1.0000	$107,936.01	$0.00	$107,936.01	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	100.0%	$107,936.01	$0.00
3.50	2024	**John B to Waverley Int.**	3.5M Asphalt Trail JB ROW to Jaybe/Waverley Intersection (Sta 1+244 to 1+520)	M	276	$550.00	$151,800.00	$0.00	$0.00	$6,506.15	$158,306.15	1.0000	$158,306.15	$0.00	$158,306.15	0.0%	$0.00	0.0%	$0.00	100.0%	$158,306.15	0.0%	$0.00	$0.00
3.60	2024	**John B to Waverley Int.**	Demolition & Removal of Existing Curb	M	574	$75.00	$43,050.00	$0.00	$0.00	$1,845.12	$44,895.12	1.0000	$44,895.12	$0.00	$44,895.12	37.9%	$17,015.25	9.1%	$4,077.82	25.3%	$11,358.47	5.8%	$2,603.92	$9,839.66
3.61a	2024	**John B to Waverley Int.**	Asphalt Removal and Disposal (John Brenton/Jaybe) - Milling	Sq.M	3,206	$20.00	$64,120.00	$0.00	$0.00	$2,748.18	$66,868.18	1.0000	$66,868.18	$0.00	$66,868.18	37.9%	$25,343.04	9.1%	$6,073.64	25.3%	$16,917.65	5.8%	$3,878.35	$14,655.50
3.61b	2024	**John B to Waverley Int.**	Asphalt Paving Base & Top (John Brenton/Jaybe)	Sq.M	2,320	$65.00	$150,800.00	$0.00	$0.00	$6,463.29	$157,263.29	1.0000	$157,263.29	$0.00	$157,263.29	37.9%	$59,602.79	9.1%	$14,284.22	25.3%	$39,787.61	5.8%	$9,121.27	$34,467.39
3.62	2024	**John B to Waverley Int.**	Residential Driveway Repairs	Each	17	$10,000.00	$170,000.00	$0.00	$0.00	$7,286.20	$177,286.20	1.0000	$177,286.20	$0.00	$177,286.20	37.9%	$67,191.47	9.1%	$16,102.91	25.3%	$44,853.41	5.8%	$10,282.60	$38,855.82
3.63	2024	**John B to Waverley Int.**	Street Tree & Landscaping replacements	Each	28	$900.00	$25,200.00	$0.00	$0.00	$1,080.07	$26,280.07	1.0000	$26,280.07	$0.00	$26,280.07	37.9%	$9,960.15	9.1%	$2,387.02	25.3%	$6,648.86	5.8%	$1,524.24	$5,759.80
3.64	2024	**John B to Waverley Int.**	Sidewalk Removals - Waverley Road	Sq.M	170	$13.00	$2,210.00	$0.00	$0.00	$94.72	$2,304.72	1.0000	$2,304.72	$0.00	$2,304.72	37.9%	$873.49	9.1%	$209.34	25.3%	$583.09	5.8%	$133.67	$505.13
3.65	2024	**John B to Waverley Int.**	Concrete Curb & Gutter incl Gravels (John Brenton, Jaybe to Waverley Intersection)	M	395	$150.00	$59,250.00	$0.00	$0.00	$2,539.46	$61,789.46	1.0000	$61,789.46	$0.00	$61,789.46	37.9%	$23,418.20	9.1%	$5,612.34	25.3%	$15,632.73	5.8%	$3,583.79	$13,542.39
3.66	2024	**John B to Waverley Int.**	Asphalt Curb incl Gravels (NW side of John Brenton Drive)	M	179	$100.00	$17,900.00	$0.00	$0.00	$767.19	$18,667.19	1.0000	$18,667.19	$0.00	$18,667.19	37.9%	$7,074.87	9.1%	$1,695.54	25.3%	$4,722.80	5.8%	$1,082.70	$4,091.29
3.67	2024	**John B to Waverley Int.**	Mailbox Pad Reinstatement	Each	2	$2,500.00	$5,000.00	$0.00	$0.00	$214.30	$5,214.30	1.0000	$5,214.30	$0.00	$5,214.30	37.9%	$1,976.22	9.1%	$473.61	25.3%	$1,319.22	5.8%	$302.43	$1,142.82
3.68	2024	**John B to Waverley Int.**	NSPI Power Pole Support	Each	2	$5,000.00	$10,000.00	$0.00	$0.00	$428.60	$10,428.60	1.0000	$10,428.60	$0.00	$10,428.60	37.9%	$3,952.44	9.1%	$947.23	25.3%	$2,638.44	5.8%	$604.86	$2,285.64
3.69	2024	**John B to Waverley Int.**	Service Lateral Reconnects and Storm Sewer Adjustments	LS	1	$75,000.00	$75,000.00	$0.00	$0.00	$3,214.50	$78,214.50	1.0000	$78,214.50	$0.00	$78,214.50	0.0%	$0.00	100.0%	$78,214.50	0.0%	$0.00	0.0%	$0.00	$0.00
3.70	2024	**John B to Waverley Int.**	Erosion & Sediment Controls (Silt Booms in Lake Charles)	LS	1	$45,000.00	$45,000.00	$0.00	$0.00	$1,928.70	$46,928.70	1.0000	$46,928.70	$0.00	$46,928.70	37.9%	$17,785.98	9.1%	$4,262.53	25.3%	$11,872.96	5.8%	$2,721.86	$10,285.36
3.73	2024	**John B to Waverley Int.**	Traffic Control	LS	1	$125,000.00	$125,000.00	$0.00	$0.00	$5,357.50	$130,357.50	1.0000	$130,357.50	$0.00	$130,357.50	37.9%	$49,405.49	9.1%	$11,840.37	25.3%	$32,980.45	5.8%	$7,560.74	$28,570.45
3.02	2024	**Jaybe to Breeze**	750mm Wright Waterline Extension from Jaybe Split to connection on Breeze (Sta 1+520 to 1+633)	M	132	$7,450.00	$983,400.00	$0.00	$0.00	$42,148.52	$1,025,548.52	1.0000	$1,025,548.52	$0.00	$1,025,548.52	100.0%	$1,025,548.52	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	$0.00
3.14	2024	**Jaybe to Breeze**	Waterline Connections @ Waverley/Jaybe Intersection	LS	1	$100,000.00	$100,000.00	$0.00	$0.00	$4,286.00	$104,286.00	1.0000	$104,286.00	$0.00	$104,286.00	100.0%	$104,286.00	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	$0.00
3.03	2024	**Jaybe to Breeze**	ARV in Waverley Road	Each	1	$85,000.00	$85,000.00	$0.00	$0.00	$3,643.10	$88,643.10	1.0000	$88,643.10	$0.00	$88,643.10	100.0%	$88,643.10	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	$0.00
3.07	2024	**Jaybe to Breeze**	Water Service Lateral Amendments and Connections	Each	8	$5,000.00	$40,000.00	$0.00	$0.00	$1,714.40	$41,714.40	1.0000	$41,714.40	$0.00	$41,714.40	100.0%	$41,714.40	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	$0.00
3.20	2024	**Jaybe to Breeze**	Twin 300mm PVC FM Waverley to Breeze Intersection (Sta 1+520 to 1+640)	M	120	$3,400.00	$408,000.00	$0.00	$0.00	$17,486.88	$425,486.88	1.0000	$425,486.88	$0.00	$425,486.88	0.0%	$0.00	29.3%	$124,667.66	0.0%	$0.00	0.0%	$0.00	$300,819.22
3.41	2024	**Jaybe to Breeze**	150mm Gasline Extension Jaybe/Waverley Int. to Breeze Int. (Sta 1+520 to 1+640)	M	120	$375.00	$45,000.00	$0.00	$0.00	$1,928.70	$46,928.70	1.0000	$46,928.70	$0.00	$46,928.70	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	100.0%	$46,928.70	$0.00
3.51	2024	**Jaybe to Breeze**	3.5M Asphalt Trail Jaybe/Waverley Intersection to Breeze Intersection (Sta 1+520 to 1+640)	M	120	$550.00	$66,000.00	$0.00	$0.00	$2,828.76	$68,828.76	1.0000	$68,828.76	$0.00	$68,828.76	0.0%	$0.00	0.0%	$0.00	100.0%	$68,828.76	0.0%	$0.00	$0.00
3.52	2024	**Jaybe to Breeze**	Crosswalk Upgrades at Waverley & Breeze Intersection (including sidewalk upgrades and TWSI)	LS	1	$48,000.00	$48,000.00	$0.00	$0.00	$2,057.28	$50,057.28	1.0000	$50,057.28	$0.00	$50,057.28	0.0%	$0.00	0.0%	$0.00	100.0%	$50,057.28	0.0%	$0.00	$0.00
3.60	2024	**Jaybe to Breeze**	Demolition & Removal of Existing Curb	M	240	$75.00	$18,000.00	$0.00	$0.00	$771.48	$18,771.48	1.0000	$18,771.48	$0.00	$18,771.48	41.1%	$7,715.08	9.9%	$1,864.51	17.9%	$3,360.09	7.1%	$1,332.78	$4,499.02
3.61a	2024	**Jaybe to Breeze**	Asphalt Removal and Disposal (Waverley) - Milling	Sq.M	1,414	$20.00	$28,280.00	$0.00	$0.00	$1,212.08	$29,492.08	1.0000	$29,492.08	$0.00	$29,492.08	41.1%	$12,121.25	9.9%	$2,929.36	17.9%	$5,279.08	7.1%	$2,093.94	$7,068.46
3.61b	2024	**Jaybe to Breeze**	Asphalt Reinstatment Base & Top (Waverley)	Sq.M	1,426	$65.00	$92,690.00	$0.00	$0.00	$3,972.69	$96,662.69	1.0000	$96,662.69	$0.00	$96,662.69	41.1%	$39,728.37	9.9%	$9,601.22	17.9%	$17,302.62	7.1%	$6,863.05	$23,167.44
3.62	2024	**Jaybe to Breeze**	Residential Driveway Repairs	Each	4	$10,000.00	$40,000.00	$0.00	$0.00	$1,714.40	$41,714.40	1.0000	$41,714.40	$0.00	$41,714.40	41.1%	$17,144.62	9.9%	$4,143.37	17.9%	$7,466.88	7.1%	$2,961.72	$9,997.82
3.63	2024	**Jaybe to Breeze**	Street Tree & Landscaping replacements	Each	12	$900.00	$10,800.00	$0.00	$0.00	$462.89	$11,262.89	1.0000	$11,262.89	$0.00	$11,262.89	41.1%	$4,629.05	9.9%	$1,118.71	17.9%	$2,016.06	7.1%	$799.67	$2,699.41
3.64	2024	**Jaybe to Breeze**	Sidewalk Removals - Waverley Road	Sq.M	170	$13.00	$2,210.00	$0.00	$0.00	$94.72	$2,304.72	1.0000	$2,304.72	$0.00	$2,304.72	41.1%	$947.24	9.9%	$228.92	17.9%	$412.54	7.1%	$163.64	$552.38

3.65	2024	**Jaybe to Breeze**	Concrete Curb & Gutter incl Gravels (John Brenton, Jaybe to Waverley Intersection)	M	152	$150.00	$22,800.00	$0.00	$0.00	$977.21	$23,777.21	1.0000	$23,777.21	$0.00	$23,777.21	41.1%	$9,772.43	9.9%	$2,361.72	17.9%	$4,256.12	7.1%	$1,688.18	$5,698.75
3.68	2024	**Jaybe to Breeze**	Waverley Road Transit Stop Removals (Stop 8452, 8454, 8476)	Each	3	$10,000.00	$30,000.00	$0.00	$0.00	$1,285.80	$31,285.80	1.0000	$31,285.80	$0.00	$31,285.80	41.1%	$12,858.46	9.9%	$3,107.52	17.9%	$5,600.16	7.1%	$2,221.29	$7,498.36
3.68	2024	**Jaybe to Breeze**	Waverley Road Transit Stop Amendments (Stop 8452, 8454, 8476)	Each	3	$15,000.00	$45,000.00	$0.00	$0.00	$1,928.70	$46,928.70	1.0000	$46,928.70	$0.00	$46,928.70	41.1%	$19,287.70	9.9%	$4,661.29	17.9%	$8,400.24	7.1%	$3,331.94	$11,247.54
3.69	2024	**Jaybe to Breeze**	Service Lateral Reconnects and Storm Sewer Adjustments	Each	1	$15,000.00	$15,000.00	$0.00	$0.00	$642.90	$15,642.90	1.0000	$15,642.90	$0.00	$15,642.90	0.0%	$0.00	100.0%	$15,642.90	0.0%	$0.00	0.0%	$0.00	$0.00
3.70	2024	**Jaybe to Breeze**	Erosion & Sediment Controls (Silt Booms in Lake Charles)	LS	1	$45,000.00	$45,000.00	$0.00	$0.00	$1,928.70	$46,928.70	1.0000	$46,928.70	$0.00	$46,928.70	41.1%	$19,287.70	9.9%	$4,661.29	17.9%	$8,400.24	7.1%	$3,331.94	$11,247.54
3.71	2024	**Jaybe to Breeze**	Temporary Support for Existing Culvert	LS	1	$70,000.00	$70,000.00	$0.00	$0.00	$3,000.20	$73,000.20	1.0000	$73,000.20	$0.00	$73,000.20	41.1%	$30,003.08	9.9%	$7,250.89	17.9%	$13,067.04	7.1%	$5,183.01	$17,496.18
3.72	2024	**Jaybe to Breeze**	Relocate Hydrant due to MUP @ STA 1+650	LS	1	$5,000.00	$5,000.00	$0.00	$0.00	$214.30	$5,214.30	1.0000	$5,214.30	$0.00	$5,214.30	100.0%	$5,214.30	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	$0.00
3.73	2024	**Jaybe to Breeze**	Domestic Temporary Water (Waverley Rd)	LS	1	$20,000.00	$20,000.00	$0.00	$0.00	$857.20	$20,857.20	1.0000	$20,857.20	$0.00	$20,857.20	41.1%	$8,572.31	9.9%	$2,071.68	17.9%	$3,733.44	7.1%	$1,480.86	$4,998.91
3.74	2024	**Jaybe to Breeze**	Traffic Control	LS	1	$300,000.00	$300,000.00	$0.00	$0.00	$12,858.00	$312,858.00	1.0000	$312,858.00	$0.00	$312,858.00	41.1%	$128,584.64	9.9%	$31,075.25	17.9%	$56,001.58	7.1%	$22,212.92	$74,983.62
3.75	2024	**Jaybe to Breeze**	Culvert and Bank Improvements	LS	1	$50,000.00	$50,000.00	$0.00	$0.00	$2,143.00	$52,143.00	1.0000	$52,143.00	$0.00	$52,143.00	41.1%	$21,430.77	9.9%	$5,179.21	17.9%	$9,333.60	7.1%	$3,702.15	$12,497.27
4.01	2024	**Breeze to 390 Waverley**	Twin 300mm PVC FM Breeze Int. to 390 Waverley PS (Sta 1+510 to 2+225)	M	567	$1,885.00	$1,068,795.00	$0.00	$0.00	$45,808.55	$1,114,603.55	1.0000	$1,114,603.55	$0.00	$1,114,603.55	0.0%	$0.00	29.3%	$326,578.84	0.0%	$0.00	0.0%	$0.00	$788,024.71
4.02	2024	**Breeze to 390 Waverley**	Relocate Existing FM (Sta 1+926 to 1+955)	M	29	$4,400.00	$127,600.00	$0.00	$0.00	$5,468.94	$133,068.94	1.0000	$133,068.94	$0.00	$133,068.94	0.0%	$0.00	29.3%	$38,989.20	0.0%	$0.00	0.0%	$0.00	$94,079.74
4.03	2024	**Breeze to 390 Waverley**	Removal of Existing Twin FM in Waverley	LS	1	$50,000.00	$50,000.00	$0.00	$0.00	$2,143.00	$52,143.00	1.0000	$52,143.00	$0.00	$52,143.00	0.0%	$0.00	29.3%	$15,277.90	0.0%	$0.00	0.0%	$0.00	$36,865.10
4.20	2024	**Breeze to 390 Waverley**	150mm Gasline Extension Breeze Intersection to 390 Waverley Rd PS (Sta 1+640 to 2+198)	M	558	$375.00	$209,250.00	$0.00	$0.00	$8,968.46	$218,218.46	1.0000	$218,218.46	$0.00	$218,218.46	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	100.0%	$218,218.46	$0.00
4.21	2024	**Breeze to 390 Waverley**	150mm Gasline Extension within Waverley Travelway in front of 390 Waverley Rd PS	M	35	$600.00	$21,000.00	$0.00	$0.00	$900.06	$21,900.06	1.0000	$21,900.06	$0.00	$21,900.06	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	100.0%	$21,900.06	$0.00
4.30	2024	**Breeze to 390 Waverley**	3.5M Asphalt Trail (Breeze Intersection to 390 Waverley Road PS)	M	575	$550.00	$316,250.00	$0.00	$0.00	$13,554.48	$329,804.48	1.0000	$329,804.48	$0.00	$329,804.48	0.0%	$0.00	0.0%	$0.00	100.0%	$329,804.48	0.0%	$0.00	$0.00
4.40	2024	**Breeze to 390 Waverley**	Retaining Wall Repairs	LS	1	$120,000.00	$120,000.00	$0.00	$0.00	$5,143.20	$125,143.20	1.0000	$125,143.20	$0.00	$125,143.20	0.0%	$0.00	17.8%	$22,220.18	28.2%	$35,290.38	11.2%	$14,016.04	$53,616.60
4.41	2024	**Breeze to 390 Waverley**	Demolition & Removal of Existing Curb	M	590	$40.00	$23,600.00	$0.00	$0.00	$1,011.50	$24,611.50	1.0000	$24,611.50	$0.00	$24,611.50	0.0%	$0.00	17.8%	$4,369.97	28.2%	$6,940.44	11.2%	$2,756.49	$10,544.60
4.42	2024	**Breeze to 390 Waverley**	Asphalt Removal and Disposal (Waverley Rd) - Milling	Sq.M	5,384	$20.00	$107,680.00	$0.00	$0.00	$4,615.16	$112,295.16	1.0000	$112,295.16	$0.00	$112,295.16	0.0%	$0.00	17.8%	$19,938.90	28.2%	$31,667.24	11.2%	$12,577.06	$48,111.96
4.43	2024	**Breeze to 390 Waverley**	Asphalt Reinstatment Base & Top (Waverley)	Sq.M	4,414	$65.00	$286,910.00	$0.00	$0.00	$12,296.96	$299,206.96	1.0000	$299,206.96	$0.00	$299,206.96	0.0%	$0.00	17.8%	$53,126.59	28.2%	$84,376.36	11.2%	$33,511.18	$128,192.83
3.65	2024	**Breeze to 390 Waverley**	Concrete Curb & Gutter incl Gravels (Sta 1+640 to 2+230)	M	657	$150.00	$98,550.00	$0.00	$0.00	$4,223.85	$102,773.85	1.0000	$102,773.85	$0.00	$102,773.85	0.0%	$0.00	17.8%	$18,248.32	28.2%	$28,982.23	11.2%	$11,510.67	$44,032.64
4.44	2024	**Breeze to 390 Waverley**	Residential Driveway Repairs	EACH	18	$10,000.00	$180,000.00	$0.00	$0.00	$7,714.80	$187,714.80	1.0000	$187,714.80	$0.00	$187,714.80	0.0%	$0.00	17.8%	$33,330.26	28.2%	$52,935.57	11.2%	$21,024.06	$80,424.90
4.45	2024	**Breeze to 390 Waverley**	Concrete Sidewalk Removals	Sq.M	885	$13.00	$11,505.00	$0.00	$0.00	$493.10	$11,998.10	1.0000	$11,998.10	$0.00	$11,998.10	0.0%	$0.00	17.8%	$2,130.36	28.2%	$3,383.47	11.2%	$1,343.79	$5,140.49
4.46	2024	**Breeze to 390 Waverley**	Waverley Road Left-Turn Lane Improvements (Part of Port Wallace Transportation CCC)	LS	1	$425,000.00	$425,000.00	$0.00	$0.00	$18,215.50	$443,215.50	1.0000	$443,215.50	$0.00	$443,215.50	0.0%	$0.00	0.0%	$0.00	100.0%	$443,215.50	0.0%	$0.00	$0.00
4.47	2024	**Breeze to 390 Waverley**	Service Lateral Reconnects and Storm Sewer Adjustments	LS	1	$125,000.00	$125,000.00	$0.00	$0.00	$5,357.50	$130,357.50	1.0000	$130,357.50	$0.00	$130,357.50	0.0%	$0.00	100.0%	$130,357.50	0.0%	$0.00	0.0%	$0.00	$0.00
4.49	2024	**Breeze to 390 Waverley**	Erosion & Sediment Controls	LS	1	$45,000.00	$45,000.00	$0.00	$0.00	$1,928.70	$46,928.70	1.0000	$46,928.70	$0.00	$46,928.70	0.0%	$0.00	17.8%	$8,332.57	28.2%	$13,233.89	11.2%	$5,256.01	$20,106.23
4.50	2024	**Breeze to 390 Waverley**	Pole Relocation	LS	1	$750,000.00	$750,000.00	$0.00	$0.00	$32,145.00	$782,145.00	1.0000	$782,145.00	$0.00	$782,145.00	0.0%	$0.00	17.8%	$138,876.10	28.2%	$220,564.89	11.2%	$87,600.24	$335,103.77
4.51	2024	**Breeze to 390 Waverley**	Street Trees & Landscaping	EACH	59	$900.00	$53,100.00	$0.00	$0.00	$2,275.87	$55,375.87	1.0000	$55,375.87	$0.00	$55,375.87	0.0%	$0.00	17.8%	$9,832.43	28.2%	$15,615.99	11.2%	$6,202.10	$23,725.35
4.52	2024	**Breeze to 390 Waverley**	Tree Clearing on Waverley (just passed Breeze)	LS	1	$5,000.00	$5,000.00	$0.00	$0.00	$214.30	$5,214.30	1.0000	$5,214.30	$0.00	$5,214.30	0.0%	$0.00	17.8%	$925.84	28.2%	$1,470.43	11.2%	$584.00	$2,234.03
4.53	2024	**Breeze to 390 Waverley**	New Catchbasin and Manhole Cover Retrofit	EACH	6	$18,000.00	$108,000.00	$0.00	$0.00	$4,628.88	$112,628.88	1.0000	$112,628.88	$0.00	$112,628.88	0.0%	$0.00	100.0%	$112,628.88	0.0%	$0.00	0.0%	$0.00	$0.00
5.01	2024	**390 Waverley to Stillwater**	150mm Gasline Extension 390 Waverley Rd PS to Stillwater (Sta 2+218 to 2+508)	M	290	$375.00	$108,750.00	$0.00	$0.00	$4,661.03	$113,411.03	1.0000	$113,411.03	$0.00	$113,411.03	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	100.0%	$113,411.03	$0.00
5.10	2024	**390 Waverley to Stillwater**	3.5M Asphalt Trail 390 Waverley Rd PS to Stillwater	M	292	$650.00	$189,800.00	$0.00	$0.00	$8,134.83	$197,934.83	1.0000	$197,934.83	$0.00	$197,934.83	0.0%	$0.00	0.0%	$0.00	100.0%	$197,934.83	0.0%	$0.00	$0.00
5.20	2024	**390 Waverley to Stillwater**	Retaining Wall Repairs	LS	1	$45,000.00	$45,000.00	$0.00	$0.00	$1,928.70	$46,928.70	1.0000	$46,928.70	$0.00	$46,928.70	0.0%	$0.00	0.0%	$0.00	71.4%	$33,507.09	28.6%	$13,421.61	$0.00
5.21	2024	**390 Waverley to Stillwater**	Demolition & Removal of Existing Curb	M	280	$40.00	$11,200.00	$0.00	$0.00	$480.03	$11,680.03	1.0000	$11,680.03	$0.00	$11,680.03	0.0%	$0.00	0.0%	$0.00	71.4%	$8,339.54	28.6%	$3,340.49	$0.00
5.22	2024	**390 Waverley to Stillwater**	Asphalt Removal and Disposal (Waverley Rd) - Milling	Sq.M	2,570	$20.00	$51,400.00	$0.00	$0.00	$2,203.00	$53,603.00	1.0000	$53,603.00	$0.00	$53,603.00	0.0%	$0.00	0.0%	$0.00	71.4%	$38,272.54	28.6%	$15,330.46	$0.00
5.23	2024	**390 Waverley to Stillwater**	Asphalt Reinstatment Base & Top (Waverley)	Sq.M	1,892	$65.00	$122,980.00	$0.00	$0.00	$5,270.92	$128,250.92	1.0000	$128,250.92	$0.00	$128,250.92	0.0%	$0.00	0.0%	$0.00	71.4%	$91,571.16	28.6%	$36,679.76	$0.00
5.24	2024	**390 Waverley to Stillwater**	Concrete Curb & Gutter incl Gravels (Sta 2+230 to 2+215)	M	285	$150.00	$42,750.00	$0.00	$0.00	$1,832.27	$44,582.27	1.0000	$44,582.27	$0.00	$44,582.27	0.0%	$0.00	0.0%	$0.00	71.4%	$31,831.74	28.6%	$12,750.53	$0.00
5.24	2024	**390 Waverley to Stillwater**	Residential Driveway Repairs	Each	11	$10,000.00	$110,000.00	$0.00	$0.00	$4,714.60	$114,714.60	1.0000	$114,714.60	$0.00	$114,714.60	0.0%	$0.00	0.0%	$0.00	71.4%	$81,906.22	28.6%	$32,808.38	$0.00
5.25	2024	**390 Waverley to Stillwater**	Concrete Sidewalk Removals	Sq.M	420	$10.00	$4,200.00	$0.00	$0.00	$180.01	$4,380.01	1.0000	$4,380.01	$0.00	$4,380.01	0.0%	$0.00	0.0%	$0.00	71.4%	$3,127.33	28.6%	$1,252.68	$0.00
5.26	2024	**390 Waverley to Stillwater**	Service Lateral Reconnects and Storm Sewer Adjustments	LS	1	$75,000.00	$75,000.00	$0.00	$0.00	$3,214.50	$78,214.50	1.0000	$78,214.50	$0.00	$78,214.50	0.0%	$0.00	100.0%	$78,214.50	0.0%	$0.00	0.0%	$0.00	$0.00
5.27	2024	**390 Waverley to Stillwater**	Relocate Hydrant @ 410 Waverley	Each	1	$5,000.00	$5,000.00	$0.00	$0.00	$214.30	$5,214.30	1.0000	$5,214.30	$0.00	$5,214.30	100.0%	$5,214.30	0.0%	$0.00	0.0%	$0.00	0.0%	$0.00	$0.00
5.28	2024	**390 Waverley to Stillwater**	Erosion & Sediment Controls	LS	1	$45,000.00	$45,000.00	$0.00	$0.00	$1,928.70	$46,928.70	1.0000	$46,928.70	$0.00	$46,928.70	0.0%	$0.00	0.0%	$0.00	71.4%	$33,507.09	28.6%	$13,421.61	$0.00
5.29	2024	**390 Waverley to Stillwater**	Street Trees & Landscaping	Each	28	$900.00	$25,200.00	$0.00	$0.00	$1,080.07	$26,280.07	1.0000	$26,280.07	$0.00	$26,280.07	0.0%	$0.00	0.0%	$0.00	71.4%	$18,763.97	28.6%	$7,516.10	$0.00
5.30	2024	**390 Waverley to Stillwater**	Waverley Road Line Painting - Removal and Reinstatment	LS	1	$50,000.00	$50,000.00	$0.00	$0.00	$2,143.00	$52,143.00	1.0000	$52,143.00	$0.00	$52,143.00	0.0%	$0.00	0.0%	$0.00	71.4%	$37,230.10	28.6%	$14,912.90	$0.00
5.31	2024	**390 Waverley to Stillwater**	Traffic Control	LS	1	$50,000.00	$50,000.00	$0.00	$0.00	$2,143.00	$52,143.00	1.0000	$52,143.00	$0.00	$52,143.00	0.0%	$0.00	0.0%	$0.00	71.4%	$37,230.10	28.6%	$14,912.90	$0.00
6.01	2024	**390 Waverley Road**	Ultimate 390 Waverley Road Pump Station (4-65HP submersible Xylem PS)	LS	1	$4,997,663.00	$4,997,663.00	$0.00	$0.00	$214,199.84	$5,211,862.84	1.0000	$5,211,862.84	$0.00	$5,211,862.84	0.0%	$0.00	29.3%	$1,527,075.81	0.0%	$0.00	0.0%	$0.00	$3,684,787.03
6.02	2024	**390 Waverley Road**	Demolition of Existing PS	LS	1	$100,000.00	$100,000.00	$0.00	$0.00	$4,286.00	$104,286.00	1.0000	$104,286.00	$0.00	$104,286.00	0.0%	$0.00	29.3%	$30,555.80	0.0%	$0.00	0.0%	$0.00	$73,730.20
7.01	2024	**Indirects**	Engineering Fees - Pre Design - Wastewater Linear, Pumping Station, Gas, MUP	LS	1	$620,000.00	$620,000.00	$0.00	$0.00	$26,573.20	$646,573.20	1.0000	$646,573.20	$0.00	$646,573.20	0.0%	$0.00	20.7%	$133,840.65	22.9%	$148,065.26	10.7%	$69,183.33	$295,483.95
7.01	2024	**Indirects**	Engineering Fees - Construction Admin - Wastewater Linear, Pumping Station & Gas	LS	1	$350,000.00	$350,000.00	$0.00	$0.00	$15,001.00	$365,001.00	1.0000	$365,001.00	$0.00	$365,001.00	0.0%	$0.00	20.7%	$75,555.21	22.9%	$83,585.23	10.7%	$39,055.11	$166,805.46
7.02	2024	**Indirects**	Archeological Fees - Shovel Testing, Monitoring & Reporting	LS	1	$55,000.00	$55,000.00	$0.00	$0.00	$2,357.30	$57,357.30	1.0000	$57,357.30	$0.00	$57,357.30	32.5%	$18,641.12	14.0%	$8,030.02	15.5%	$8,893.38	7.2%	$4,129.73	$17,668.05
7.03	2024	**Indirects**	Geotechnical Material Testing (Stantec offer with HRM/HW)	LS	1	$100,000.00	$100,000.00	$0.00	$0.00	$4,286.00	$104,286.00	1.0000	$104,286.00	$0.00	$104,286.00	32.5%	$33,892.95	14.0%	$14,600.04	15.5%	$16,164.33	7.2%	$7,508.59	$32,120.09
			Subtotal				**$29,493,194.20**	**$0.00**	**$0.00**	**$1,264,078.30**	**$30,757,272.50**		**$30,757,272.50**	**$0.00**	**$30,757,272.50**		**$9,967,811.29**		**$4,357,413.02**		**$4,748,662.86**		**$2,219,682.02**	**$9,463,703.31**

April 7, 2017

Job No.: 15-001

Port Wallace Holdings Limited
255 Lacewood Drive, Suite 100C
Halifax, Nova Scotia
B3M 4G2
Attention: Scott MacCallum, P. Eng., MBA

RE: 390 Waverley Road Pumping Station

At the request of Port Wallace Holdings Ltd., we have reviewed the wastewater servicing tributary to the 390 Waverley Road Pumping Station. It is understood that Port Wallace Holdings Ltd. is planning a development upstream of this pumping station and that the ultimate design will include a new larger pumping station with the flows re-directed to the North Dartmouth Trunk Sewer. In the interim (2-3 years), it is possible to service a small portion of the proposed development using the existing system with minor upgrades. This pumping station currently has two Gorman-Rupp self priming T6 pumps with a backup power generator.

On January 29, 2015, DesignPoint staff conducted a drawdown test at the 390 Waverley Road Pump Station.

390 Waverley Road Pumping Station currently services an area of 57 hectares with 465 residential units. At a population density of 3.35 persons per unit. This gives a total population of 1,558 persons.

Using Halifax Water design criteria / formula for wastewater, we have calculated the following:

- Peak dry weather flow – 24.8 l/s
- Peak wet weather flow – 40.8 l/s

The capacity of the sanitary sewer system is as follows:

- Existing gravity pipe system to 390 Waverley Road: 370 l/s
- Single force main at maximum velocity of 2.4 m/s: 118 l/s
- Pump #1 at 390 Waverley Road Pumping Station: 37.0 l/s
- Pump #2 at 390 Waverley Road Pumping Station: 43.3 l/s
- Pump #1 and #2 on at same time: 54.7 l/s

The theoretical flows for each pump at the 390 Waverley Road Pumping Station are 44 l/s at 1350 RPM and 56 l/s at 1550 RPM.

The firm capacity of the 390 Waverley Road Pumping Station is 37.0 l/s (firm capacity is the capacity of a pumping station with the largest pump out of service). The ultimate capacity of the 390 Waverley Road Pumping Station is 54.7 l/s. Sansom Equipment staff also visited the pumping station and noted that Pump #1 had the belt slipping and if this were fixed, it would bring the Pump # 1 capacity up to 43.3 l/s.

Peak wet weather flows derived from Halifax Water "Pump Runtime Data" show a peak flow of 44 l/s on September 22, 2014 and 54.7 l/s on December 10, 2014. Both pumps ran for approximately 9 hours on December 10, 2014. Because both pumps were running simultaneously for 9 hours it is possible that the peak flow to the station was much higher than 54.7 l/s (which is the peak capacity of both pumps running). Because this peak wet weather flow is so much higher than the theoretical value of 40.8 l/s it is likely that there is excessive I/I entering the system.

The rainfall event that occurred on December 10, 2014 was an extreme event that should be considered rare and above what we would typically design for.

On December 10, 2014, 113.6 mm was recorded at Shearwater, the 1:100 yr. winter 24-hour rainfall depth is 96 mm for Shearwater. The 1:100 yr. Shearwater summer 24-hour rainfall depth is 151 mm.

The December 10, 2014 rainfall event also caused extreme flooding in the HRM area, for example the Sackville River was at its peak levels. The rainfall event was more than the 1:100 yr. amount for a winter storm and it is not reasonable to use the peak wet weather flows at 390 Waverley Road Pumping Station on that date for design purposes.

If we compare the Halifax Water theoretical flows to the pump station capacity, there would be approximately 13.9 l/s to spare. However, the peak flows from the December 10, 2014 storm indicate that there was no spare capacity with the current pumping station design on that day.

The 390 Waverley Road Pumping Station was designed with 40 hp motors to allow for a future pump capacity increase by changing the pulleys and belts thus increasing the speed from 1350 RPM to 1550 RPM. This improvement will bring each pump up to 56 l/s and with both pumps running, the ultimate capacity of the station would be 85 l/s.

Because there are only two pumps, under this scenario the firm capacity is still only 56 l/s. To increase the firm capacity, we would normally recommend two larger pumps. In this case, that would increase the downstream flows where there are possible capacity constraints at the 200 Waverley Road Pumping Station.

We have reviewed possible upgrades at the station with Sansom Equipment (supplier of Gorman-Rupp pumps) and they confirm that it is possible to add a third pump and set the controls up to limit the number of pumps operating to only two. This in effect will bring the firm capacity up to 85 l/s (the original design peak flow for this pumping station) without increasing the ultimate capacity. It is important to note that the original design of this pumping station was to pump a peak flow of 85 l/s to the downstream system and we do not propose to exceed this. This scenario will increase the firm capacity by 41.7 l/s which is equivalent to 438 single family homes. The other advantage of this upgrade is that because only two pumps would be on at the same time there should be no need to upgrade the existing backup power generator.

We understand that Port Wallace Holdings Ltd. (with the approval of Halifax Water) would like to move forward with the pre-design of the interim pump station upgrade at 390 Waverley Road. The Port Wallace master plan process is well underway with targeted development agreement approvals by March 2018.

Port Wallace Holdings Ltd. is requesting approval to allow the construction of 200 homes that would be contributing to the interim upgraded 390 Waverley Road Pumping Station. 200 homes would be equivalent to a wastewater increase of 19 l/s.

The interim sanitary approval would permit approximately two years of development while the ultimate 390 Waverley Road Pumping Station, along with linear infrastructure to the North Dartmouth Trunk Sewer is constructed. Port Wallace Holdings Ltd. is hopeful to have the first homes started in November 2018 and to be occupied by Spring of 2019. If approved, the interim upgrade could be constructed concurrent with the local infrastructure and be commissioned by November 2018.

The upgrades described above would be temporary until the flows are redirected to the North Dartmouth Trunk Sewer with the construction of the new larger permanent pumping station.

If you have any questions or require anything further, please feel free to contact us.

Thank you,

DesignPoint Engineering & Surveying Ltd.

Glenn Woodford, P. Eng.
Senior Engineer & Principal

June 15th, 2022

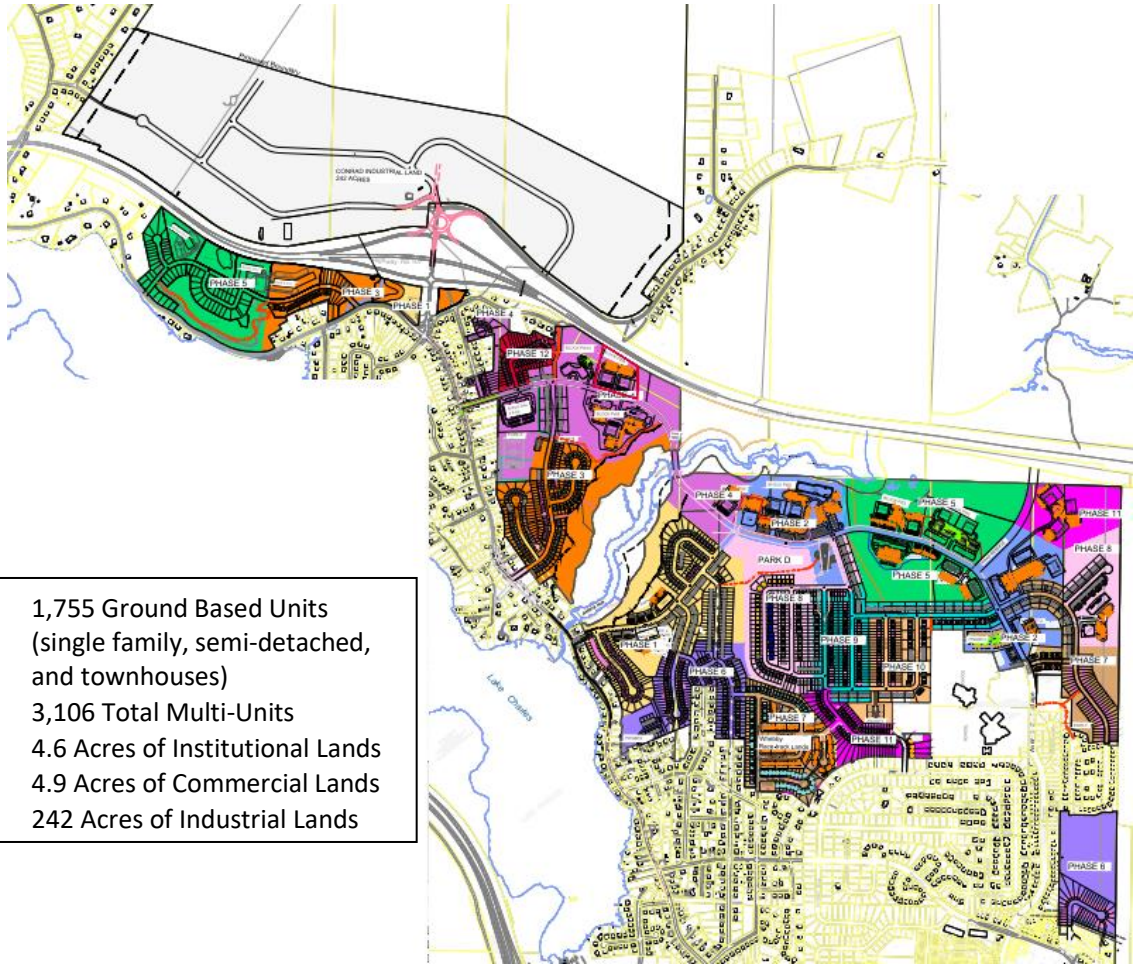
Halifax Water
PO Box 8388, RPO CSC
Halifax, NS
B3K 5M1

Attn: Kevin Gray, P. Eng. Manager, Engineering Approvals

RE: 390 Waverley Road Wastewater Pumping Station Upgrade – Pre-Design Brief
DesignPoint Project #: 22-106 (Halifax Water Capital Cost Charge)

Introduction

The 2014 HRM Regional Plan identifies Port Wallace as one of three potential growth nodes located inside the Urban Settlement designation that could be serviced with municipal wastewater and water services. The project includes the development of 220 ha (543 acres) of residential, institutional, and commercial lands, as well as 98 ha (242 acres) of industrial lands.



- 1,755 Ground Based Units (single family, semi-detached, and townhouses)
- 3,106 Total Multi-Units
- 4.6 Acres of Institutional Lands
- 4.9 Acres of Commercial Lands
- 242 Acres of Industrial Lands

Figure 1 - Port Wallace Development Area Concept & Development Summary

Wastewater Servicing Strategy

The overall wastewater servicing strategy for the proposed Port Wallace development includes a gravity wastewater main along Waverley Road, to a pumping station, where it will be pumped through Shubie Park, across Highway 118, and ultimately discharge into the North Dartmouth Trunk Sewer at Dartmouth Crossing. There is an existing wastewater pumping station at 390 Waverley Road that currently services existing residential development. A report by DesignPoint Engineering & Surveying Ltd. (DesignPoint) dated March 27, 2017 identified that there is approximately 54.7 L/S of available capacity in the existing pumping station. The Port Wallace project is expected to generate wastewater flows in excess of this additional capacity, and as such, Clayton Developments Limited (Clayton) has engaged DesignPoint to complete the detailed design of the replacement of the existing pumping station on behalf of the pending Halifax Water Capital Cost Contribution (CCC) program.

Pump System Optimization

Pump systems operate most efficiently when they are optimized to suit a specific hydraulic regime. Unlike many engineering scenarios, being overly conservative with design assumptions for pump systems can lead to inefficient operations and potential system problems. For example, one problem with oversizing infrastructure is that odor control issues arise from sewage sitting stagnant in either the force main or the wet well, allowing the sewage to become septic. Another problem created by oversizing pumping stations is there are larger capital costs and maintenance/operations costs due to the installation of larger infrastructure than may be required. Pumps are designed to operate under a set of defined hydraulic parameters; and if the actual flows do not meet those design parameters, the pump system may not operate as originally intended, leading to potential premature wear on the mechanics.

To mitigate these issues, it is prudent to conduct a “right-sizing” analysis of the theoretical flows. The intent of this analysis is to optimize the theoretical design values to ensure an efficient pump system design, tailored to suit expected flow regimes. This includes a review of calculated wastewater flow generation and comparison to actual flow monitor data for a local development of comparable size and configuration. As part of this review, DesignPoint analyzed the Bedford West Hollyhock pumping station (PID 41403684), using flow data provided by Halifax Water. This analysis provides ‘calibrated’ theoretical values for domestic allowance, inflow and infiltration, peaking factor, and industrial flow allowances.

Domestic Demands

Domestic demand is the base flow experienced in the system; it represents the Average Dry Weather Flow (ADWF) from domestic populations. To calculate the projected sewage flows for the proposed development, DesignPoint compared aerial imaging to correlate serviced populations of the sewershed from 2018 to 2022. Using a value of 3.35 people per Townhouse and Semi-Detached unit and 2.25 people per Multi-Unit Residential Unit, we are able to ascertain serviced populations, which can then be compared to actual flow monitor data.

Two distinct sub-catchments were identified within the Bedford West Hollyhock pumping station sewershed. Each sub-catchment was monitored using its own flow meter. Area A was monitored by flow gauge FG478, and Area B was monitored by flow gauge FG479. The sewershed, and its sub-catchments can be seen in Appendix A. Determined populations for each sub-catchment were then plotted with a linear fit to determine the population growth rate of each respective sub-catchment:

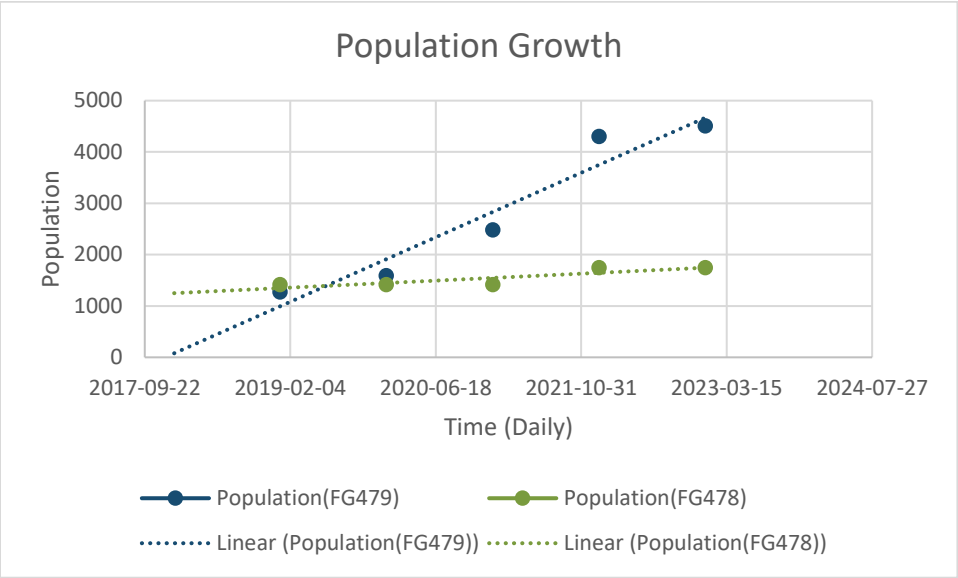


Figure 2: Linear Fit of Population Growth

The flow from the metered areas was then divided by their sub-catchments population to determine an Average Dry Weather Flow:

	FG479 (L/day/person)	FG478 (L/day/Person)
Average	139	169

Table 1: Average Flows in Areas A and B

Based on these observations, a value of **150 L/day/person** is recommended as a theoretical ADWF design flow for the design of the Port Wallace domestic loading.

Extraneous Flow – Inflow & Infiltration (I&)

Another contributor to the wastewater system comes from extraneous sources; Inflow and Infiltration. To quantify the impact of I&I on the Bedford West sewershed, the flow data was compared against rainfall data collected at the Halifax Windsor Park weather station.

The following figures illustrate the rainfall data compared to the station's monitored flows. These graphs demonstrate that there is little correlation between rainfall and impact on the station flows. Although slight increases can be observed in the station flows during and immediately after rain events, the impact was not necessarily significant. This indicates the wastewater collection system is relatively watertight and not significantly susceptible to I&I.

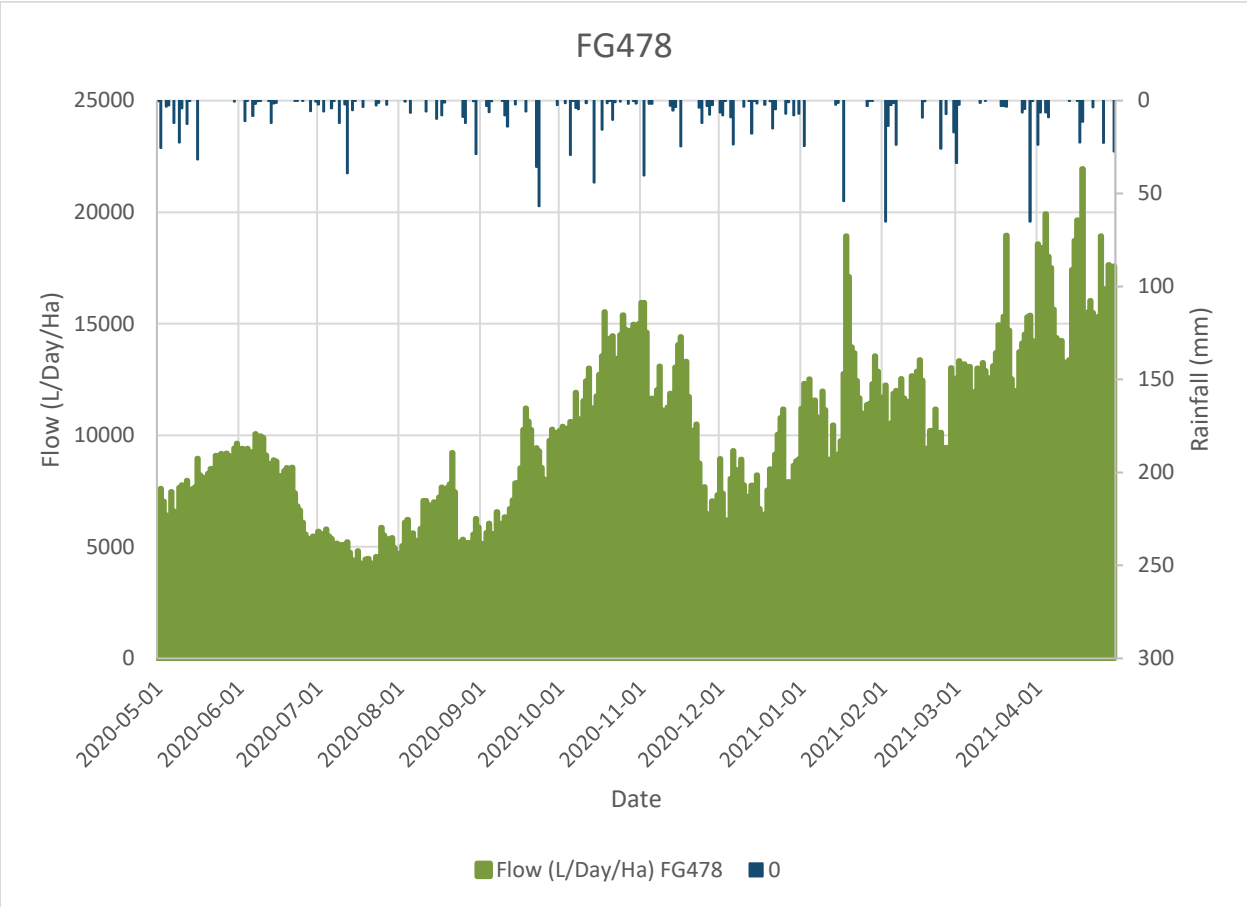


Figure 3: FG 478 Flow Data vs Rainfall

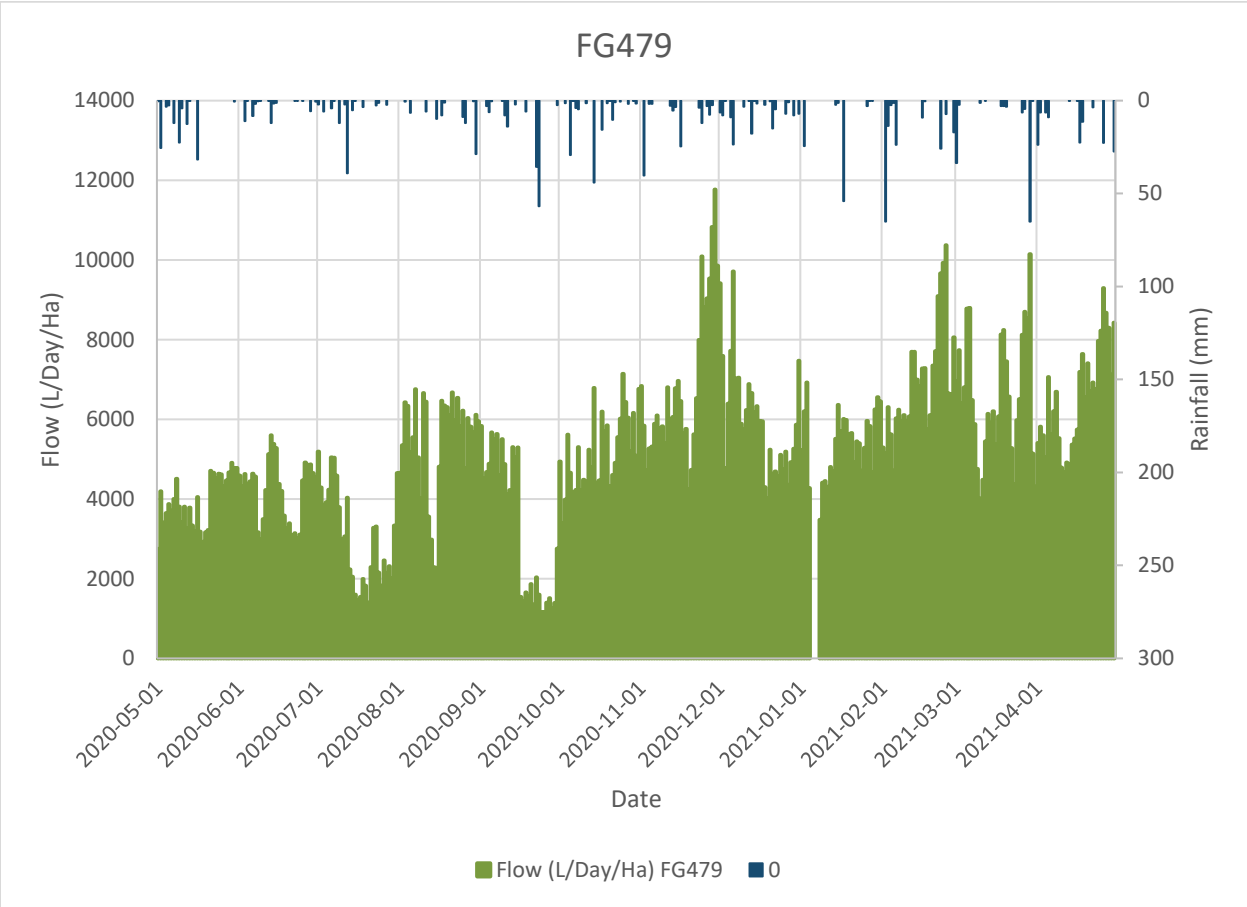


Figure 4: FG 479 Flow Data vs Rainfall

With the advent of modern wastewater system construction techniques and testing standards, newly constructed systems are not as susceptible to I&I influences. The Halifax Water Design Guidelines specify a long-term infiltration/inflow allowance of 24 m^3/hectare/day. However, a value previously accepted by Halifax Water in the design of the Talus Pumping Station Design Brief West Bedford - Phase 7-3, prepared by Strum Consulting on January 24, 2020, reduced the I&I allowance of 15 m^3/hectare/day. As this value has proven to be effective in previous projects, we recommend using this as the baseline I&I allowance.

In addition to the I&I flow allowance, the tributary area used to calculate the I&I was reviewed. Historically, the net developable area was used to calculate extraneous flows. However, this is not necessarily appropriate in all cases. I&I is greatly influenced by groundwater conditions, soil conditions, drainage patterns, topography, and other surficial and sub-surface drainage hydrologic characteristics. Therefore, it is prudent to examine these drainage characteristics when calculating I&I allowances.

For example, the Port Wallace development area is surrounded by wetlands and watercourses. These areas will remain undisturbed throughout development, and thus, we can assume that the water from these areas will not contribute to the sanitary system flows. Likewise, when reviewing the proposed development grading and drainage plans, we can see that many areas of the development are directing rear yard drainage and backyard swales to these undisturbed areas, thereby maintaining many natural drainage patterns. The back yards for the residential lots were also removed from the I&I area calculations. It is assumed that these areas will drain to a swale, which will lead directly into the storm system and not make it into the sanitary system.

Similarly, commercial and multi-unit sites included as part of the development will have stormwater management plans to prevent the water from entering the sanitary system. As such, by overlaying the storm drainage and grading plans with the sanitary system, we are able to carefully refine the area that may contribute I&I to the wastewater system, and not overestimate the extraneous flow allowance.

Peaking Factor

Another factor in calculating wastewater system flows is the Peaking Factor. The Peaking Factor accounts for variations in loading throughout the day; for example, wastewater flows in residential areas generally follow a 'diurnal curve' pattern, with a peak during high useage times; typically in the morning when most people are showering and getting ready for work, and again in the evening when people are cooking supper, etc., with periods of low flow while people are away for work or overnight when people are sleeping.

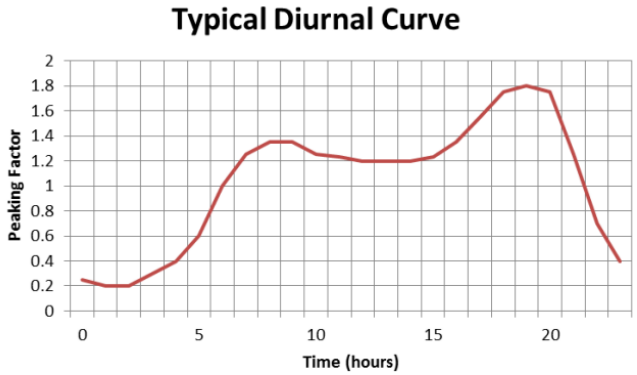


Figure 5: AWWA Typical Diurnal Curve

Peak flows at the Bedford West Hollyhock pumping station were reviewed in order to calculate comparable Peaking Factors that could be used in the theoretical design for Port Wallace. DesignPoint analyzed the hourly flow data to determine the peaking factors seen at the Bedford West pumping station. The maximum peaking factor calculated each month was compared against population. As Area A was almost at its full buildout at the start of the flow data, the entire measured flow period was plotted. Area B, however, saw a significant increase in population over the measured flow period. Due to this increase in population, we removed the first 17 months of data from the plot. This is due to the fact that peaking factors reduce as the population increases, and the peaking factors shown within the first 17 months were not representative of a larger buildout population. Once plotted, a fitting constant was applied to the Harmon Peaking Factor formula to fit the curve to the data calculated in the Bedford West sewer shed. This plot can be seen in Figures 2 and 3.

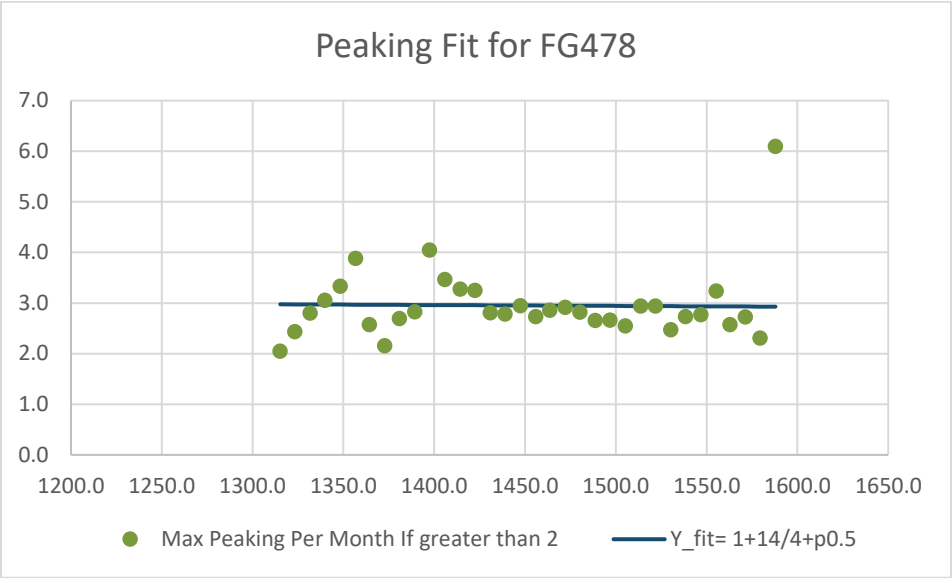


Figure 6: Peaking Fit for Area A

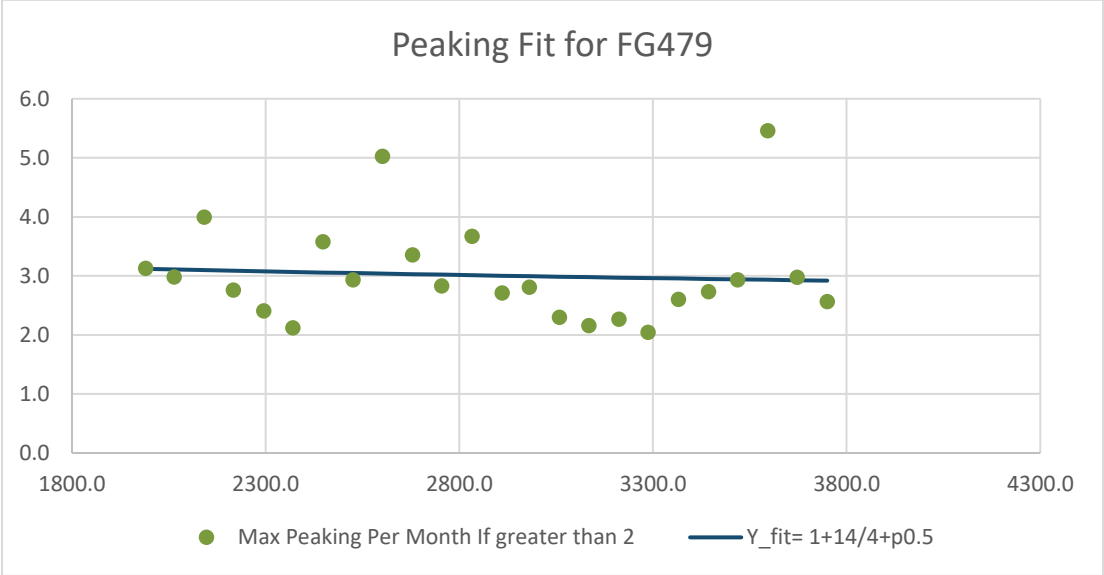


Figure 7: Peaking Fit for Area B

For Area A, a fitting constant of 0.8 was calculated, while for area B, a fitting constant of 0.87 was determined. After determining the fitting constants, the data was extrapolated to Port Wallace's final buildout population using the following Adjusted Harmon Peaking Factor Formula:

Equation 1: Harmon Peaking Formula with a Fitting Constant

$$M = F \times (1 + \frac{14}{4 + P^{0.5}})$$

Where,

M= Peaking factor
F= Fitting constant
P= Design Population in thousands

Peaking factors for Port Wallace were determined using the Port Wallace final buildout population and the fitting constants defined above. These values returned Peaking Factors of 2.27 and 2.47. Based on these observations, it is recommended to use a peaking factor of **2.5** for domestic flows in the full buildout of Port Wallace.

Industrial Flow Allowance

The third contributor in the Port Wallace wastewater system is from the industrial lands proposed in the current quarry area. The typical flow allowance for "Light Industrial" uses is 35 m^3/hectare-day in the Atlantic Canada Wastewater Guidelines. After completing a literature review of other similar municipalities, we found this value to be relatively consistent across various jurisdictions. The wastewater flows generated from various industrial uses can vary significantly based on use; for example, a self storage facility may generate very little wastewater, but a marijuana production facility may generate significantly higher wastewater flows. There may be an opportunity to refine the theoretical design allowance if there is a mechanism to define the uses within the proposed development. However, in lieu of defined uses, it is recommended to use the generally accepted allowance of **35 m^3/hectare-day** for the purposes of calculating industrial wastewater ADWF.

A peaking factor of **2** may be applied due to an assumed operating time of 12 hours per day for the businesses in the industrial area. That accounts for the fact that the ADWF from these businesses would be generally condensed into 12 hours of normal operation instead of a full 24-hour day.

System Design Flow Summary

The following table summarizes the theoretical design values recommended for the Port Wallace development area:

Table 2 - Development Flow Summary

	Quantity	Units
ADWF (Domestic)	150	L/P/D
ADWF (Industrial)	35	m^3/D/Ha
PF (Domestic)	2.5	
PF (Industrial)	2	
I&I	15	m^3/D/Ha
Peak Wet Weather Flow (PWWF) – Port Wallace Domestic	65	L/s
PWWF – Port Wallace Industrial	81	L/S
PWWF – Existing Serviced Area	41	L/S
TOTAL DESIGN PWWF	**187**	**L/S**

Other System Considerations

In addition to calibrating theoretical design flows for the proposed station upgrades, it is also important for determining other system parameters and configuration to optimize system design.

System Configuration and Operation Logic

The existing system is duplex Gorman-Rupp Suction Lift station. Suction lift stations have the advantage of having the pump mechanics (motor, volute, etc.) located above grade for ease of maintenance. This an efficient model for small scale stations and shallow wetwells.

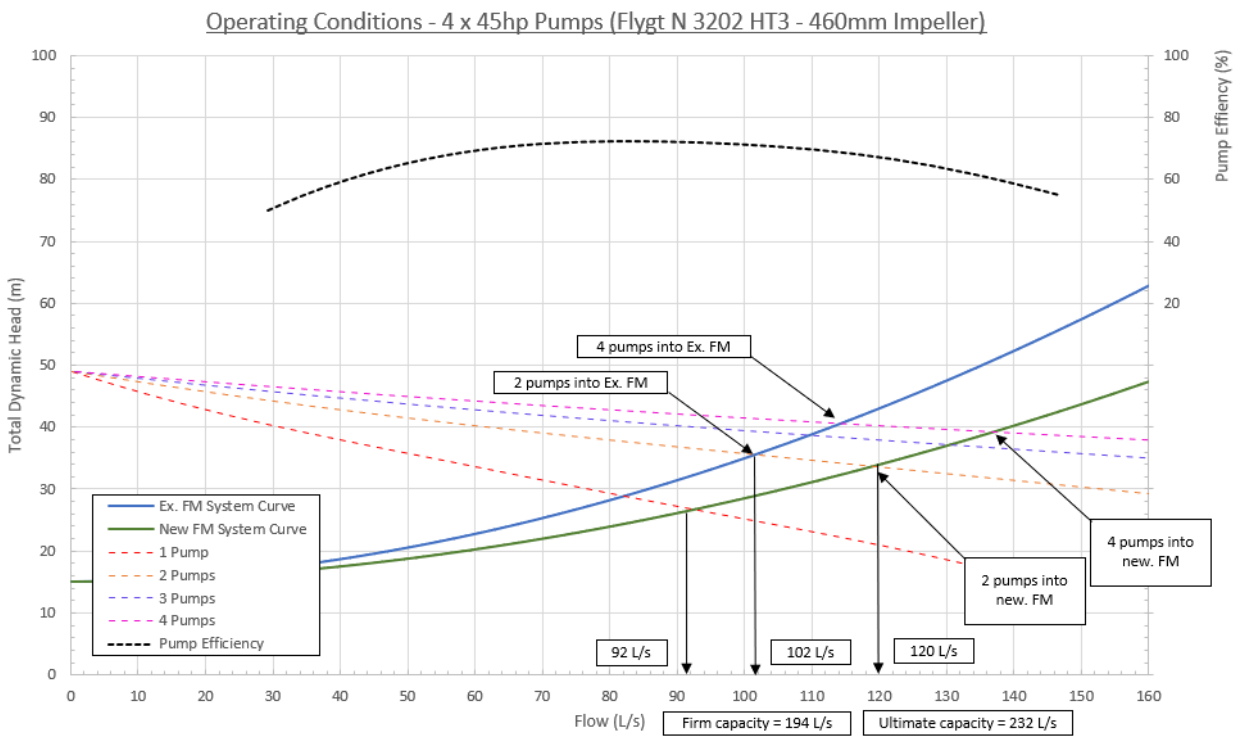
Based on the flow and head conditions anticipated, along with site spatial constraints, we are proposing a quad-plex submersible station that will function with a typical lead/lag arrangement. The system will include dual forcemains for redundancy during normal conditions, but with the ability to operate simultaneously during extreme peak wet weather events. Two pumps will operate into two independent, but connected forcemains.

Firm vs Ultimate Capacity

Ultimate capacity of a wastewater pumping station is the full flow under fully operational conditions. In our case, 4 pumps operating simultaneously into 2 forcemains.

Firm capacity, on the other hand, is the limiting factor. It is defined as the output capacity of the station with the largest pump out of service. This accounts for the possibility of peak flows occurring during a period when the largest pump is out of service and the station needs to remain operational.

Based on the above noted design flows, the following figure demonstrates the proposed station's firm and ultimate capacity:



- *Figure 8: Proposed System Curve*

-

Forcemain Sizing

The system curve presented above demonstrates the proposed operating hydraulic parameters of the proposed WWPS. The system proposed is comprised of 4 pumps and 2 forcemains, re-using a portion of the existing forcemain from 390 Waverley to Jaybe Drive.

A key factor in determining the size of the forcemain in the system curve is the velocities experienced at peak flow. The ACWWA guidelines specify a range of 0.8 to 2 m/s. Lower velocities can lead to solids deposition and not achieving adequate cleansing inside the pipe. Conversely, higher velocities can lead to sever vibration, high pressures and dynamic losses, as well as cavitation and premature pipe failure.

According to the duty points identified on this system curve, 2 pumps operating in the existing forcemain produce a total flow of 102 L/s. Since a portion of the existing forcemain is 250 mm in diameter, this equates to a maximum velocity of approximately **2.08 m/s**. 2 pumps operating into a new 300 mm diameter forcemain produce 120 L/s, which equates to a velocity of approximately 1.70 m/s. Although the velocity within the 250 mm diameter portion of the existing forcemain is slightly higher than the typical range, given the significant total length of forcemain, increasing the diameter will significantly increase the total volume of effluent that will be required to evacuate the forcemain. This is a particularly important consideration for a phased development such as Port Wallace. In the early stages of development, the flows to the station will be much smaller than ultimately designed for. This can lead to long durations between pump cycles, meaning effluent can sit within the forcemain for long periods of time before being discharged to the receiving system. For this reason, the proposed system is intentionally closer to the upper range of the acceptable velocities.

Odour Control

As alluded to above, phased developments present a unique challenge in terms of infrastructure sizing: the underground primary infrastructure should be sized to accommodate the full buildout of the development, but during the initial phases of development, only a small fraction of the flows will be realized. This can lead to long cycle times in wetwells and long turnover times in forcemains, which in turn can lead to deposition and septicity, which lead to major gas and odour problems.

To mitigate these risks, the proposed system will include the following design elements:

- ‘Calibrated’ theoretical design flow rates;
- Optimized (not oversized) infrastructure sizing (pumps, pipes, wetwells, etc);
- VFD controlled pumps to allow wide range of operating conditions;
- Variable pump control (float) settings to allow for easy adjustment of cycle settings as development progresses;
- Intentionally achieving slightly elevated velocities to minimize pipe turnover times and maximize self cleansing inside forcemains;
- Odour control at strategic locations (wetwell, ARV chambers, and gravity discharge manhole);

Closing

This briefing report was intended to provide context and rationale for the proposed hydraulic parameters used in the design of the Port Wallace WWPS. If you are satisfied with this rationale, detailed design of the station and forcemain system will proceed under this logic; with further details being provided as design progresses.

If you have any questions or concerns, or should you require any further information, please feel free to contact the undersigned at your earliest convenience.

Thank you,
DesignPoint Engineering & Surveying Ltd.

Evan Teasdale, P.Eng.
Project Engineer & Principal

APPENDIX A – WEST BEDFORD HOLLYHOCK PUMPING STATION DRAINAGE MAP

FORECAST LEGEND

OCCUPANCY BY COLOR CODE

- 2018 (OCCUPIED)
- 2019
- 2020
- 2021
- 2022
- 2023

TEMPORARY SANITARY DIVERSION
DOWN GARY MARTIN DR TO
HOLLYHOCK PS

FG 479

B

FG 478

A

BROAD ST

LARRY UTECK BLVD

GARY MARTIN DR

ASPENHILL COURT

HAZELTON HILL

BERNARD ST

SAMIA DR

BRAINWELL CRES

SEROTINA LANE

GRAYMINDER DR

ABRAHAM DR

ABRAHAM AVE

EVANGELINE LANE

MORYA EVERSONS

ARBUTUS AVE

BRADFORD PL

CRAMFIELD COURT

AMESBURY CRES

MC GREGOR LANE

BELLE ST

BLUE MOUNTAIN DRIVE

ARBOR WAY

TERRADORE

ROAD 8-5

ROAD 8-4

ROAD 8-2A

ROAD 8-1A

ROAD 8-1

BREAKTRAIL DR

CAIRNSTONE LANE

PARK

PS

NEAR RDW

40846404

40846396

40846387

40846367

40846187

41060185

ATTACHMENT I

Port Wallce - Water CCC Charge Summary

Cost of Oversized Water Infrastructure	**(A)**	$	6,172,411.54		
Interest During Construction	**(B)**	$	128,818	**Note 1**	
Total Cost of Oversized Water Infrastructure Installed	**(C) = (A) + (B)**	$	6,301,230		
Portion to be deducted, Fire Protection paid by the Municipality	**(D) = (C) * 29.0%**	$	1,827,357		
Net Capital Cost Contribution (Water)	**(E) = (C) - (D)**	$	4,473,873		
Portion to be deducted, Benefit to Existing paid by Halifax Water	**(F) = (E) * 29.9%**	$	1,336,440		
Net Capital Cost Contribution (Water)	**(G) = (E) - (F)**	$	3,137,433		
Inflation Adjustment	**(G') = Inflation Adjustment**	$	(652,448)	**Note 2**	
Total Capital Cost Contribution (Water)	**(G") = (G) + (G')**	$	2,484,985		
Area of land that can be developed	**(H)**		785.274	acres	
Capital Cost Contribution (Water) charge (base year 2024, prior to density factor)	**(I) = (G") / (H)**	**$**	**3,164.48**	**per acre**	**base year 2024**

Note 1: Interest during construction 2.124%

Note 2: Inflation Adjustment, in the absence of inflation factors applied to the CCC charge, equals the amount of financing charges.
The presence of an inflationary adjustment for the charge changes this amount so that the per person charge in year 1 can be calculated.
Inflation factors are applied annually to the base charge.

ATTACHMENT J

Port Wallace - Wastewater CCC Charge Summary

Cost of the Port Wallace Utility Corridor (Water, Wastewater, Gas & Municipal Flatworks)	**(A)**	$	30,757,273	
Interest During Construction (CCC Costs are actual tendered amounts, IDC not necessary)	**(B)**	$	-	**Note 1**
Total Cost of the Port Wallace Utility Corridor	**(C) = (A) + (B)**	$	30,757,273	
Portion to be deducted, Port Wallace Water Transmission Main Project	**(D1)**	$	9,967,811	
Portion to be deducted, WW Infrastructure benefitting Halifax Water Customers	**(D2)**	$	4,357,413	**Note 2**
Portion to be deducted, Infrastructure benefitting Halifax Reigonal Municipality	**(E)**	$	4,748,663	
Portion to be deducted, Infrastructure benefitting Eastward Energy	**(F)**	$	2,219,682	
Net Capital Cost Contribution (Wastewater)	**(G) = (C) - (D1) - (D2) - (E) - (F)**	$	9,463,703	
Inflation Adjustment	**(G') = Inflation Adjustment**	$	247,688.40	**Note 3**
Total Capital Cost Contribution (Wastewater) - Developer Benefit	**(G'') = (G) + (G')**	$	9,711,392	
Area of land that can be developed	**(H)**		785.274	acres
Capital Cost Contribution (Wastewater) charge (base year 2024, prior to density factor)	**(I) = (G'') / (H)**	**$**	**12,366.89**	**per acre base year 2024**

Note 1: Port Wallace Utility Corridor project will be tendered spring 2024, all CCC components will be built day one, costs are actual tender values, interest during contruction is not necessary in this calcualtion.

Note 2: 29.3% Benefit to Halifax Water Existing Customers on wastewater components of the Utility Coordior only.

Note 3: Inflation Adjustment, in the absence of inflation factors applied to the CCC charge, equals the amount of financing charges. The presence of an inflationary adjustment for the charge changes this amount so that the per person charge in year 1 can be calculated. Inflation factors are applied annually to the base charge.

TO: Colleen Rollings, P.Eng., PMP., Chair, and Members of the Halifax Regional Water Commission Board

SUBMITTED BY:

Digitally signed by Colin Waddell
Date: 2024.01.19 13:16:24 -04'00'

Colin Waddell. CEng MIET, CMgr MCMI, MIoL, Acting Director, Operations

Digitally signed by Kenda MacKenzie
Date: 2024.01.19 10:41:57 -04'00'

Kenda MacKenzie, P.Eng. Director, Regulatory Compliance Services

Digitally signed by Cindy MacLean
Date: 2024.01.17 10:01:58 -04'00'

Cindy MacLean, Supervisor, Human Resources

APPROVED: Tareq Al-Zabet

Digitally signed by Tareq Al-Zabet
Date: 2024.01.19 13:26:03 -04'00'

Tareq Al-Zabet, Ph.D., CEO & General Manager

SUBJECT: **Operational Performance Information Report**

INFORMATION REPORT

ORIGIN:

Regular update.

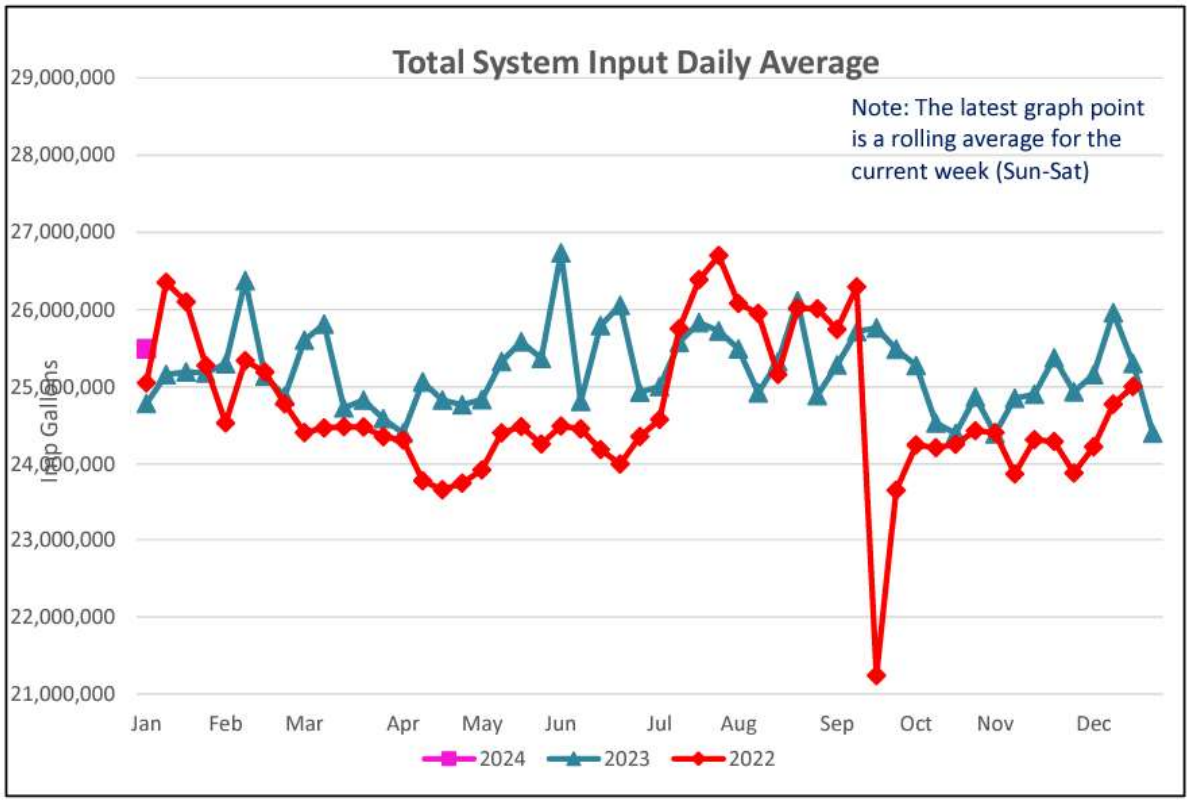
This report provides a high level overview of operational performance for the utility. The safety statistics results are first, followed by indicators and statistics for water and wastewater.

SAFETY STATISTICS – October 1, 2023 – December 31, 2023

Organizational Metrics	Q3 Oct 1 to Dec 31	CBS Target 2023-24
Lost Time Incident Reporting (LTIR) (Lost Time Cases x 200,000 / Total Employee Hours Worked)	2.37	3
Safe Driving (Number of traffic accidents per 1,000,000 km driven)	4.87	4
Workplace inspections conducted	114	Score
Safety Talks conducted (reported at the end of each quarter)	54%	85%
High Potential/Near Miss	19	N/A
Employees on accommodation or gradual return to work	13	N/A
WCB claims	6	N/A
Work refusals	0	N/A
Incidents with written compliance orders	0	0-2
Employees trained or recertified before due date	253	85%
• Courses Taken	425	N/A

* Percentage Data generated at year end due to variants in system data (ie. multiple certifications required for one employee)

AVERAGE DAILY WATER PRODUCTION



* The decrease from the end of September/beginning of October 2022 is due to the system being out for a significant amount of time during Fiona resulting in data gaps.

Regional Water Main Break/Leak Data		
Year	**Total Breaks/Leaks**	**Current 12 Month Rolling Total** ***(up to December 2023)***
2022/23	176	**196**
2021/22	232	
2020/21	179	
2019/20	191	
2018/19	226	
Total	**1004**	
Yr. Avg.	**200.8**	

Water Accountability
Losses per Service Connection/Day (International Water Association Standard)
Period Ending December 31, 2023
Real Losses: 195 litres CBS Target: 160 - 170

COMPLIANCE SUMMARY

Water Safety Plan Objectives 2023-2024 Q3				
Objective	Total Sites	% Sites Achieving Target	All Sites: 90th Percentile < 15 µg/L	CBSC Awarded Points
Disinfection	63	100%	---	20
Total Trihalomethanes	25	76%	---	0
Haloacetic Acids	21	95%	---	16
Particle Removal	5	98%	---	18
Corrosion Control	123	---	2.25	20
Summary Total				74

Score: 74/100

Bacteriological Results (% Samples absent of Total Coliforms) 99.84%

In this report each facility is assessed using monthly or quarterly averages, depending on the averaging period specified in its Approval to Operate.

Wastewater Treatment Facility Monthly Compliance Summary

Wastewater Treatment Facility	October-23								November-23								December-23								Toxicity
	$CBOD_5$ (mg/L)		TSS (mg/L)		E. coli (counts/ 100mL)		pH		$CBOD_5$ (mg/L)		TSS (mg/L)		E. coli (counts/ 100mL)		pH		$CBOD_5$ (mg/L)		TSS (mg/L)		E. coli (counts/ 100mL)		pH		
	NSECC Limit	Avg.	NSECC Limit	Avg.	NSECC Limit	Avg.	NSECC Limit	Avg.	NSECC Limit	Avg.	NSECC Limit	Avg.	NSECC Limit	Avg.	NSECC Limit	Avg.	NSECC Limit	Avg.	NSECC Limit	Avg.	NSECC Limit	Avg.	NSECC Limit	Avg.	
Halifax	50	62	40	61	5000	22,448	6-9	6.9	50	48	40	45	5000	0*	6-9	6.9	50	51	40	69	5000	0*	6-9	6.8	Not acutely lethal
Dartmouth	50	39	40	17	5000	164	6-9	6.8	50	46	40	45	5000	0*	6-9	6.8	50	38	40	30	5000	0*	6-9	6.7	Not acutely lethal
Herring Cove	50	18	40	11	5000	33	6-9	7.0	50	19	40	11	5000	0*	6-9	6.9	50	17	40	8	5000	11	6-9	6.6	Not acutely lethal
Eastern Passage	25	6	25	6	200	79	6-9	7.2	25	4	25	5	200	0*	6-9	7.2	25	9	25	6	200	0*	6-9	6.9	Not acutely lethal
Mill Cove	25	14	25	15	200	86	6-9	6.4	25	16	25	15	200	28	6-9	6.5	25	15	25	17	200	34	6-9	6.6	Not acutely lethal

*Seasonal Disinfection in effect November 1 through April 30

* E.coli is not measured during Seasonal Disinfection November 1 to April 30 (except HCWWTF December 25 to January2).

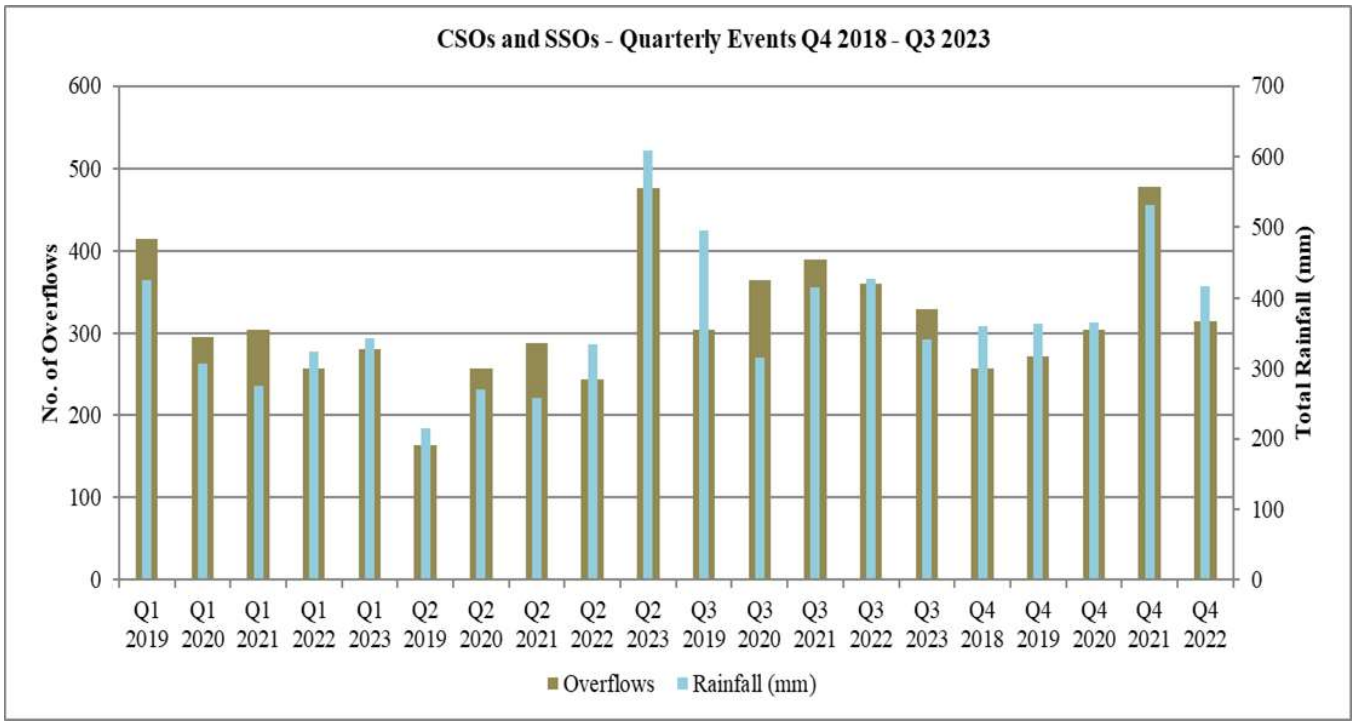
Wastewater Treatment Facility Quarterly Compliance Summary
October, November, and December 2023

Wastewater Treatment Facility	$CBOD_5$ (mg/L)		TSS (mg/L)		E. coli (counts/ 100mL)		pH		Ammonia (mg/L)		Phosphorous (mg/L)		TRC (mg/L)		Dissolved Oxygen (mg/L)		Toxicity
	NSECC Limit	Avg.	NSECC Limit	Avg.	NSECC Limit	Avg.	NSECC Limit	Avg.	NSECC Limit	Avg.	NSECC Limit	Avg.	NSECC Limit	Avg.	NSECC Limit	Avg.	
Springfield	20	4	20	14	200	20	6-9	6.7	-		-		-		-		-
Frame	20	2	20	1	200	10	6-9	6.9	-		-		-		-		-
Middle Musq.	20	5	20	5	200	25	6-9	7.0	-		-		-		-		-
Uplands	20	7	20	7	200	111	6-9	6.8	-		-		-		-		-
Aerotech	5	3	5	1	200	10	6-9	7.2	5.7 W 1.2 S	0.1	0.13	0.04	-		6.5	8.1	Not acutely lethal
North Preston	10	4	10	21	200	13	6-9	6.6	3	0.1	1.5	0.5	-		-		-
Lockview	20	3	20	10	200	242	6.5-9	6.8	8.0 S	0.4	1.2 S	0.6	-		-		-
Steeves (Wellington)	20	2	20	1	200	10	6.5-9	7.1	14.4 S	0.1	1.0 S	0.1	-		-		-
BLT	15	4	20	14	200	12	6-9	7.3	5 W 3 S	1	3 W 1 S	1	0.02 *	0.10	-		Not acutely lethal

NOTES & ACRONYMS:
$CBOD_5$ - Carbonaceous 5-Day Biochemical Oxygen Demand
TSS - Total Suspended Solids
* TRC - Total Residual Chlorine - Bureau Veritas can only measure 0.10 mg/L residual; results of 0.1 mg/L are compliant
BDL - Below Detection Limit
W / S - Winter / Summer compliance limits
NSECC requires monthly averages be less than the NSECC Compliance Limit for each parameter at Dartmouth, E'n Passage, Halifax, Herring Cove, Mill Cove
NSECC requires quarterly averages be less than the NSECC Compliance Limit for each parameter at Aerotech, Lockview, Middle Musquodoboit, Frame, BLT, Uplands and Springfield Lake
NSECC requires annual averages be less than the NSECC Compliance Limit for each parameter at North Preston and Steeves

LEGEND
NSECC Compliant
NSECC Non-Compliant

NON-COMPLIANCE EXPLANATIONS:
Halifax WWTF: Operating on single treatment train under TBA October and November. Operating on single treatment train during emerg. work in December.
Dartmouth WWTF: High influent flow events (precipitation-based) in November created operational difficulty.
North Preston WWTF: High influent flow events (precipitation-based) in November created operational difficulty.
Lockview (MacPherson) WWTF: October and December results affected by issues with the sand filter treatment process.



NOTES & ACRONYMS: CSO - Combined Sewer Overflow SSO - Sanitary Sewer Overflow

Rainfall data is from Halifax Water's rain gauge at the Halifax WWTF.

There were twenty overflows in Q3 beginning on days when there was no recorded rainfall, as follows:

1. October 1: The CSO at Maitland St PS & CSO was due to a blockage caused by debris.
2. October 7: The CSO at Sackville St CSO was due to a blockage caused by debris.
3. October 12: The CSOs at Chain Rock PS & CSO were due to rain on the previous day.
4. October 14: The CSO at Chain Rock PS & CSO was due to increased flow to the CSO for an undetermined reason.
5. November 15: The CSO at Chain Rock PS & CSO was the result of work that was being undertaken at a nearby pump station.
6. November 19: The CSOs at Maitland St PS & CSO were due to rain on the previous day and a pump issue.
7. November 24: The CSO at Ferguson Rd CSO was due to rain on the previous day.
8. December 12: The CSO at Old Ferry Rd PS & CSO was due to an intentional flow restriction to facilitate debris removal from the influent waste stream at the Dartmouth WWTF.
9. December 16: The SSO at Governors Glen PS was due to a pump issue.
10. December 22: The CSO at Upper Water St CSO was due to a blockage caused by debris.

11. December 23: The CSO at Upper Water St CSO was due to a blockage caused by debris.

12. December 24: The CSO at Upper Water St CSO was due to a blockage caused by debris.

13. December 25: The CSO at Upper Water St CSO was due to a blockage caused by debris.

14. December 26: The CSO at Upper Water St CSO was due to a blockage caused by debris.

ITEM #2-I
Halifax Water Board
January 25, 2024

Halifax Water Compliance Statement
Quarterly Certification

For the period of October 1, 2023 to December 31, 2023

We hereby certify that the Halifax Regional Water Commission is current in making all statutory remittances for payroll taxes, Harmonized Sales Tax and other remittances as required under the laws of the Government of Canada and its Provinces (the significant remittances are noted in the appendix) and that all significant legal claims have been disclosed.

Digitally signed by Kenda Signature
Date: 2024.01.23 13:51:56 -04'00'

Kenda MacKenzie, P.Eng.
Acting CEO and General Manager

Louis de Montbrun
Digitally signed by Louis de Montbrun
Date: 2024.01.22 09:13:25 -04'00'

Louis de Montbrun, CPA, CA
Director, Corporate Services/CFO

Dated:

January 19, 2024

Halifax Water Compliance Statement
Quarterly Certification
Appendix I

Significant statutory remittances for payroll taxes, Harmonized Sales Tax and other remittances as required under the laws of the Government of Canada and its Provinces for the Halifax Regional Water Commission.

Statutory Payroll Remittances

- **Canada Revenue Agency (CRA) -** Statutory employee payroll deductions and employer related contributions for:
  - Income Tax
  - Canada Pension Plan (CPP)
  - Employment Insurance (EI)

- **Workers' Compensation Board of Nova Scotia (WCB)** – Employer remittance based on employee payroll

Other Payroll Remittances

- **Northern Trust -** Employee payroll deductions and employer contributions to Halifax Water and HRM defined benefit pension plans

- **Industrial Alliance** – employer and employee contributions to defined contribution pension plan

- **Medavie Blue Cross & SSQ** – employee payroll deductions and employer related contributions for Health & dental, LTD, and Life benefit coverage, and payroll deductions for AD&D

- **Canadian Union of Public Employees** – Employee payroll deductions of union dues
  - CUPE Local 227
  - CUPE Local 1431

HST and Other Remittances

- **Canada Revenue Agency (CRA) -** Harmonized Sales Tax (HST) is filed online and a refund issued as HST paid is greater than HST collected

- **Workers' Compensation Board of Nova Scotia (WCB)** – Remittance for sub-contractors

ITEM #2-I
HRWC BOARD
January 25, 2024

Quarterly Remittance Certification

Appendix II

Period: **October to December** **2023/2024**

Vendor	Vendor #	Items Remitted	Total remitted	Exceptions
Statutory Payroll Remittances				
CRA	174	Tax, CPP, EI, WCB	$3,985,498.68	
Other Payroll				
Northern Trust	1215	HW Pension Plan	$ 2,331,416.54	
Northern Trust	1216	HRM Pension Plan	$ 228,714.75	
Manulife Financial	1171	Bedford Pension Plan	$ 2,210.97	
Industrial Alliance	2971	DCPP	$ 20,727.20	
Medavie Blue Cross	340, 3101	Health, Dental, Life, LTD	$ 987,835.61	
SSQ Insurance	429	AD&D	$ 6,662.71	
CUPE	160	Union Dues 1431	$ 40,630.61	
CUPE	3517	Union Dues 227	$ 63,811.76	
HST and Other				
CRA	N/A	HST (refunds)	$ (3,434,092.08)	
Receiver General	210	WCB subcontractors	$ -	

Other payroll items remitted in accordance with stated requirements:

United Way, Credit Union, Garnishments (WCB, CRA, Family Court, Sherriff's Office), Water for People, Salvation Army, Racially Visible Caucus

Exceptions, errors and/or late remittances

ITEM #3-I
Halifax Water Board
January 25, 2024

TO: Colleen Rollings, P.Eng., PMP, Chair, and Members of the Halifax Regional Water Commission Board as Trustees of the Halifax Regional Water Commission Employees' Pension Plan

SUBMITTED BY: Louis de Montbrun Digitally signed by Louis de Montbrun Date: 2024.01.19 10:38:43 -04'00'

Louis de Montbrun, CPA, CA, Director, Corporate Services / CFO

APPROVED:

Tareq Al-Zabet, Ph.D., CRSP, P.Geo, CEO & General Manager

DATE: January 11, 2024

SUBJECT: **Halifax Regional Municipality Master Trust Investment Performance, Third Quarter, 2023**

INFORMATION REPORT

ORIGIN

The Halifax Regional Municipality Master Trust (the "Master Trust") investment performance is reported to the Halifax Regional Water Commission Board as Trustees of the Halifax Regional Water Commission Employees' Pension Plan periodically throughout the year.

BACKGROUND

None.

DISCUSSION

The table below and the attached Investment Report provide a performance update for the Third Quarter of 2023 (January to September) for the Master Trust, of which Halifax Regional Water Commission Employees' Pension Plan (the "Plan") is a part. The fair value of the investment in the Master Trust is determined and updated at year-end, and the Plan's share in the Master Trust at December 31, 2022 was 6.56%, totaling $173.0 million.

The Master Trust earned 0.09% in the Third Quarter, which outperformed the Third Quarter policy benchmark of -0.26% by 0.35%. The return for the 1-year period ended September 30, 2023, is

10.62%, underperforming the 1-year policy benchmark of 11.0% by -0.38%. Other historical returns are provided in Table 1 below.

Table 1 – Returns

	Current Quarter (Jul to Sep)	1-Year	3 - Year Annualized	4 - Year Annualized	Inception To Date
Fund Return	0.09%	10.62%	7.37%	7.05%	7.06%
Policy Benchmark	-0.26%	11.00%	4.33%	4.80%	5.50%
Excess Return	0.35%	-0.38%	3.04%	2.25%	1.56%

The total fund returns are subject to investment management fees and plan expenses.

As at September 30, 2023, the Master Trust was in compliance with the Statement of Investment Policies and Procedures (SIP&P).

ATTACHMENT

Attachment 1 – HRM Master Trust Investment Performance Q3 2023

Attachment 2 – HRM Master Trust Investment Risk & Analytical Services Q3 2023

Report Prepared by: Heather Britten

Digitally signed by Heather Britten
Date: 2024.01.19 10:42:45 -04'00'

Heather S. Britten, Quality Assurance Officer (782) 641- 1431

Plan Performance

Plan Performance Summary

	Q3	YTD	1 year	4 year
Total Plan	0.1%	5.2%	10.6%	7.0%
Benchmark	-0.3%	6.5%	11.0%	4.8%
Value Add	0.4%	-1.3%	-0.4%	2.2%

	Q3	YTD	1 year	4 year
Equities	-0.1%	6.7%	16.5%	6.3%
Benchmark	-1.5%	7.7%	17.2%	7.2%
Value Add	1.4%	-1.0%	-0.7%	-0.9%

	Q3	YTD	1 year	4 year
Fixed Income	-1.1%	1.7%	3.0%	1.6%
Benchmark	-2.6%	-0.3%	0.3%	-0.9%
Value Add	1.5%	2.0%	2.7%	2.5%

Plan Performance Summary

	Q3	YTD	1 year	4 year
Real Assets	1.4%	7.0%		
Benchmark	2.1%	6.3%		
Value Add	-0.7%	0.7%		

	Q3	YTD	1 year	4 year
Public Market Alternatives	2.0%	3.4%	5.9%	
Benchmark	2.1%	6.3%	8.4%	
Value Add	-0.1%	-2.9%	-2.5%	

Consent Agenda Item No. 1

HRM Master Trust

Investment Risk & Analytical Services

September 30, 2023

Table of Contents

SECTION 1

HRM Master Trust

Investment Risk & Analytical Services

September 30, 2023

Market Overview

MARKET OVERVIEW - THIRD QUARTER 2023

PROVIDED BY NORTHERN TRUST ASSET MANAGEMENT

IT'S A MARATHON... As most of the world's population exits summer, marathon season resumes – with two of the six majors* (Berlin and Chicago) bookending the start and end of the third quarter, and New York coming up in November. The "it's a marathon, not a sprint" analogy is (too) often used to assess investment portfolio performance, but a marathon analogy also applies nicely to current economic dynamics.

Who's winning? The three global economic epicenters – the United States, the European Union and China – have had varying levels of speed and stamina over this post-pandemic** economic marathon. The U.S. economy – fueled by a large fiscal energy boost and harnessing a strong monetary tailwind out of the gate – has grown 5.3% annually in real terms. Adding a hot 5.6% post-pandemic inflation level to the strong real growth has resulted in double-digit nominal economic growth – a speed not seen in the U.S. since the 1970s. This combo led to strong equity returns, with the S&P 500 rising at a 17.4% annualized clip from post-pandemic stabilization. Europe is modestly off America's pace due to energy security challenges, despite also biting off some of the fiscal stimulus energy bar and enjoying an early easy money tailwind. Post-pandemic splits include 6.0% annualized real economic growth (heavily influenced by an 11.5% quarter out of the gate); a 5.7% annualized rate of inflation; and a 12.7% annualized equity market return (MSCI Europe). But, as the monetary tailwind turned to a stiff headwind, Europe has hit a bit of the proverbial wall –falling back from the U.S. toward a materially slowing China. Reliable economic data is lacking, but Chinese growth is clearly deteriorating in the face of elevated debt levels amid an already slow post-pandemic reopening. Reflecting these challenges, China's stock market has posted a -5.5% post-pandemic annual split (MSCI China).

An economic second wind. As Europe and China fade, there is some evidence that the U.S. may have found its economic "second wind". Once a forgone conclusion that the U.S. would fall prey to recession, most forecasters are now calling for this economic landing to be prefixed with "soft" (inflation falls without the recession) or even "no" (as in no recession but also no respite from high inflation). The consumer will play a large part in this determination. Here, it seems they have the willingness to keep going (thanks to a still-strong job market) but may not have the capacity (as gas prices move higher, mortgage rates hit new highs and student loan debt payments resume). That internal struggle will define where the economic "finish line" sits.

Runner's high? Despite the economic uncertainty, stock market valuations, notably in the U.S., remain elevated – driven, in large part, by the tech sector and the promise of AI. Indeed, whether AI serves as a mere near-term "sugar rush" or a longer-lived (and quickly harnessed) support will go a long way toward determining how this race ends.

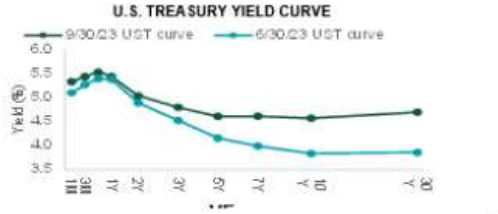
THIRD QUARTER 2023 TOTAL RETURNS (%)

Natural resources, cash and high yield were the only major assets that didn't stop for breath last quarter.

Source: Northern Trust Asset Management, Bloomberg. NR: Natural Resources; GRE: Global Real Estate; GLI: Global Listed Infrastructure.

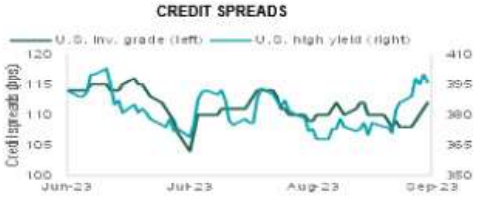
Interest Rates

Duration-sensitive assets took a hit as interest rates rose to cycle highs. After hiking in July, the Fed opted to hold its policy rate at 5.5% in September. But it was a hawkish hold given meaningful upward revisions to its median policy rate and economic growth projections. Short-end yields saw modest upward pressure as investors repriced a higher-for-longer policy path. Back-end yields saw more significant upward moves (e.g., 30-year yield was up 84 basis points), with surprising economic durability helping drive a surge in real yields.



Credit Markets

Credit spreads were mostly rangebound and ended the quarter little changed overall. Investment grade spreads narrowed 2 basis points (bps) to 112 bps and high yield widened 4 bps to 396 bps. High yield (+0.5%) returned more than investment grade fixed income (-3.2%) as higher income yields and less interest-rate sensitivity supported relative performance. Concerns of a default wave resulting from central bank tightening and/or other sources of economic strain were well contained with strong performance across lower-quality credits.



Equities

Traditional stock-bond diversification provided little respite as fixed income declines coincided with global equity losses (-3.3%). Equity weakness extended across regions, with only small and temporary boosts to emerging markets from China stimulus. Early-quarter strength came from upside surprises across economic growth data amid lower inflation prints and talks of final policy rate hikes. Returns hooked lower once economic durability fed into higher interest rates, pressuring equities priced for a mostly benign economic outcome.

Real Assets

Natural resources (+3.7%) was one of the few bright spots in a quarter where most assets moved lower. Higher energy prices drove most of the gain as oil prices broke out to the upside. Global real estate (GRE, -4.9%) and global listed infrastructure (GLI, -7.3%) severely lagged natural resources and to a smaller but still meaningful extent lagged global equities (-3.3%). All sectors within both GRE and GLI posted losses, suggesting that macro pressures from higher interest rates and negative market sentiment were at play.

MARKET EVENTS

JULY	AUGUST	SEPTEMBER
7 Nonfarm payrolls report is not as strong as feared, helping ease concern on labor market overheating from strong ADP jobs data released the prior day.	1 Fitch downgrades its U.S. sovereign credit rating because of expected fiscal deterioration over the coming years and an erosion of confidence in governance.	1 U.S. jobs data shows orderly loosening, adding to soft landing hopes fueled by benign inflation and solid consumer spending data the day before.
12 Financial markets embrace lower U.S. Consumer Price Index (CPI) prints, with modest month-over-month changes in headline and core (0.2%).	8 China CPI moves into negative territory as it contends with weak trade, high youth unemployment and ongoing property- and debt-related stresses.	14 The ECB raises its key policy rate by 25 bps, but its statement language hints that it is likely done hiking for now.
17 Wheat and other agricultural-related commodities see volatility after Russia backs out of the Black Sea grain deal.	16 U.K. core CPI remains unchanged at a high level of 6.9% year-over-year – a worrisome development for the Bank of England given accelerating wages.	20 The Fed holds its policy rate, but the press conference and updated Summary of Economic Projections signal a higher-for-longer policy path.
26 The Fed hikes by 25 basis points (bps) to 5.25-5.50% – the last rate hike of the cycle that investors anticipate.	18 Rising interest rates weigh on equities with the 30-year Treasury yield hitting its highest level since 2011 (rises about 40 bps more through quarter-end).	29 Strikes broaden to more plants at the three largest U.S. automakers, with the walkouts poised to enter week three.
27 The European Central Bank (ECB) hikes by 25 bps, but moving forward it signals a more data-dependent approach versus a bias to tighten.	25 No surprises from Fed Chair Powell at Jackson Hole with Powell noting inflation remains too high and the Fed is prepared to raise rates more if needed.	30 U.S. unexpectedly avoids government shutdown after last-minute deal provides funding at current levels for six more weeks.

IMPORTANT INFORMATION

Indexes used: Bloomberg Barclays (BBC) 1-3 Month UST (Cash); BBC Municipal (Muni); BBC Aggregate (Inv. Grade); BBC TIPS (TIPS); BBC High Yield 2% Capped (High Yield); JP Morgan GBI-EM Global Diversified (Em. Markets Fixed Income); MSCI U.S. Equities IMI (U.S. Equities); MSCI World ex-U.S. IMI (Dev. ex-U.S. Equities); MSCI Emerging Market Equities IMI (Em. Markets Equities); S&P Global Natural Resources (Natural Resources); MSCI ACWI IMI Core Real Estate (Global Real Estate); S&P Global Infrastructure (Global Listed Infrastructure).

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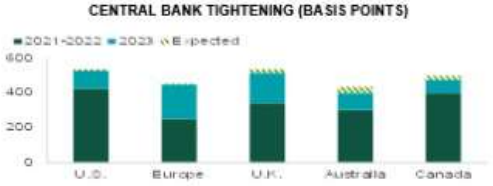
Past performance is no guarantee of future results. Performance returns and the principal value of an investment will fluctuate. Performance returns contained herein are subject to revision by Northern Trust. Comparative indices shown are provided as an indication of the performance of a particular segment of the capital markets and/or alternative strategies in general. Index performance returns do not reflect any management fees, transaction costs or expenses. It is not possible to invest directly in any index. For additional information on fees, please refer to Part 2a of the Form ADV or consult a Northern Trust representative.

Northern Trust Asset Management is composed of Northern Trust Investments, Inc. Northern Trust Global Investments Limited, Northern Trust Fund Managers (Ireland) Limited, Northern Trust Global Investments Japan, K.K, NT Global Advisors, Inc., 50 South Capital Advisors, LLC, Belvedere Advisors LLC, Northern Trust Asset Management Australia Pty Ltd, and investment personnel of The Northern Trust Company of Hong Kong Limited and The Northern Trust Company.

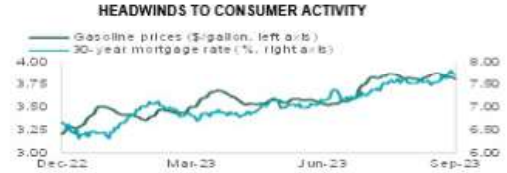
Approaching the Peak

The broader U.S. economic narrative around resilient – but softening – growth and moderating inflation gained traction. Hopes for a "soft landing" outcome have grown as 2023 recession forecasts have been phased out with more investor expectations around higher-for-longer monetary policy. In addition to the Fed, most major non-U.S. central banks appear to be nearing peak policy rates. Even the previously more-hawkish central banks have moderated their messaging to better balance growth concerns versus still-elevated core inflation.



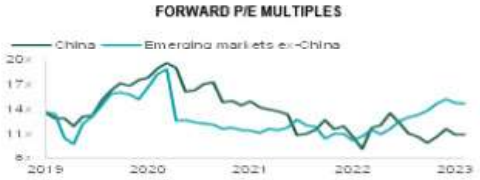
Consumer Challenges

Consumer activity has been a key driver of U.S. economic resilience. Consumers face building headwinds from the lagged and variable impacts of Fed tightening. Higher mortgage rates, rising gasoline prices and resumed student loan payments are all a direct drag on consumers plus broader issues (e.g., U.S. government shutdown risk and the auto labor strike). Consumers may still have an appetite to spend, but their capacity to do so is shrinking as pandemic savings are whittled down and credit card debt levels rise.



China Balance Sheet Woes

China's economic situation marks a reversal from initial optimism on a 2023 rebound. Structural economic challenges are at the forefront, including debt and the property sector. Recent policy support has not moved the needle on property sector confidence or investor sentiment. China's economy benefits from being largely self-financed, but there is no quick fix as economic actors grapple with debt reduction at a time of falling asset prices. China also faces drag from tensions with the West – creating opportunity for other EM countries.



No Place to Hide?

With muted 3Q returns in the largest tech-related stocks, the S&P 500 (market-cap-weighted) return was closer to its equal-weighted counterpart versus earlier in 2023. Broader U.S. Treasury indexes matched the S&P 500's 3% loss with the move higher in interest rates – leaving balanced portfolios in negative territory. On a more positive note, high yield fixed income posted a modest gain in 3Q (0.5%), showing how credit can enhance diversification in relation to traditional market (equity) and term (interest rate) exposures.

Investment Hierarchy

Account/Group	Ending Market Value CAD	Ending Weight	% Rate of Return One Month	Three Months	Year to Date	One Year	Three Years	Four Years	Ten Years	Inception to Date	Inception Date
HRM Master Trust	**2,760,482,042**	**100.00**	**-1.74**	**0.09**	**5.23**	**10.62**	**7.37**	**7.05**	**7.98**	**7.06**	**09/30/1999**
HRM Policy Benchmark			*-2.07*	*-0.26*	*6.50*	*11.00*	*4.33*	*4.80*	*5.82*	*5.50*	*09/30/1999*
Excess Return			*0.32*	*0.35*	*-1.28*	*-0.38*	*3.04*	*2.25*	*2.16*	*1.56*	*09/30/1999*
HRM Total Equity	**1,271,885,786**	**46.07**	**-2.81**	**-0.08**	**6.73**	**16.48**	**6.75**	**6.31**	**-**	**6.96**	**12/31/2015**
HRM Total Equity Benchmark			*-4.09*	*-1.53*	*7.67*	*17.17*	*7.06*	*7.23*	*-*	*7.74*	*12/31/2015*
Excess Return			*1.28*	*1.45*	*-0.94*	*-0.69*	*-0.31*	*-0.91*	*-*	*-0.77*	*12/31/2015*
HRM Cdn Equity	**101,943,726**	**3.69**	**-3.06**	**-1.67**	**2.97**	**9.63**	**9.48**	**5.66**	**4.80**	**4.55**	**03/31/2006**
S&P/TSX Composite			*-3.33*	*-2.20*	*3.38*	*9.54*	*9.88*	*7.32*	*7.54*	*5.85*	*03/31/2006*
Excess Return			*0.27*	*0.53*	*-0.41*	*0.09*	*-0.41*	*-1.66*	*-2.74*	*-1.30*	*03/31/2006*
Blackrock	**99,211,591**	**3.59**	**-3.50**	**-2.01**	**3.20**	**10.42**	**9.99**	**7.41**	**7.46**	**8.14**	**12/31/2003**
S&P/TSX Composite			*-3.33*	*-2.20*	*3.38*	*9.54*	*9.88*	*7.32*	*7.54*	*7.47*	*12/31/2003*
Excess Return			*-0.17*	*0.19*	*-0.18*	*0.88*	*0.10*	*0.09*	*-0.07*	*0.67*	*12/31/2003*
P2P Holdings	**2,732,135**	**0.10**	**15.91**	**12.41**	**-4.81**	**-12.78**	**-1.03**	**-12.74**	**-**	**-26.72**	**02/03/2017**
S&P/TSX Composite			*-3.33*	*-2.20*	*3.38*	*9.54*	*9.88*	*7.32*	*-*	*6.78*	*02/03/2017*
Excess Return			*19.24*	*14.61*	*-8.18*	*-22.32*	*-10.92*	*-20.06*	*-*	*-33.50*	*02/03/2017*
HRM Global Equity	**765,128,424**	**27.72**	**-4.06**	**-1.13**	**8.61**	**-**	**-**	**-**	**-**	**8.61**	**12/31/2022**
HRM Custom Global Equity Index			*-4.38*	*-1.60*	*9.20*	*-*	*-*	*-*	*-*	*9.20*	*12/31/2022*
Excess Return			*0.32*	*0.47*	*-0.59*	*-*	*-*	*-*	*-*	*-0.59*	*12/31/2022*
AB EDHEC	**136,788,176**	**4.96**	**-3.55**	**-0.45**	**6.91**	**18.02**	**8.06**	**6.57**	**-**	**7.40**	**12/31/2015**
MSCI World ND			*-4.38*	*-1.36*	*10.86*	*20.00*	*8.52*	*9.23*	*-*	*8.76*	*12/31/2015*
Excess Return			*0.83*	*0.91*	*-3.95*	*-1.98*	*-0.46*	*-2.66*	*-*	*-1.36*	*12/31/2015*
Blackrock Global Alpha Advanta	**125,523,286**	**4.55**	**-3.67**	**-0.06**	**13.75**	**25.49**	**-**	**-**	**-**	**6.34**	**05/25/2021**
MSCI ACWI ND			*-4.20*	*-1.30*	*9.82*	*18.86*	*-*	*-*	*-*	*3.44*	*05/25/2021*
Excess Return			*0.53*	*1.24*	*3.93*	*6.63*	*-*	*-*	*-*	*2.90*	*05/25/2021*
Blackrock MSCI Small Cap	**47,077,762**	**1.71**	**-5.30**	**-2.27**	**3.11**	**12.76**	**-**	**-**	**-**	**-1.04**	**05/19/2021**
MS Wld Small Cap Net Index			*-5.31*	*-2.31*	*2.70*	*12.17*	*-*	*-*	*-*	*-1.43*	*05/19/2021*
Excess Return			*0.01*	*0.04*	*0.41*	*0.60*	*-*	*-*	*-*	*0.39*	*05/19/2021*
Blackrock MSCI World Passive	**133,157,088**	**4.82**	**-4.35**	**-1.28**	**11.20**	**20.50**	**-**	**-**	**-**	**6.48**	**05/12/2021**
MSCI World ND			*-4.38*	*-1.36*	*10.86*	*20.00*	*-*	*-*	*-*	*6.08*	*05/12/2021*
Excess Return			*0.03*	*0.08*	*0.34*	*0.50*	*-*	*-*	*-*	*0.40*	*05/12/2021*
Global Alpha	**47,231,522**	**1.71**	**-6.47**	**-4.16**	**-1.33**	**5.77**	**-**	**-**	**-**	**-4.16**	**03/09/2022**
MS Wld Small Cap Net Index			*-5.31*	*-2.31*	*2.70*	*12.17*	*-*	*-*	*-*	*-0.93*	*03/09/2022*
Excess Return			*-1.16*	*-1.86*	*-4.03*	*-6.39*	*-*	*-*	*-*	*-3.23*	*03/09/2022*

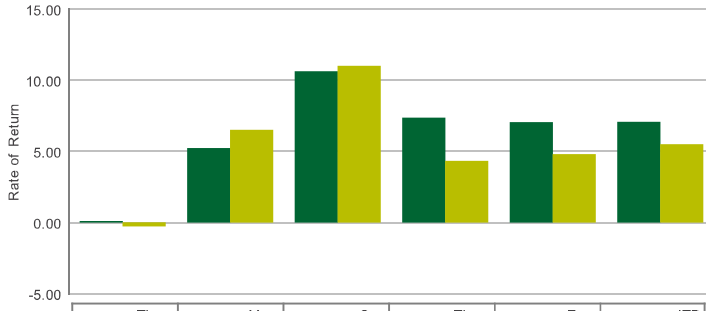
Account/Group	Ending Market Value CAD	Ending Weight	% Rate of Return One Month	Three Months	Year to Date	One Year	Three Years	Four Years	Ten Years	Inception to Date	Inception Date
Marathon International Equity	**66,715,060**	**2.42**	**-3.28**	**-1.48**	**6.63**	**24.06**	**-**	**-**	**-**	**0.59**	**05/28/2021**
MSCI EAFE ND			*-3.48*	*-2.03*	*6.85*	*23.63*	*-*	*-*	*-*	*1.40*	*05/28/2021*
Excess Return			*0.20*	*0.55*	*-0.21*	*0.43*	*-*	*-*	*-*	*-0.81*	*05/28/2021*
Mawer International Equity	**76,749,990**	**2.78**	**-3.58**	**-2.90**	**5.27**	**18.50**	**-**	**-**	**-**	**-0.87**	**02/28/2021**
MSCI ACWI ex USA ND			*-3.23*	*-1.68*	*5.11*	*18.46*	*-*	*-*	*-*	*-0.12*	*02/28/2021*
Excess Return			*-0.35*	*-1.22*	*0.16*	*0.04*	*-*	*-*	*-*	*-0.75*	*02/28/2021*
Wellington US Equity	**131,885,541**	**4.78**	**-3.98**	**-0.01**	**12.65**	**20.18**	**13.54**	**13.62**	**12.99**	**13.25**	**04/30/2011**
HRM US Equity			*-4.83*	*-1.17*	*12.82*	*19.67*	*12.15*	*12.33*	*11.95*	*11.87*	*04/30/2011*
Excess Return			*0.85*	*1.16*	*-0.17*	*0.52*	*1.39*	*1.29*	*1.05*	*1.38*	*04/30/2011*
HRM Emerging Markets	**94,665,507**	**3.43**	**-2.92**	**-0.34**	**3.29**	**11.45**	**-2.67**	**0.55**	**5.14**	**4.55**	**09/30/2010**
MSCI Emerging Markets ND			*-2.68*	*-0.82*	*1.60*	*9.91*	*-1.33*	*1.74*	*4.91*	*3.69*	*09/30/2010*
Excess Return			*-0.24*	*0.48*	*1.69*	*1.54*	*-1.34*	*-1.18*	*0.23*	*0.86*	*09/30/2010*
CC&L Emerging Markets	**41,869,951**	**1.52**	**-1.97**	**2.44**	**-**	**-**	**-**	**-**	**-**	**-**	**12/31/2022**
MSCI Emerging Markets ND			*-2.68*	*-0.82*	*1.60*	*-*	*-*	*-*	*-*	*1.60*	*12/31/2022*
Excess Return			*0.72*	*3.26*	*-*	*-*	*-*	*-*	*-*	*-*	*12/31/2022*
Trinetra Emerg Mrkts Grwth Fnd	**52,795,556**	**1.91**	**-3.66**	**-2.44**	**1.28**	**10.08**	**-3.46**	**0.59**	**-**	**1.83**	**08/31/2017**
MSCI Emerging Markets ND			*-2.68*	*-0.82*	*1.60*	*9.91*	*-1.33*	*1.74*	*-*	*1.51*	*08/31/2017*
Excess Return			*-0.98*	*-1.63*	*-0.32*	*0.18*	*-2.13*	*-1.15*	*-*	*0.32*	*08/31/2017*
HRM Private Equity	**310,148,129**	**11.24**	**0.52**	**3.16**	**4.07**	**3.64**	**22.65**	**19.07**	**20.17**	**20.32**	**09/30/2011**
HRM PE Benchmark			*-4.22*	*-0.87*	*12.50*	*14.28*	*9.00*	*8.29*	*7.15*	*7.05*	*09/30/2011*
Excess Return			*4.74*	*4.04*	*-8.44*	*-10.64*	*13.66*	*10.78*	*13.03*	*13.28*	*09/30/2011*
Private Equity	**310,148,129**	**11.24**	**0.52**	**3.16**	**4.07**	**3.64**	**22.65**	**19.07**	**20.17**	**20.32**	**09/30/2011**
HRM Total Fixed Income	**593,413,737**	**21.50**	**-1.07**	**-1.11**	**1.69**	**2.96**	**0.35**	**1.61**	**-**	**2.54**	**12/31/2015**
HRM FI Benchmark			*-1.90*	*-2.56*	*-0.27*	*0.29*	*-2.43*	*-0.86*	*-*	*0.76*	*12/31/2015*
Excess Return			*0.83*	*1.44*	*1.96*	*2.67*	*2.78*	*2.46*	*-*	*1.78*	*12/31/2015*
Cash and Cash Equivalents	**42,000,685**	**1.52**	**0.46**	**1.25**	**3.24**	**3.75**	**1.67**	**1.56**	**2.44**	**4.33**	**03/31/2009**
3M CAD Bankers Acceptance Rate			*0.46*	*1.38*	*3.99*	*5.23*	*2.51*	*2.18*	*1.68*	*1.49*	*03/31/2009*
Excess Return			*-0.00*	*-0.13*	*-0.76*	*-1.49*	*-0.84*	*-0.62*	*0.76*	*2.84*	*03/31/2009*
Lincluden CDOR	**42,000,685**	**1.52**	**0.46**	**1.25**	**3.24**	**3.75**	**1.65**	**1.78**	**-**	**1.69**	**12/31/2013**
3M CAD Bankers Acceptance Rate			*0.46*	*1.38*	*3.99*	*5.23*	*2.51*	*2.18*	*-*	*1.69*	*12/31/2013*
Excess Return			*-0.00*	*-0.13*	*-0.76*	*-1.49*	*-0.86*	*-0.40*	*-*	*-0.00*	*12/31/2013*
Global Credit	**75,755,866**	**2.74**	**-0.21**	**1.16**	**2.76**	**5.00**	**-**	**-**	**-**	**0.38**	**03/31/2022**
Global Credit Custom Benchmark			*-0.32*	*0.72*	*2.53*	*4.31*	*-*	*-*	*-*	*-0.15*	*03/31/2022*
Excess Return			*0.11*	*0.44*	*0.22*	*0.69*	*-*	*-*	*-*	*0.53*	*03/31/2022*

Account/Group	Ending Market Value CAD	Ending Weight	% Rate of Return								
			One Month	Three Months	Year to Date	One Year	Three Years	Four Years	Ten Years	Inception to Date	Inception Date
AB Global Credit	**75,755,866**	**2.74**	**-0.21**	**1.16**	**2.76**	**5.00**	**0.37**	**0.69**	**2.73**	**4.71**	**03/31/2009**
Global Credit Custom Benchmark			*-0.32*	*0.72*	*2.53*	*4.31*	-	-	-	-	*03/31/2009*
Excess Return			*0.11*	*0.44*	*0.22*	*0.69*	-	-	-	-	*03/31/2009*
North American Credit	**186,930,466**	**6.77**	**-0.15**	**0.85**	**5.20**	**7.04**	**5.68**	**6.94**	**-**	**5.80**	**12/31/2015**
HRM Custom Corporate Benchmark			*-0.77*	*-0.55*	*1.34*	*2.35*	*-2.84*	*-0.49*	-	*1.79*	*12/31/2015*
Excess Return			*0.62*	*1.40*	*3.87*	*4.69*	*8.52*	*7.44*	-	*4.01*	*12/31/2015*
Canso	**86,927,706**	**3.15**	**-0.56**	**0.66**	**6.41**	**8.93**	**7.45**	**9.15**	**7.14**	**7.90**	**02/28/2010**
FTSE TMX Corporate Bond IDX			*-1.77*	*-2.22*	*0.69*	*1.69*	*-3.05*	*-0.65*	*2.43*	*3.18*	*02/28/2010*
Excess Return			*1.21*	*2.87*	*5.73*	*7.23*	*10.50*	*9.80*	*4.70*	*4.72*	*02/28/2010*
HRM Corporate Debt	**100,002,760**	**3.62**	**0.21**	**1.03**	**4.23**	**5.53**	**2.95**	**3.49**	**-**	**6.08**	**01/31/2014**
FTSE TMX Short Corp BD IDX			*-0.35*	*0.13*	*1.82*	*2.94*	*-0.69*	*0.86*	-	*1.84*	*01/31/2014*
Excess Return			*0.57*	*0.90*	*2.41*	*2.59*	*3.64*	*2.62*	-	*4.23*	*01/31/2014*
Government Bonds	**194,398,749**	**7.04**	**-2.93**	**-4.38**	**-2.40**	**-2.00**	**-5.21**	**-2.11**	**-**	**0.48**	**12/31/2015**
FTSE TMX Government Univers			*-2.91*	*-4.44*	*-2.19*	*-2.40*	*-5.88*	*-2.78*	-	*0.09*	*12/31/2015*
Excess Return			*-0.03*	*0.06*	*-0.21*	*0.40*	*0.67*	*0.67*	-	*0.38*	*12/31/2015*
Lincluden Gov't	**107,975,820**	**3.91**	**-3.15**	**-4.70**	**-1.96**	**-1.84**	**-5.25**	**-2.22**	**1.56**	**1.60**	**08/31/2013**
FTSE TMX Government Univers			*-2.91*	*-4.44*	*-2.19*	*-2.40*	*-5.88*	*-2.78*	*1.36*	*1.41*	*08/31/2013*
Excess Return			*-0.24*	*-0.26*	*0.23*	*0.56*	*0.63*	*0.56*	*0.19*	*0.19*	*08/31/2013*
Wellington Bond Overlay	**86,422,929**	**3.13**	**-2.51**	**-3.80**	**-3.45**	**-2.49**	**-5.28**	**-2.09**	**2.01**	**1.57**	**08/31/2012**
FTSE TMX Government Univers			*-2.91*	*-4.44*	*-2.19*	*-2.40*	*-5.88*	*-2.78*	*1.36*	*1.09*	*08/31/2012*
Excess Return			*0.39*	*0.63*	*-1.26*	*-0.09*	*0.60*	*0.69*	*0.65*	*0.48*	*08/31/2012*
Private Debt	**94,327,972**	**3.42**	**-0.29**	**-1.12**	**1.90**	**2.53**	**11.47**	**8.31**	**8.86**	**0.61**	**12/31/2011**
HRM PD Benchmark			*0.84*	*3.21*	*9.95*	*11.69*	*8.17*	*7.68*	*6.90*	*6.85*	*12/31/2011*
Excess Return			*-1.13*	*-4.33*	*-8.05*	*-9.16*	*3.30*	*0.63*	*1.96*	*-6.24*	*12/31/2011*
Private Debt	**94,327,972**	**3.42**	**-0.29**	**-1.12**	**1.90**	**2.53**	**11.47**	**8.31**	**8.86**	**0.61**	**12/31/2011**
HRM Real Assets	**753,979,369**	**27.31**	**-0.82**	**1.35**	**7.01**	**-**	**-**	**-**	**-**	**7.01**	**12/31/2022**
Rolling CPI 5 year + 5%			*0.69*	*2.08*	*6.30*	*-*	*-*	*-*	*-*	*6.30*	*12/31/2022*
Excess Return			*-1.51*	*-0.73*	*0.71*	*-*	*-*	*-*	*-*	*0.71*	*12/31/2022*
Infrastructure	**328,359,460**	**11.90**	**-1.26**	**2.80**	**14.81**	**20.26**	**13.83**	**12.37**	**10.54**	**18.62**	**06/30/2011**
HRM Infrastructure Index			*0.28*	*2.06*	*7.37*	*8.97*	*10.23*	*9.04*	*7.66*	*7.42*	*06/30/2011*
Excess Return			*-1.54*	*0.74*	*7.44*	*11.29*	*3.60*	*3.33*	*2.88*	*11.20*	*06/30/2011*
Infrastructure	**328,359,460**	**11.90**	**-1.26**	**2.80**	**14.81**	**20.26**	**13.83**	**12.37**	**10.54**	**18.62**	**06/30/2011**
Real Estate	**425,619,909**	**15.42**	**-0.46**	**0.26**	**1.28**	**9.47**	**12.09**	**12.45**	**11.66**	**11.57**	**09/30/2011**
HRM Real Estate Index			*0.28*	*2.06*	*7.37*	*8.97*	*10.23*	*9.04*	*7.66*	*7.41*	*09/30/2011*
Excess Return			*-0.74*	*-1.80*	*-6.09*	*0.50*	*1.85*	*3.41*	*4.00*	*4.16*	*09/30/2011*
Real Estate	**425,619,909**	**15.42**	**-0.46**	**0.26**	**1.28**	**9.47**	**12.09**	**12.45**	**11.66**	**11.57**	**09/30/2011**

Account/Group	Ending Market Value CAD	Ending Weight	% Rate of Return								
			One Month	Three Months	Year to Date	One Year	Three Years	Four Years	Ten Years	Inception to Date	Inception Date
Public Market Alternatives	**126,822,328**	**4.59**	**0.98**	**1.97**	**3.36**	**5.86**	**-**	**-**	**-**	**3.96**	**02/28/2022**
3M CAD Bankers Acceptance R+3%			*0.71*	*2.13*	*6.31*	*8.38*	*-*	*-*	*-*	*7.46*	*02/28/2022*
Excess Return			*0.28*	*-0.16*	*-2.96*	*-2.52*	*-*	*-*	*-*	*-3.50*	*02/28/2022*
Public Market Alternatives	**126,822,328**	**4.59**	**0.98**	**1.97**	**3.36**	**5.86**	**-**	**-**	**-**	**3.96**	**02/28/2022**
3M CAD Bankers Acceptance R+3%			*0.71*	*2.13*	*6.31*	*8.38*	*-*	*-*	*-*	*7.46*	*02/28/2022*
Excess Return			*0.28*	*-0.16*	*-2.96*	*-2.52*	*-*	*-*	*-*	*-3.50*	*02/28/2022*
HRM Operating	**14,380,822**	**0.52**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**12/31/2015**
Operating Account	**14,380,822**	**0.52**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**03/31/2004**

Executive Summary

HRM MASTER TRUST TOTAL FUND NET OF FEES



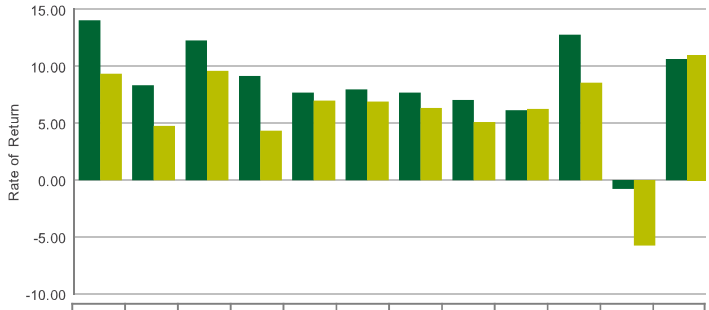
	Three Months	Year to Date	One Year	Three Years	Four Years	ITD
Fund	0.09	5.23	10.62	7.37	7.05	7.06
Index	-0.26	6.50	11.00	4.33	4.80	5.50

Index: HRM Policy Benchmark

RISK STATISTICS	3 Mos	1 Yr	4 Yrs
Return	0.09	10.62	7.05
Index Return	-0.26	11.00	4.80
Excess Return	0.35	-0.38	2.25
Standard Deviation	-	4.27	5.31
Index Standard Deviation	-	6.11	6.02
Tracking Error	-	2.93	2.28
Information Ratio	-	-0.13	0.99
Sharpe Ratio	-	1.71	1.08
Index Sharpe Ratio	-	1.26	0.58
Jensen's Alpha	-	2.17	2.76
Relative Volatility (Beta)	-	0.65	0.82
R Squared	-	0.81	0.86
Beginning MV (in 000s)	2,762,399	2,499,827	2,150,619
Net Contributions (in 000s)	-4,461	-4,576	-55,288
Income (in 000s)	10,973	48,518	218,543
Appreciation (in 000s)	-8,428	216,713	446,608
Ending MV (in 000s)	2,760,482	2,760,482	2,760,482

Index: HRM Policy Benchmark. Risk Free Index: JP Morgan 3 month Cash (CAD)
Category: Total Fund Net of Fees. Calculation Frequency: Monthly

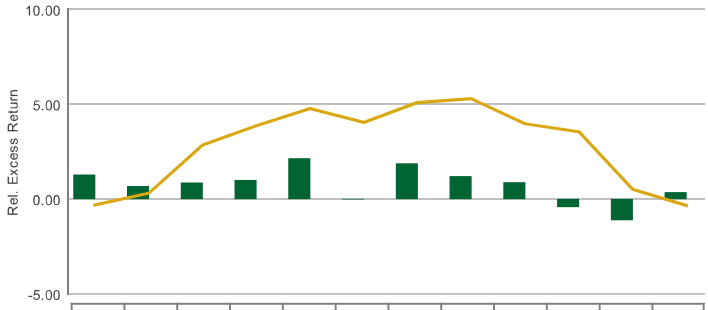
HRM MASTER TRUST ROLLING YEARS TOTAL FUND NET OF FEES



	Sep '12	Sep '13	Sep '14	Sep '15	Sep '16	Sep '17	Sep '18	Sep '19	Sep '20	Sep '21	Sep '22	Sep '23
Fund	14.02	8.31	12.25	9.12	7.66	7.95	7.68	7.03	6.11	12.75	-0.77	10.62
Index	9.32	4.75	9.57	4.31	6.96	6.88	6.31	5.09	6.23	8.55	-5.76	11.00

Index: HRM Policy Benchmark

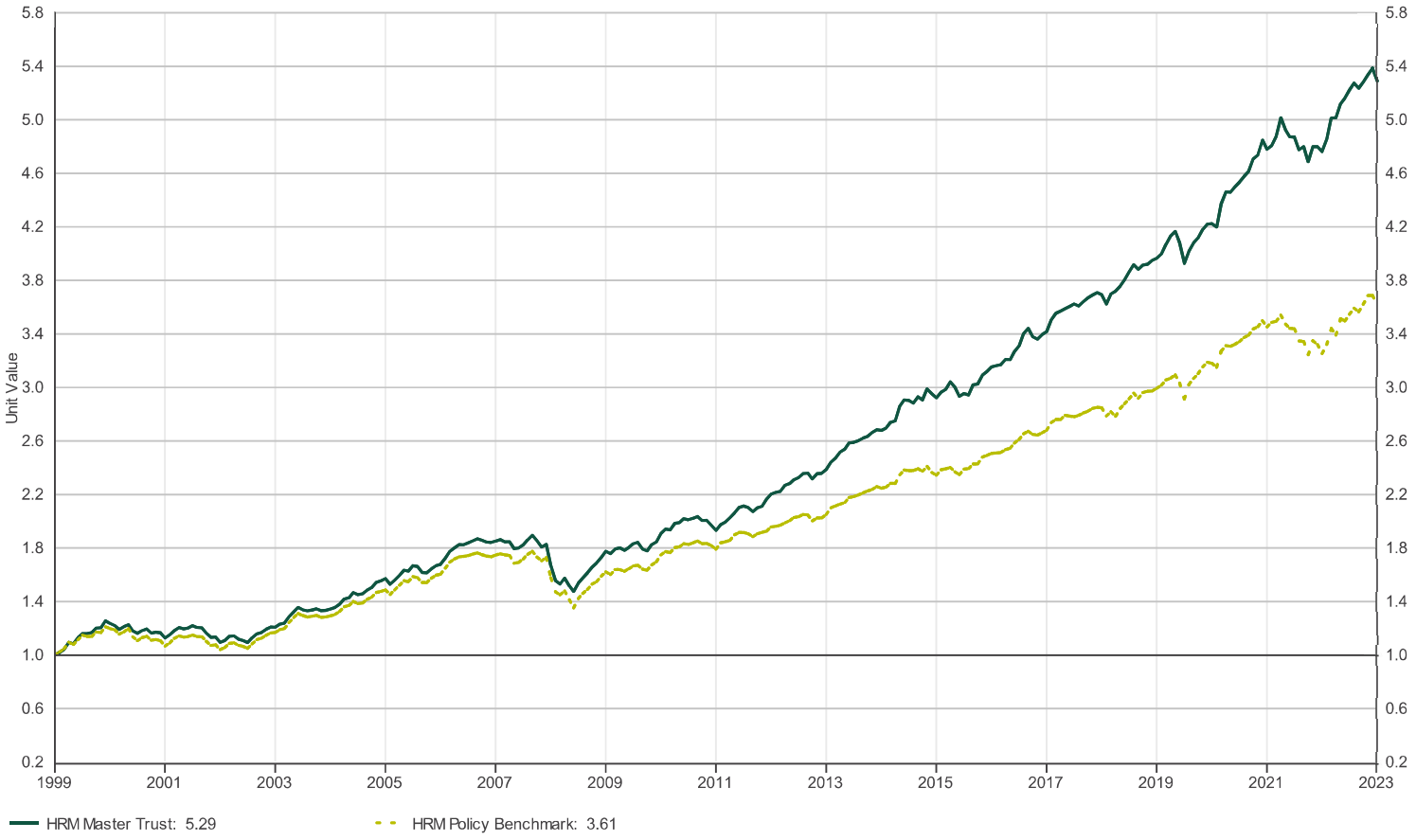
HRM MASTER TRUST ROLLING QUARTERS TOTAL FUND NET OF FEES



	Q4 '20	Q1 '21	Q2 '21	Q3 '21	Q4 '21	Q1 '22	Q2 '22	Q3 '22	Q4 '22	Q1 '23	Q2 '23	Q3 '23
3M R.Excess	1.28	0.68	0.86	1.00	2.15	-0.02	1.88	1.20	0.87	-0.43	-1.12	0.35
1Y R.Excess	-0.31	0.30	2.85	3.87	4.77	4.04	5.09	5.29	3.97	3.54	0.50	-0.34

Index: HRM Policy Benchmark

Growth Over Time - Inception to Date



ITEM # 4-I
Halifax Water Board

January 25, 2024

TO: Colleen Rollings, P. Eng., PMP, Chair and Members of the Halifax Regional Water Commission Board, as Trustees of the Halifax Regional Water Commission Employees' Pension Plan

SUBMITTED BY: Heather Britten
Digitally signed by Heather Britten
Date: 2024.01.19 10:51:54 -04'00'

Heather Britten, Chair and Members of the Pension and Benefits Advisory Committee

APPROVED: Louis de Montbrun
Digitally signed by Louis de Montbrun
Date: 2024.01.19 10:53:08 -04'00'

Louis de Montbrun, CPA, CA, Director of Corporate Services and CFO

DATE: January 3, 2024

SUBJECT: **2023 Annual Report - Pension and Benefits Advisory Committee**

ORIGIN

Activities of the Pension and Benefits Advisory Committee (the "Committee") are reported to the Halifax Regional Water Commission Board of Commissioners (the "Administrator") annually, in accordance with the Terms of Reference of the Committee.

RECOMMENDATION

None

BACKGROUND

As defined in the Terms of Reference of the Committee, its objectives and responsibilities include:

- Monitor the administration of the pension and benefits plans (the "Plans") to ensure that the Plans are conducted in a manner consistent with the provisions of the official pension plan documents, group insurance and other benefit plan documents, and governing legislation
- Make recommendations to the Administrator respecting the administration of the Plans
- Promote awareness and understanding of the Plans on the part of members, and persons receiving pension or other benefits under the Plans

- Assist with the monitoring of the Plans activities, and provide input in this regard, through review of audited financial statements, actuarial valuations, key contracts and agreements, reports on investment performance and other performance metrics
- Review annual communication plans to all stakeholders, which minimally will include a plan for:
  - ✓ Annual pension statements
  - ✓ Newsletters and articles in the Pipeline Post
  - ✓ Annual general meeting for pension plan members, and
  - ✓ Educational sessions for pre-retirement.

The purpose of this report is to provide a summary of the Committee's activities during 2023.

DISCUSSION

The Committee met as follows during 2023:

- March 21, 2023 1:00 pm
- May 15, 2023 2:30 pm
- November 22, 2023 1:00 pm

All meetings were held virtually via MS Teams.

Table 1 below provides a summary of attendance at Committee meetings held during 2023.

Table 1

Pension and Benefits Advisory Committee
Attendance Report - 2023

		March 21	May 15	November 22
Representatives:				
Heather Britten, Chair	Non-Union	✓	✓	✓
Joel O'Neil, Vice Chair	Local 227	n/a	✓	✓
Gary McPherson	Local 227	-	-	✓
Paul Taylor	Local 1431	✓	✓	✓
Anna McCarron	Local 1431	✓	✓	✓
Alicia Scallion	Management	✓	✓	n/a
Louis de Montbrun	Management	✓	✓	✓
Karen Kearney	Non-Union	✓	✓	✓
Cheryl Little	Pensioners	✓	✓	✓
Alternates:				
Stephen Kerr	Local 227	✓	-	-
Susan Dwyer	Local 1431	n/a	✓	✓
Joel Haley	Non-Union	✓	✓	✓
Blaine Rooney	Pensioners	✓	-	✓
Observers:				
Rochelle Bellemare	Manager, HR	✓	✓	n/a
Cindy MacLean	Supervisor, HR	n/a	n/a	✓
Administration Support				
Amanda Jodrey		✓	n/a	n/a
Ellen Wilcox		✓	✓	✓

Legend:		
	✓	- Present
	-	- Absent
	n/a	- Not a Member of the Committee / not in that position, at that time.

Key issues the Committee addressed or discussed during the year included:

- Life, Dependent Life and Long-term Disability (LTD) insurance renewals.
- Benefit renewals for Health and Dental
- Proposed enhancements to health benefits including:
  - ✓ Short Term Disability
  - ✓ Increase dental coverage for preventative care and major restorative care
  - ✓ Optional life, dependent life, and critical illness insurances
  - ✓ Diabetic pump supplies

Main accomplishments of the Committee for the year were:

1. Through Mercer, Halifax Water was able to successfully negotiate benefit renewals for health and dental, with increases of 4.0% and 5.0% respectively. The renewals became effective June 1, 2023.
2. Through Mercer, Halifax Water was able to successfully negotiate Life, Dependent Life and LTD insurance renewals. Basic Life and Dependent Life rates did not change while LTD rates increased by 5.0%. These rates became effective April 1, 2023.
3. The review of various pension and benefit communication initiatives during the year prepared by Halifax Water staff such as, the annual Pension Plan budget, and the Pension Plan financial reports that go to the Administrator quarterly. The purpose of these initiatives was to provide members:
    i. Updated information regarding the financial health of the Pension Plan.
    ii. Overview of the Pension Plan.
    iii. Overview of health, dental and other benefits accessible to members.

SUBSEQUENT EVENTS AND FUTURE INITIATIVES

- Review and provide recommendations as required relating to benefit plan enhancements
- Continuing education for Committee members, including guest speakers at scheduled meetings

FORMAL MOTIONS TO THE ADMINISTRATOR

There were no formal motions made to the Administrator during 2023.

Report Prepared by: Heather Britten Digitally signed by Heather Britten Date: 2024.01.19 10:52:22 -04'00'

Heather Britten, B. Comm.
Quality Assurance Officer (782) 641-1431

ITEM #5-I

Halifax Water Board

January 25, 2024

TO: Colleen Rollings, P.Eng., PMP., Chair and Members of the Halifax Regional Water Commission Board

SUBMITTED BY: Digitally signed by Louis de Montbrun Date: 2024.01.18 21:42:18 -04'00'

Louis de Montbrun, Director, Corporate Services/CFO

APPROVED: Tareq Al-Zabet Digitally signed by Tareq Al-Zabet Date: 2024.01.19 10:18:36 -04'00'

Tareq Al-Zabet, Ph.D., CEO & General Manager

DATE: January 18, 2024

SUBJECT: **Information Report – Enterprise Risk Management Semi-Annual Report**

ORIGIN

The Enterprise Risk Management (ERM) Semi-Annual report was presented to the ERM Committee at the January 10, 2024, ERM committee meeting. The committee endorsed the report for the information of the Board.

Please see attached the ERM Semi-Annual report.

ATTACHMENTS

Enterprise Risk Management Semi-Annual Report dated January 02, 2024.

Report Prepared by: Digitally signed by Adedamola M. Akande Date: 2024.01.18 21:54:57 -04'00'

Adedamola M. Akande, ERM Risk Management, Program Manager

Financial Review by: Digitally signed by Louis de Montbrun Date: 2024.01.18 21:39:53 -04'00'

Louis de Montbrun, CPA, CA

Director, Corporate Services/CFO

Halifax Water

ITEM 4

Halifax Water Enterprise Risk Management Committee

January 10, 2024

TO: Chair, and Members of the Halifax Regional Water Commission Enterprise Risk Management Committee

SUBMITTED BY: Digitally signed by Louis de Montbrun Date: 2024.01.09 10:54:21 -04'00'

Louis de Montbrun, CPA, Director, Corporate Services/CFO

APPROVED: Tareq Al-Zabet Digitally signed by Tareq Al-Zabet Date: 2024.01.09 13:53:30 -04'00'

Tareq Al-Zabet, Ph.D., CEO & General Manager

DATE: January 02, 2024

SUBJECT: **Enterprise Risk Management Semi-Annual Report**

ORIGIN

Enterprise Risk Management (ERM) Policy & Framework and ERM Board Committee Business Cycle.

RECOMMENDATION

It is recommended that the ERM Committee endorse the ERM Semi-Annual Report and forward the report to the Board for their information.

INTRODUCTION

The Semi-Annual report is an outline of the key activities in the ERM Program within the last term and highlights the progress made on various components of the ERM program. The report also itemizes next steps in the implementation journey and dependencies that may impact on the delivery of the program.

ERM PROGRAM HIGHLIGHTS

ERM Policy Review: The Enterprise Risk Management Policy was reviewed during the period, key changes and recommendations were made to the Board for approval. The Board asked for additional edits and the Policy will be amended and forwarded to the Board. The review of the

ERM policy will contribute to the ERM framework, and the adoption of risk management tools and processes to improve the risk management program and culture across the entire governance structure.

ERM Governance Structure: The ERM Steering committee was reconstituted and members from across the organization were appointed. Members, from areas previously unrepresented, have now been nominated to join the steering committee. Feedback on nominated staff members have been received and the exercise is now completed. The Steering Committee will begin to meet in early 2024.

Risk Register Design, and Corporate Risk and Control Self-Assessment; The Halifax Water Risk Register has been reviewed in two broad scopes. The Risk Register was redesigned to a support a more efficient review and update process, the workbook adopted a seamless design, and the risk matrix was also reviewed to minimize ambiguity in categorizing and ranking risks. Following the redesign of the risk register, a risk assessment exercise for key risk items commenced. This involved engaging with the Executives in a detailed review of the risks and the ranking of those risks based on applicable realities, control effectiveness, dependencies, and other related factors.

Risk Profile Design and Heat Map - Tier 1 Risks; After completing the risk assessment exercise with the Executives, the ERM team has developed a risk profile map highlighting key risk points in the enterprise. A heat map was also developed to represent the current exposure areas of the organization from an enterprise risk management viewpoint.

Cyber Security Program: The Cyber Program is generally on schedule and is executing as an integrated team of staff from Information and Operations Technology. The focus of the program for 2023 was the recommendations from the Municipal Auditor General (MAG) report and the priority recommendations from the Cyber Security Strategy.

There were 47 recommendations from the MAG Audit.
As of December 2023, 85% of MAG recommendations are either in progress or completed.
There are also 100 recommendations from the Cyber Security Strategy assessment and as of December 2023, 67% of these recommendations are either in progress or completed.

Some of the key accomplishment of the Cyber Program includes:

a)Multi-Factor Authentication (MFA) for all corporate accounts and for OT system remote access, Advancements in Cyber Governance including creating a role and responsibilities organization chart as well as writing and updating policies.
b)The development and exercise of an Incidence Response Plan.
c)Lastly, the Cyber Awareness Program has ensured that all Halifax Water staff have training in Cyber Fundamentals, are exposed to regular phishing campaigns, and receive communications regarding Cyber Hygiene. Role specific trainings are also conducted the operations technology staff.

NEXT STEPS

Following the milestones achieved this period, the following goals have been outlined to commence within the next period and going forward:

1. Organization Wide Risk and Control Self-Assessment Exercise
2. ERM Risk Register Update
3. Remediation Action Tracker
4. Development of Key Risk Indicators
5. Expansion of the Business Continuity Management Program to cover the entire organization.

CONCLUSION

The ERM program reached important milestones in the initial phase of implementing the program. This was achievable through the commitment of all key stakeholders including the Executive team, staff members and the support of the board. As the program moves forward into the subsequent phases, the demand on people and technological resources will increase accordingly, and more support and commitment will be required to sustain the current momentum into the next stages of the program.

Report Prepared by:

Digitally signed by Adedamola M. Akande
Date: 2024.01.09 10:25:40 -04'00'

Adedamola M. Akande, Enterprise Risk Management, Program Manager

Financial Review by:

Digitally signed by Louis de Montbrun
Date: 2024.01.09 10:54:45 -04'00'

Louis de Montbrun, CPA, CA

Director, Corporate Services/CFO

ITEM # 6-I
Halifax Water Board
January 25, 2024

TO: Colleen Rollings, P.Eng., PMP., Chair and Members of the Halifax Regional Water Commission Board

SUBMITTED BY: Digitally signed by Reid Campbell Date: 2024.01.17 09:42:13 -04'00'

Reid Campbell, M.Eng., P.Eng., Director, Engineering & Technology Services

APPROVED: Tareq Al-Zabet Digitally signed by Tareq Al-Zabet Date: 2024.01.17 12:29:08 -04'00'

Tareq Al-Zabet, Ph.D., CEO & General Manager

DATE: January 25, 2024

SUBJECT: **Capital Projects Status Dashboard**

INFORMATION REPORT

ORIGIN

Capital Budget

BACKGROUND and DISCUSSION

Each year Halifax Water prepares and Annual Capital Budget for Halifax Water Board approval. The budget contains from 2-300 line items of capital projects and capital purchases. Many projects span multiple fiscal years so there can be several hundred active capital accounts at any one time.

The Halifax Water Board has expressed an interest in obtaining dashboard type visibility into Halifax Water's capital program. Halifax Water is currently implementing a capital project planning and management information system platform (CPMIS). When complete, this platform will provide statistics and reporting in dashboard form that can be shared with the Halifax Water Board, executive and managers within Halifax Water. This project will not be complete before March 2023, which means that capital project dashboards will not be available until into the 2024/25 fiscal year.

In the interim period, Engineering & Technology Services staff have prepared a summary of project status, in spreadsheet form, for all projects with approved funding of greater than $1 million which represents the approximately largest current 50 projects.

Staff is prepared to consider adding additional or different information should the Board wish.

ATTACHMENT

Capital project status summary report.

Capital Projects 1M.xlsx