



TOWN OF OXFORD

Nova Scotia

REQUEST FOR PROPOSALS

RFP 2026-05-02-TOO

**Service Renewal to Support Community Growth Project
Phase 1**

Issued By:	Town of Oxford 105 Lower Main Street Oxford, Nova Scotia B0M 1P0
Issue Date:	June 12, 2026
Submission Deadline:	2:00 p.m. ADT, Monday, July 6, 2026
Procurement Contact:	Linda Cloney, CAO (902) 447-2624 lcloney@oxfordns.ca

Proposals must be received by the deadline stated above. Late submissions will not be considered.

Section 1 Introduction and Background

1.1 About the Town of Oxford

The Town of Oxford is a small municipality located in Cumberland County, Nova Scotia, with a current population of approximately 1,170 people. The Town owns and operates a municipal water distribution system and a wastewater collection and treatment system. The Town's wastewater treatment system consists of gravity sewer, lift stations, sanitary forcemains, and an aerated waste stabilization lagoon with ultraviolet disinfection, discharging to the River Philip. The water distribution system is supplied by a wellfield located approximately 14 km north of the Town. Oxford Frozen Foods (OFF) accounts for 70-90% of the Town's total water demand. Town growth and future needs of OFF are significant considerations for available system capacity.

1.2 Project Background

The development community has expressed interest in constructing a mix of commercial and residential land uses on the south side of the Trans-Canada Highway (Highway 104) along Main Street. In response, the Town engaged Dillon Consulting Limited (Dillon) to assess the feasibility of extending municipal water and sanitary sewer services to this area.

Dillon's feasibility assessment (Water & Sewer Extensions South of Highway 104, December 2024, File 24-9041) confirmed that the proposed development is feasible with infrastructure extensions and associated off-site upgrades. This assessment is included as **Appendix A** to this RFP along with the Development of WaterCAD model report as **Appendix B**.

A new sanitary lift station and sanitary forcemain are required to convey wastewater from the proposed development to the existing gravity collection system. A watermain extension is required to provide potable water supply and fire protection to the development. Both the sanitary forcemain and the watermain must cross Highway 104, which requires trenchless installation with secondary containment (carrier and casing pipe). This has been discussed with Nova Scotia Department of Public Works (NSDPW) and work under this RFP will include submissions to NSDPW for permitting purposes.

The feasibility assessment also identified that the Town's water supply wellfield is currently operating near or at the limits of its Approval to Withdraw from the Nova Scotia Department of Environment and Climate Change (NSECC). Confirmation of water supply adequacy is required before water-side design can be advanced beyond preliminary design and is included in this scope of services.

The Town also owns an existing lift station near Main Street and the Scotiabank, and an existing sanitary forcemain from that station to the sewage treatment plant. Preliminary assessment indicates these may require upgrades to accommodate additional flows from the proposed development. The Town has completed a CCTV inspection of the existing Main Street gravity sanitary sewer; results are included as **Appendix C** to this RFP. The scope of any required off-site sanitary upgrades will be confirmed by the Proponent following review of available data.

Note: Appendices must be reviewed by all Proponents prior to preparing their proposals. The background information is provided to encourage competitive bidding for proponents with and without prior project knowledge.

1.3 Reference Documents

The following background documents are provided with this RFP:

- Appendix A: Water & Sewer Extensions South of Highway 104 - Feasibility Study (Dillon Consulting Limited, December 2024, File 24-9041)
- Appendix B: Development of WaterCAD Model, Town of Oxford (Dillon Consulting Limited, July 2024, File 23-7219)
- Appendix C: CCTV Inspection Report, Main Street Gravity Sanitary Sewer
- Appendix D: Town of Oxford Water Utility Emergency Contingency Plan Distribution System Schematic (2020)

Note: *Upon award of contract, the Town will provide the successful Proponent with the WaterCAD model file (.wtg) as background information to assist in completing the water supply adequacy assessment required under Task 1.2. The model is provided strictly as-is, without warranty of any kind and without representation as to its accuracy, completeness, or fitness for any purpose. The Town makes no claim that the model is validated, current, or suitable for use in detailed design. Reliance on the model, and any decision to use it without independent verification, is entirely at the Proponent's risk.*

*The model was developed by an engineering consultant retained by the Town and is based on network data from 2004/2005. A validation exercise was conducted against hydrant flow testing in December 2023; the scope, assumptions, and limitations of that validation are documented in **Appendix B**. The Proponent is solely responsible for evaluating whether the model is adequate for the purposes of this Project and for determining whether additional field investigation, data collection, or re-calibration is required before the model can be relied upon to support design decisions. Proponents should use this information, together with their professional judgment, to estimate the level of re-calibration effort required. The water model will not be provided to proponents during the RFP stage.*

Water and sewer pipe plan locations and sizes based on available as-constructed information and review with Public Works, current to 2024, will be provided in GIS format to the successful proponent. The GIS dataset does not contain elevation information for the pipes. For hydraulic modelling purposes where field survey data is not available, minimum cover depths consistent with the ACWWA Atlantic Canada Water Supply Guidelines (2022) and Atlantic Canada Wastewater Systems Guidelines (2022) respectively may be assumed; the Proponent shall document all such assumptions in the Basis of Design.

For new infrastructure designed under Task 2 (lift station, forcemain, watermain extension, and off-site upgrades), assumed cover depths per ACWWA minimums are acceptable for preliminary (30%) design; topographic survey of the proposed alignments is required prior to 60% design as stated in Task 3.2.2. For assessment of existing infrastructure under Task 3.1 (existing lift station, forcemain, and gravity sewer), assumed cover depths are not acceptable; actual elevations shall be determined through CCTV data, as-built records, or field survey as required to support the capacity assessment

Section 2 Project Overview and Objectives

The Town of Oxford is seeking proposals from qualified engineering consulting firms to provide detailed design and construction administration services for water and sanitary sewer extensions south of Highway 104. The Project is intended to provide municipal servicing capacity to support planned commercial and residential development in this area.

2.1 Project Objectives

The Proponent shall achieve the following objectives:

- Design a new sanitary lift station and sanitary forcemain capable of conveying peak wet weather flows from the proposed development to the existing sanitary collection system.
- Design a watermain extension to deliver potable water and residential fire protection to the proposed development.
- Update hydraulic model to contain scenarios for:
 - a) Existing conditions,
 - b) Existing conditions plus the new mixed-use development south of Highway 104
 - c) Future conditions using “full build out” conditions; that is, with all lots developed to the maximum extent possible under existing land use guidelines.
- Generate preliminary sizing and specifications (type, volume, operating levels) for a replacement water reservoir at the Pugwash Road location. The existing water reservoir is located on a service road beside 390 Pugwash Road. This information is provided only to assist proponents in desktop review of the area. There are no site visits planned as part of the RFP process but may be included as part of project delivery.
- Design Highway 104 crossings for both the sanitary forcemain and the watermain using trenchless installation methods (method to be determined by the Proponent (following geotechnical investigation), incorporating secondary containment (casing pipe) as required by NSDPW.
- Confirm the adequacy of the Town's existing water supply to serve the proposed development and recommend any approvals or system improvements required to support the water service extension. Further work to design or construct source water improvements and obtain approvals for additional flow are excluded from this contract.
- Assess the capacity of the existing sanitary collection infrastructure to accommodate additional flows and design any required off-site upgrades.
- Produce a complete tender-ready construction document package for all confirmed design elements.
- Provide construction administration and site services through to project closeout.

2.2 Project Location

The Project is in Oxford, Nova Scotia. The proposed development area is located south of the Trans-Canada Highway (Highway 104). Refer to **Appendix A** (Figures 1 and 2) for the conceptual servicing plan and highway crossing profile.

Section 3 Scope of Services

The scope of services is organized into six tasks. All tasks shall be performed by or under the direct supervision of a Professional Engineer licensed to practice in Nova Scotia. The Proponent shall confirm the scope as part of their proposal and identify any clarifications or assumptions.

3.1 Task 1: Project Initiation, Background Review, and Water Supply Adequacy

3.1.1 Background Review and Project Initiation

Review all background documents provided in the RFP appendices. Attend a project initiation meeting with Town staff to confirm design objectives, identify outstanding data needs, and confirm the scope of Task 3 off-site sanitary assessment. Prepare and issue meeting minutes within five (5) business days.

3.1.2 Water Supply Adequacy Assessment

The Town's wellfield is currently operating near or at the limits of its Approval to Withdraw. The Proponent must confirm whether sufficient approved water supply exists or can be obtained to serve the proposed development before advancing water-side design beyond preliminary design. This sub-task shall include:

- Design and conduct flow tests at the existing four wellheads to determine aquifer yield capacity.
- Update the WaterCAD model (provided by the Town on contract award) to incorporate the proposed watermain extension, off-site main upgrades, and development demand nodes at design flows established in **Appendix A**. Confirm that system pressures and fire flows meet ACWWA Atlantic Canada Water Supply Guidelines (2022) for all demand scenarios (ADD, MDD, PHD, MDD plus fire flow).
- Review the Town's current water withdrawal data against the existing Approval to Withdraw (No. 2000-016824-02) limits. Assess whether the proposed development demand can be accommodated within the current approval, and if not, identify what wellfield expansion investigation or approval amendment is required.
- Explicitly address risk and sensitivity to changes in aquifer quantity and quality that may result from climate change induced changes to hydrology such as, but not limited to, changes in winter snowpack, drier summer months, higher annual average precipitation and rapid aquifer recharge during heavy precipitation or riverine flooding events. This is not intended as a detailed, quantified hydrogeological study but a qualitative investigation to help the Town consider future supply risk in development decisions.
- Prepare a Water Supply Adequacy Technical Memorandum presenting findings and recommendations, including identification of any regulatory approvals or additional studies required before water-side construction can proceed.

The Water Supply Adequacy Technical Memorandum is a design hold point: the Proponent shall not advance the watermain extension or off-site water upgrades beyond 30% preliminary design until the Town has reviewed and accepted the Memorandum. If the Town directs the Proponent to proceed with water-side design prior to supply confirmation, the Proponent shall document this direction in writing.

3.1.3 Geotechnical Investigation for Highway Crossing

The Highway 104 crossing is within an active Karst region with a documented history of sinkhole formation (refer to background reports cited in **Appendix A**). A site-specific geotechnical investigation is required before the trenchless installation method can be selected and designed. The Proponent shall retain a qualified geotechnical sub-consultant to:

- Design and implement a geotechnical investigation program of sufficient depth and extent to characterize subsurface conditions along the proposed crossing alignment. The program shall consider Ground Penetrating Radar (GPR) or equivalent non-invasive methods to identify potential voids or dissolution features along the bore path.
- Evaluate subsurface conditions to support selection and detailed design of the trenchless installation method (HDD or jack-and-bore), and provide specific design recommendations including bore path geometry, casing design, and secondary containment requirements consistent with NSDPW preferences as documented in Appendix A.
- Prepare a Geotechnical Investigation Report with design recommendations.

The Proponent shall prepare and submit the NSDPW Work Within Highway Right-of-Way Permit application on behalf of the Town. NSDPW permit fees are paid by the Town. Record drawings shall be submitted to NSDPW upon completion of construction as required.

3.2 Task 2: Primary Infrastructure Design (Confirmed Scope)

Task 2 covers design of the confirmed new infrastructure: new sanitary lift station, new sanitary forcemain, Highway 104 trenchless crossings, and the watermain extension with associated off-site water upgrades. Design shall be advanced through coordinated milestones from 30% preliminary design through Issued for Tender documents.

3.2.1 Sanitary Lift Station

Design a new submersible sewage lift station to serve the proposed development in accordance with the ACWWA Atlantic Canada Wastewater Systems Guidelines (2022) and the design parameters established in Appendix A. The design shall include at minimum:

- Hydraulic analysis confirming pump selection. Duty/standby duplex configuration, capable of pumping the peak wet weather flow with one pump out of service. Variable frequency drives (VFDs) on all pumps.
- Precast concrete wet well sized per ACWWA pump cycle requirements.
- Ductile iron internal piping with flanged or Victaulic couplings. Discharge header to include a flow meter.
- Backup generator sized for all station equipment during power interruptions, with automatic transfer switch and noise suppression equipment.
- Wet well and valve chamber ventilation.
- Local control panel with Hand/Off/Auto selector, designed for integration with the Town's existing SCADA network. Ultrasonic level control with auxiliary float backup for high- and low-level alarms.

- Confined space access provisions compliant with the Nova Scotia Occupational Health and Safety Act.
- Site design including access road, perimeter fencing, security lighting, and electrical service coordination with utility provider.

3.2.2 Sanitary Forcemain

Design HDPE sanitary forcemain from the new lift station to the connection point with the existing gravity sanitary sewer at the intersection of Main Street and Black River Road. The design shall:

- Confirm forcemain alignment and grade through topographic survey and field investigation.
- Achieve a minimum self-cleansing velocity and maximum velocity per ACWWA Atlantic Canada Wastewater Systems Guidelines (2022).
- Include air valve (ARV) chambers at high points in the alignment.
- Specify the trenchless installation within the Highway 104 crossing zone in accordance with the Task 1.3 geotechnical recommendations. HDPE carrier pipe within a casing pipe (secondary containment) is required. The Proponent shall design the casing pipe system including spacers, end caps, and annular void management consistent with NSDPW requirements.

3.2.3 Watermain Extension and Off-Site Water Upgrades

Design a watermain extension from the existing distribution system at Main Street and Black River Road, crossing Highway 104, to the boundary of the proposed development. Subject to the findings of Task 1.2, also design the following off-site watermain upgrades identified in

Appendix A:

- Replacement of 249 m of 150 mm watermain on Main Street from Black River Road to the Irving location with 250 mm HDPE.
- Replacement of 472 m of 200 mm watermain on Main Street from the Oxford Frozen Foods frontage to Black River Road with 250 mm HDPE.
- Replacement of 847 m of 150 mm watermain on Highway 204 from the 350 mm main south of PRV-10 to Sunset Avenue with 200 mm HDPE.

All watermain design shall conform to ACWWA Atlantic Canada Water Supply Guidelines (2022), achieving minimum residual pressures. If minimum residual pressures cannot be achieved without construction of the new Pugwash Road reservoir, design shall state the minimum achievable pressures pending reconstruction of the reservoir.

The watermain and sanitary forcemain shall each have a dedicated trenchless crossing with adequate provisions to prevent cross-contamination. The Proponent shall confirm crossing geometry and separation distance in the 30% design submission and shall coordinate the two bore alignments to minimize the combined footprint of launch and reception areas on either side of the highway.

The feasibility study states that commercial fire flow requirements (116 L/s) cannot be met from the municipal system under existing or upgraded conditions. The design documents shall

include documentation amending this finding conditional on construction of a new reservoir at Pugwash Road or supporting the recommendation that commercial developments incorporate on-site cistern and fire pump systems, consistent with **Appendix A**.

Road restoration for all watermain and forcemain work along Main Street, from the Highway 104 crossing to the Oxford Frozen Foods frontage, shall be designed as full-width pavement reconstruction (curb to curb or edge of travelled way to edge of travelled way, as applicable) for the full length of the corridor affected by this Project, regardless of trench width or the extent of subsurface disturbance at any given location. Trench-width-only restoration (patching) is not an acceptable design basis for this corridor. The Proponent's Class B cost estimates shall reflect full-width paving quantities for this extent. Road restoration for the Highway 204 off-site watermain upgrade and any other disturbed roadway segments outside the Main Street corridor described above shall also be designed to full-width restoration standards consistent with NSDPW and Town standards, unless otherwise directed by the Town.

Task 3: Off-Site Sanitary Upgrade Assessment and Conditional Design

The existing sanitary collection system includes a lift station at Main Street near Scotiabank and a sanitary forcemain from that station to the sewage treatment plant. These may require upgrades to accommodate additional flows from the proposed development. The scope of required upgrades cannot be confirmed until existing infrastructure data has been reviewed.

3.3.1 Existing Infrastructure Assessment

Using the CCTV inspection data provided in **Appendix C** and the design flows established in Task 2, assess:

- Whether the existing gravity sanitary sewer on Main Street between Black River Road and the existing lift station has sufficient capacity and structural integrity to accept new flows without replacement or rehabilitation.
- Whether the existing lift station near Main Street and Scotiabank has sufficient wet well volume and pumping capacity to handle the additional design flows. The Proponent shall verify existing pump curves, wet well dimensions, and control settings through site investigation and discussion with Town operations staff.
- Whether the existing sanitary forcemain from the existing lift station to the sewage treatment plant has sufficient hydraulic capacity to convey combined design flows.

A Technical Memorandum summarizing findings and recommended off-site upgrade scope shall be submitted to the Town for review and approval before the Proponent advances any off-site sanitary design.

3.3.2 Conditional Design of Off-Site Sanitary Upgrades

Conditional on Task 3.1 findings and written direction from the Town, the Proponent shall advance detailed design of required off-site sanitary upgrades. Based on the feasibility assessment and the Town's understanding of the existing infrastructure condition, the following components and planning-level parameters define the scope for binding fee purposes:

- **Lift station near Main Street and Scotiabank:** full replacement, including a new wet well, site works and electrical/controls/SCADA integration, to a station of comparable hydraulic

capacity to the new lift station designed under Task 2.1 plus the existing gravity flow tributary to this station. The Proponent's Task 3.2 fee shall be based on a full replacement scope of this nature.

- **Sanitary forcemain replacement:** approximately 95 m, from the existing lift station to the sewage treatment plant.
- **Gravity sanitary sewer:** rehabilitation of the Main Street segment between Black River Road and the existing lift station, approximately 550 m.

Proponents shall base their Task 3.2 fee on these parameters and shall state this basis explicitly in the Financial Submission.

The Proponent shall provide a separate fee estimate for Task 3.2 conditional design services as a clearly labelled line item in the Financial Submission (Section 6). This fee will be included in the total fee used for evaluation scoring. Task 3.2 services will only be authorized and commenced upon written Change Order from the Town following acceptance of the Task 3.1 Technical Memorandum. The fee proposed at submission is binding and may not be renegotiated at the time of authorization, except as follows:

A Change Order to adjust the Task 3.2 fee will be considered only where the Task 3.1 findings establish conditions materially more favourable or more extensive than the parameters stated above. For example: (i) the existing lift station wet well is found to be structurally suitable for retention, such that the scope can be reduced to a mechanical, electrical, and controls upgrade without wet well replacement; (ii) the forcemain or gravity sewer lengths requiring replacement or rehabilitation differ by more than 25% from the lengths stated above; or (iii) the gravity sewer segment is found to require full replacement rather than rehabilitation. In any such case, the adjustment shall be proportional to the documented difference in scope from the stated parameters and shall be agreed in writing before Task 3.2 design proceeds.

Task 4: Permitting Support and Regulatory Approvals

The Proponent shall identify all required permits and regulatory authorizations and shall prepare and submit applications on behalf of the Town. Required approvals include, but are not limited to:

- NSDPW Work Within Highway Right-of-Way Permit (prepared under Task 1.3; Proponent to manage submission and agency responses).
- NSECC Application to Alter (or equivalent current instrument) under the Nova Scotia Environment Act for the new lift station and sanitary forcemain.
- NSECC notification or amendment as required for the watermain extension and off-site water upgrades.
- NSECC Approval to Withdraw amendment application support documents, if required by the Task 1.2 findings.
- Any environmental or archaeological assessments required to support permitting.

Permit fees are paid by the Town. The Proponent shall track permitting status and include updates in monthly progress reports.

Task 5: Detailed Design and Tender Documents

The Proponent shall advance design to 30%, 60%, and 90% completion milestones for Town review, followed by Issued for Tender (IFT) documents targeting completion by December 18, 2026. The following applies to all design submissions:

- Drawings prepared in AutoCAD (latest version) in metric SI units using 'A1' size (559 x 432 mm) title blocks. Electronic CAD files provided in bound AutoCAD format with all layers embedded.
- All IFT drawings signed and sealed by the Professional Engineer of record, licensed in Nova Scotia.
- Class B cost estimates prepared at 60% and 90% milestones in elemental format with a Basis of Estimate identifying all assumptions, allowances, exclusions, and contingency rationale.
- Complete Tender Package including IFT drawings, technical specifications, supplementary general conditions, form of agreement, and instructions to bidders, for issuance by the Town.
- Pre-tender site meeting, responses to bidder enquiries, addenda as required, bid review, and written recommendation for award.

Task 6: Construction Administration and Site Services

The Proponent shall provide construction administration and site services for all constructed components, including:

- Pre-construction meeting attendance and minutes.
- Shop drawing and submittal review.
- Responses to contractor Requests for Information (RFIs).
- Issuance of site instructions and change orders as required.
- Inspection and testing oversight for HDPE pipe fusion, pressure testing, post-construction CCTV of forcemains, and lift station commissioning.
- Settlement and vibration monitoring during and following trenchless installation as required by NSDPW.
- Substantial performance and final completion certifications.
- Record drawings (as-builts) in AutoCAD format, submitted to NSDPW and provided to the Town.
- Commissioning and Start-Up Report for the new lift station including pump curve verification and SCADA confirmation.
- Assistance with NSECC post-construction compliance documentation.

The level and frequency of construction oversight shall be determined by the Engineer of Record based on professional judgment, risk to the Town, and the specific construction activities underway at each stage, not on a fixed daily or full-time inspection model by default. The Proponent's Technical Submission shall describe the proposed oversight approach by construction phase (e.g., trenchless crossing installation, lift station construction and

commissioning, forcemain pressure testing, tie-ins to live infrastructure), identifying which activities warrant continuous presence, which warrant scheduled site visits, and which can be confirmed through documentation review, photographs, or contractor self-certification with spot verification. The Town will evaluate this approach for appropriateness to risk, not for the total number of site visits proposed.

Section 4 Deliverables and Milestones

The following table summarizes key deliverables, milestones, and Town review periods. The Proponent shall propose a detailed project schedule in their Technical Submission. Town review periods are minimums; complex submissions may require additional time.

Deliverable / Milestone	Description	Town Review
Project Initiation Meeting and Minutes	Agenda and minutes within 5 business days of meeting	N/A
Water Supply Adequacy Technical Memo (Task 1.2)	Wellfield and model assessment; design hold points for water side before advancing beyond 30%	10 business days
Geotechnical Investigation Report (Task 1.3)	Subsurface characterization, trenchless method recommendation, casing design criteria	10 business days
Off-Site Sanitary Assessment Memo (Task 3.1)	Existing LS and forcemain capacity; conditional scope confirmation	10 business days
30% Preliminary Design Package	Basis of Design report, 30% drawings, preliminary alignment and lift station layout	10 business days
60% Design Package	Issued for Review (IFR) drawings, draft specs, Class B cost estimate and Basis of Estimate	10 business days
90% Design Package	Issued for Approval (IFA) drawings, near-final specs, updated Class B cost estimate	10 business days

Deliverable / Milestone	Description	Town Review
Issued for Tender Package (IFT) Target: December 18, 2026	Final sealed drawings, specifications, supplementary conditions, form of agreement, instructions to bidders	10 business days
Tender Support and Award Recommendation	Pre-tender meeting, addenda, bid review, written recommendation for award	N/A
Construction Administration (ongoing)	RFI responses, shop drawing reviews, site reviews, commissioning, monitoring	Per contract
Record Drawings and Project Closeout	As-built AutoCAD drawings, commissioning report, NSDPW and NSECC closeout submissions	5 business days

Note: Deliverables for Task 3.2 conditional off-site sanitary upgrades will follow a milestone schedule agreed upon at the time of written authorization.

Section 5 Proponent Qualifications and Experience Requirements

Proposals will only be considered from Proponents who can demonstrate the following minimum qualifications. Failure to satisfy all mandatory requirements will result in rejection of the proposal without further evaluation.

5.1 Mandatory Requirements

- Prior project experience in Nova Scotia or other Atlantic Canada jurisdictions, with working knowledge of ACWWA guidelines, NSECC permitting, and NSDPW right-of-way requirements.
- The lead Professional Engineer responsible for the Project must be licensed with Engineers Nova Scotia (ENS), or eligible for registration in Nova Scotia, at the time of contract award. All sealed drawings and reports shall bear the seal and signature of a Professional Engineer licensed in Nova Scotia.
- The Proponent (or Proponent team) must demonstrate at least two (2) completed lift station design projects in the past seven (7) years in which the proposed Project Manager or Engineer of Record served in a lead engineering role. At least one project must involve a submersible lift station with SCADA integration.
- The Proponent (or a named sub-consultant) must demonstrate at least one (1) completed trenchless pipeline design project in the past seven (7) years involving HDD or jack-and-bore installation under a road or highway. The sub-consultant providing trenchless design expertise must be named in the proposal.

- The Proponent (or a named geotechnical sub-consultant) must demonstrate at least one (1) completed geotechnical investigation program in support of trenchless pipeline installation in the past seven (7) years.

5.2 Preferred Experience

While not mandatory, the Town will assign higher scores to Proponents who demonstrate:

- Prior experience with NSECC Approval to Withdraw applications or wellfield capacity assessments in Nova Scotia.
- Prior experience with WaterCAD hydraulic modelling and water distribution system design in small Atlantic Canada municipalities.

5.3 Project Team Stability

The Project Manager, Engineer of Record, and key sub-consultants named in the proposal are considered material to the Town's evaluation. The Proponent shall not substitute key personnel after award without the Town's prior written consent. If a named key individual becomes unavailable, the Proponent must propose a replacement of equivalent qualification for the Town's written approval before any substitution takes effect.

Section 6 Proposal Requirements and Format

6.1 Submission Format

Proposal Technical submissions shall be submitted electronically as a single password-free PDF file to the Procurement Contact identified on the cover page of this RFP, by the submission deadline. It is the Proponent's responsibility to confirm receipt by following up with the Procurement Contact. Proposals submitted by fax or telephone will not be accepted.

Proposals shall use a two-section structure within the PDF:

- Section 1 Technical Submission (as described in Section 6.2)
- Section 2 Financial Submission (as described in Section 6.3)

The Financial Submission shall be submitted electronically as a separate, password-protected PDF file to the Procurement Contact identified on the cover page of this RFP. Following review of the technical submission, the top three proponents will be contacted for the financial submission password.

The Technical Submission must not contain any pricing information or dollar amounts.

6.2 Technical Submission Page Limit and Content

The main body of the Technical Submission shall not exceed ten (10) pages, single-sided, minimum 10-point font, with standard margins. The following supplementary materials are excluded from the page count:

- Cover letter (maximum 1 page)
- Completed Proposal Declaration in **Appendix E** of this RFP (required)
- Resumes for key personnel (**maximum 2 pages per person with relevant experience**)

- Project reference sheets (**maximum 1 page per project; maximum 3 project sheets**)
- Signed acknowledgement of all addenda issued

Note: The page limit is strictly enforced. Pages beyond 10 in the main body will not be evaluated. Attempts to circumvent the limit through reduced font size, compressed kerning, or by relocating substantive methodology content into appendices will not be accepted.

The Technical Submission main body shall be organized as follows:

Section A: Proponent Team (maximum 2 pages)

Provide a brief firm profile and an organization chart identifying the Project Manager, Engineer of Record (civil/sanitary), trenchless design lead, geotechnical sub-consultant, and any other key roles. For each key individual, state their professional designation, relevant years of experience, and available commitment for this Project. Resumes shall be included as supplementary material outside the page limit.

Section B: Relevant Project Experience (maximum 2 pages)

Describe up to three relevant completed projects demonstrating the team's experience with: (i) lift station and forcemain design; (ii) trenchless pipeline design under roadways; (iii) watermain design and distribution hydraulic modelling; and (iv) Atlantic Canada regulatory permitting. For each project, include: client name and reference contact, project location, brief description, Proponent's specific role, approximate construction value, and completion year. All projects must have been completed within the past seven (7) years.

Section C Understanding of the Project and Technical Approach (maximum 6 pages)

Demonstrate that the Proponent has read and understood the background documents provided in this RFP. Describe the Proponent's understanding of the key technical challenges, including the Karst geology risk at the highway crossing, the water supply adequacy question, the interaction between new and existing sanitary infrastructure, and the multi-discipline coordination this Project requires. Articulate the proposed methodology for:

- The geotechnical investigation program design and trenchless method selection process.
- The water supply adequacy assessment, including the approach to updating the WaterCAD model and evaluating wellfield withdrawal approval limits.
- Lift station hydraulic design, pump selection, and SCADA integration with the Town's existing network.
- Highway crossing design and secondary containment system.
- Managing the conditional scope boundary in Task 3 off-site sanitary upgrades.
- Construction oversight strategy: the proposed approach to construction administration oversight by phase, demonstrating risk-based allocation of EOR attention rather than uniform inspection intensity.

This section carries the most evaluation weight. Generic or templated methodology descriptions will score poorly. The Town expects proposals to engage with the specific technical and regulatory context of the Town of Oxford.

Section D Project Schedule (1 page or fold-out, **excluded from page count**)

Provide a project schedule in bar chart format showing all major tasks, key milestones, and Town review periods. Use calendar months. Identify the assumed contract award date and confirm the IFT target date of December 18, 2026. Identify any critical path items and dependencies.

6.3 Financial Submission

The Financial Submission shall include:

- A summary of the fee basis and key assumptions.
- A staffing table showing all personnel by role, hourly billing rates, and estimated hours by task for Tasks 1 through 6. Include Task 3.2 conditional scope as a separate column.
- A lump sum fixed fee for Tasks 1 through 5 (initiation, assessment, design, and tender services), broken down by task.
- A fixed fee or upset-limit time-and-materials fee for Task 6 (construction administration), with a clearly stated ceiling.
- A fee estimate for Task 3.2 conditional design services, presented as a separate clearly labelled line item. This fee will be included in the total fee used for evaluation scoring. The Proponent shall state the assumptions on which the Task 3.2 estimate is based. The fee is binding; it may not be increased at the time of authorization on the grounds that scope is now better defined, unless the Town issues a formal scope change that materially differs from the assumptions stated at submission.
- A disbursements basis (travel, printing, survey, etc.). No mark-up on disbursements will be paid.
- Hourly rates for additional services, if requested by the Town.

The Proponent shall not exceed quoted fixed fees without prior written authorization. Scope changes require a formal Change Order executed by both parties.

Section 7 Evaluation Criteria and Weighting

Proposals will be evaluated using a two-stage process. Technical Submissions will be evaluated first. Only proposals achieving a Technical score of 60 or more points out of 70 will have their Financial Submission opened and scored. Proponents falling below the technical threshold will be notified without financial evaluation.

Evaluation Criterion	Points	Scoring Guidance
TECHNICAL SUBMISSION (70 points total)		
A Proponent Team Qualifications	15	Relevance and depth of team experience; NS licensure; completeness of team. Mandatory requirements per Section 5.1 must be met.

Evaluation Criterion	Points	Scoring Guidance
B Relevant Project Experience	15	Quality and direct relevance of referenced projects to lift station/forcemain design, trenchless installation, water system design, and NSDPW and NSE permitting.
C Understanding and Technical Approach	35	<p>Demonstrated understanding of project-specific technical challenges; quality and specificity of proposed methodology; evidence of engagement with background documents. Generic or templated responses: 0-10 points. Strong, project-specific responses: 28-35 points.</p> <p>For the construction oversight strategy specifically, proposals that demonstrate a risk-differentiated approach, appropriately intensive oversight for high-consequence activities (e.g., trenchless crossing, lift station commissioning, live tie-ins) and appropriately lighter oversight for lower-risk activities, will score higher than those that default to uniform full-time inspection without justification, or that propose minimal oversight without addressing how high-risk activities will be managed.</p>
D Project Schedule	5	Realistic, well-sequenced schedule; appropriately sized Town review periods; clearly identified critical path; confirms IFT target of December 18, 2026.
FINANCIAL SUBMISSION (30 points total)		
Total Fixed Fee Tasks 1-5 and Task 6	30	<p>Points allocated by formula: $30 \times (\text{Lowest Total Fee} / \text{Proponent's Total Fee})$.</p> <p>Total Fee includes Tasks 1-6 and the Task 3.2 conditional scope as a single sum.</p>
TOTAL	100	

The Proponent achieving the highest combined score will be identified as the Preferred Proponent. The Town will negotiate a contract with the Preferred Proponent. If negotiations are unsuccessful, the Town may proceed to the next-highest ranked Proponent.

Note: *The Town reserves the right to conduct reference checks, request written clarifications, and seek supplementary information from any Proponent. Requests for clarification will be directed to all Proponents simultaneously. No information provided after the submission deadline will be considered unless specifically requested by the Town.*

Section 8 Contract Terms Summary

The following summarizes key contract terms. A form of Professional Services Agreement will be provided to the Preferred Proponent following evaluation.

8.1 Payment and Holdbacks

Payment will be made monthly against invoices reflecting work completed in the prior month. A holdback of ten percent (10%) will be retained from each progress invoice for Tasks 1 through 5. The holdback will be released upon the Town's written acceptance of the complete IFT package. For Task 6, the holdback will be retained until issuance of the Final Completion Certificate and delivery of accepted record drawings. Monthly invoices shall be accompanied by a brief progress narrative. The Town will process invoices within thirty (30) days of receipt.

8.2 Intellectual Property

All plans, drawings, specifications, and reports produced specifically for this Project shall, upon payment, become the property of the Town of Oxford for the Town's use in connection with this Project.

Notwithstanding the foregoing, the updated WaterCAD model (including all input files, network data, and associated documentation) shall become the sole property of the Town upon payment. The Town may use, modify, update, recalibrate, and distribute the model, without restriction, without further compensation to or consent from the Proponent. The Proponent retains ownership of, and the Town acquires no rights in, any other pre-existing tools, software, proprietary methodologies, calculation templates, standard details, or specifications used in producing the Project deliverables.

The Proponent retains ownership of any pre-existing tools, software, proprietary methodologies, calculation templates, standard details, and specifications incorporated into the Project Deliverables ("Background IP"). By submitting the Project Deliverables, the Proponent grants the Town a perpetual, irrevocable, royalty-free licence to use any Background IP embedded in the Project Deliverables to the extent necessary for the Town to use, maintain, modify, and extend the Project Deliverables for municipal purposes. This licence does not transfer ownership of Background IP and does not entitle the Town to use Background IP independently of the Project Deliverables.

The Proponent may retain copies of the Project Deliverables for its own records, quality assurance, and professional liability purposes, and may reference the Project (including general project description, scope, and role) for marketing and qualification purposes, without seeking the Town's consent, provided no confidential Town information is disclosed.

The Proponent shall not be required to waive moral rights, but agrees that the Town may modify, adapt, or update the Project Deliverables (including the WaterCAD model) for municipal purposes without further reference to the Proponent, and that such modification by the Town or others does not constitute an infringement of the Proponent's moral rights.

8.3 Insurance Requirements

The Proponent shall obtain and maintain the following coverage for the duration of the contract:

- Commercial General Liability: not less than \$2,000,000 per occurrence and in aggregate. The Town of Oxford named as additional insured. Policy to contain cross-liability and severability of interest provisions.
- Professional Liability (Errors and Omissions): not less than \$2,000,000 per claim and in aggregate, on a claims-made basis. Coverage maintained for a minimum of two (2) years following completion of services.
- Automobile Liability: not less than \$2,000,000 inclusive per occurrence.
- Workers' Compensation: the Proponent and all sub-consultants shall be in good standing with the Workers' Compensation Board of Nova Scotia at the time of proposal submission and throughout the contract.

Certificates of insurance with thirty (30) days notice of cancellation shall be provided to the Town prior to commencement of services.

8.4 Conflict of Interest

Proponents shall disclose in their proposals any actual or potential conflicts of interest, including any prior engagement with the Town of Oxford or involvement in studies related to this Project. Prior involvement does not disqualify a Proponent but must be disclosed. Failure to disclose a material conflict may result in disqualification at the Town's sole discretion.

8.5 Confidentiality

Background documents provided with this RFP are provided solely for proposal preparation and may not be reproduced, distributed, or used for any other purpose without the Town's consent. Proponents shall not initiate new contact with NSDPW, NSECC, or the development proponent specifically regarding this Project during the evaluation period without prior written permission from the Town. This restriction does not prohibit a Proponent from drawing on its existing working relationships, general regulatory knowledge, or prior correspondence with these agencies (on unrelated matters) to inform its proposed methodology, provided no Project-specific information is sought or disclosed and no commitments on the Town's behalf are made

or implied. Any substantive Project-specific discussion with these agencies, however initiated, shall be promptly disclosed to the Town's Procurement Contact.

8.6 Dispute Resolution

Disputes shall be addressed first through good-faith negotiation involving senior management of both parties. If not resolved within thirty (30) days, either party may initiate mediation with a jointly selected mediator, costs shared equally. If mediation fails, disputes shall be resolved by a court of competent jurisdiction in Nova Scotia, governed by the laws of Nova Scotia.

8.7 Termination

The Town may terminate for convenience upon fifteen (15) days written notice, paying the Proponent for services properly rendered and disbursements properly incurred to the date of termination. The Town may terminate for default if the Proponent fails to correct a material default within thirty (30) days of written notice, without prejudice to any other remedy.

8.8 Procurement Compliance

This procurement is subject to the Nova Scotia Public Procurement Act and the Canadian Free Trade Agreement (CFTA). The Town will not give preference to local proponents in ways that conflict with CFTA obligations. Proposal packages may be subject to disclosure under the Nova Scotia Municipal Government Act (FOIPOP). By submitting a proposal, the Proponent agrees to appropriate disclosure of information provided, subject to governing law.

Section 9 Submission Instructions

9.1 Closing Deadline

Proposals must be received by 2:00 p.m. Atlantic Daylight Time (ADT) on Monday, July 6, 2026. Proposals received after this deadline will not be accepted or considered. The time of receipt recorded by the Town email system will govern. Delays caused by electronic delivery services will not be grounds for extension.

9.2 Submission

Proposals shall be submitted electronically in PDF format by email to the Procurement Contact:

Linda Cloney, CAO
Town of Oxford
105 Lower Main Street
Oxford, Nova Scotia B0M 1P0
Tel: (902) 447-2624
lcloney@oxfordns.ca

The email subject line shall read: 2026-05-02-TOO_Proposal Submission_Firm Name.

It is the Proponent's sole responsibility to confirm receipt. Replacements for undelivered or corrupted files will not be accepted after the deadline. If file size is expected to exceed 20 MB, contact the Procurement Contact in advance to arrange secure file transfer.

9.3 Questions and Addenda

Questions regarding this RFP must be submitted in writing by email to the Procurement Contact no later than 2:00 p.m. ADT on Friday, June 26, 2026. Questions and responses of general interest will be issued as addenda to the Nova Scotia procurement site. No list of registered bidders will be retained. No oral communication will modify the terms of this RFP.

Proponents are responsible for monitoring for addenda. Failure to acknowledge all issued addenda in the proposal may result in rejection.

9.4 Proposal Validity

Proposals must remain valid and irrevocable for not less than ninety (90) days from the submission deadline.

9.5 No Commitment

This RFP does not commit the Town of Oxford to award a contract, to proceed to negotiations, or to reimburse any costs incurred by Proponents in preparing or submitting proposals. The Town reserves the right to cancel this RFP at any time, to reject any or all proposals, to waive formalities, and to accept the proposal deemed most advantageous to the Town.

Section 10 Appendices

The following appendices are attached to and form part of this RFP:

Appendix	Title	Notes
A	Water & Sewer Extensions South of Highway 104: Feasibility Study (Dillon Consulting Limited, December 2024, File 24-9041)	Primary project reference. All Proponents must read in full.
B	Development of WaterCAD Model, Town of Oxford (Dillon Consulting Limited, July 2024, File 23-7219)	Water distribution model documentation. WaterCAD .wtg file provided to successful Proponent on contract award.
C	CCTV Inspection Report: Main Street Gravity Sanitary Sewer	To be provided when available. Proponents to confirm receipt with Procurement Contact.
D	Town of Oxford Water Utility Emergency Contingency Plan: Distribution System Schematic (2020)	Network layout reference. Based on 2004/2005 mapping as documented in Appendix B.
E	Proposal Declaration Form	Must be completed and included with all Technical Submissions. See following page.

Memo

To: Linda Cloney
CAO, Town of Oxford

From: Matt Rodgers

Date: July 4, 2025

Subject: Water & Sewer Extensions South of Highway 104

Our File: 24-9041

Introduction

Project Understanding

The Town of Oxford (Town) has engaged Dillon Consulting Limited (Dillon) to assess the feasibility of extending the Town's water and sanitary system to an area south of the Trans Canada Highway (Highway 104) along Main Street; refer to **Figure 1** (enclosed under Appendix). The development community has expressed interest in building a mix of commercial and residential land uses on the south side of Highway 104. The goal of this project is to confirm the feasibility and associated opinion of probable costs to expand the water distribution and wastewater collection systems on Main Street from the Circle K Irving located at 4602 Main Street to the intersection of Main Street and Knol Drive.

This technical memorandum assesses the existing water and sanitary sewer systems and identifies the extent of upgrades required to support the development. It is understood that the Town will use this technical memorandum to apply for funding through the Provincial Capital Assistance Program (PCAP) and as a basis for future funding requests for the detailed design and construction phases of the project.

Review of Background Information

Dillon reviewed relevant background information, drawings, and reports to gain an understanding of the Town's water distribution and sanitary sewer systems. Key documents in this review included:

- Monthly sewage lagoon readings for January through October 2024;
- Well readings for 2023 and 2024;
- Chlorine residual data at the Chlorine Building, Little River Road Tank, and Pugwash Road Tank for January through November 2024;
- Development of WaterCad Model – Town of Oxford – Report (Dillon, 2024);
- Atlantic Canada Water Supply Guidelines (Atlantic Canada Water & Wastewater Association (ACWWA), 2022);
- Atlantic Canada Wastewater Systems Guidelines (ACWWA, 2022);
- Town of Oxford Operations and Maintenance Manual (Dillon, 2021);

- Water Supply for Public Fire Protection (Fire Underwriters Survey, 2020);
- Oxford Highway 104 Sinkhole Investigation (Harbourside Geotechnical Consultants, 2020);
- Oxford Sinkhole Investigation – Recommendations and Options (GHD, 2019); and
- Preliminary Sinkhole Assessment, Oxford Lions Park (Fracflow Consultants, 2018).

Study Limitations

The commentary provided in this report is preliminary in nature and has been developed solely for conceptual level planning purposes. It is important to emphasize that the following preliminary assessment was completed with limited information based on staff discussion and available record information. The assessment is based upon our experience working on similar projects and limited to our review of the background information. As such, confirmation of engineering opportunities and/or constraints requires further investigation, analysis, and discussion with utility providers, the Nova Scotia Department of Public Works (NSDPW), and other third-party agencies. The cost estimates provided are opinion of probable cost and offer a high-level overview of the anticipated costs which include a contingency allowance of 30% and an engineering allowance of 15% of the total estimated capital costs.

Design Criteria

Proposed Development

The proposed development may consist of a combination of commercial and residential lots; however, at the time of preparing this technical memorandum, information about specific land uses was not available. The following sections outline the assumptions made for each type of development.

Commercial Development

It is understood that the proposed development could include up to 10 commercial lots. The exact nature of these commercial lots was not known at the time of preparing this technical memorandum; however, examples provided were consistent with standard highway commercial development (e.g., fast food restaurant, strip mall, motel). The land area associated with the proposed commercial lots has not been defined; therefore, it was assumed that each commercial lot would have an area of 1 ha, which is a conservative estimate, considering the sizes of the existing commercial lots on the north side of Highway 104 (which are approximately 0.5 ha in size). As the specific commercial uses are unknown, the commercial flows were estimated based on an equivalent population of 85 persons per ha, as per the ACWWA Atlantic Canada Wastewater Systems Guidelines. This results in an equivalent population allowance of 850 people.

Residential Development

It is understood that the proposed development could include up to 50 single family homes. A population density of 2.2 people per dwelling was used, consistent with 2016 census data and the Development of WaterCad Model – Town of Oxford – Report (Dillon, 2024), resulting in a population allowance of 110 people.

Water Distribution System

Water Demand

Water demand is critical in determining the distribution network, pumping capability, and storage requirements. Three critical rates of demand are normally used: average day, maximum day, and peak hour demand. Fire flows, in conjunction with the maximum day flows, are also used to test the system's capability to deliver water and meet demands.

Average Day Demand

The average day demand (ADD) is determined by dividing the total annual consumption by 365 days. By dividing this rate by the population served, the per capita per day demand is derived. This rate is used primarily as a basis for the projection of the total water demand.

Maximum Day Demand

The maximum day demand (MDD) is determined by the single day of maximum consumption observed in the distribution system over one year. In using the single day of maximum flow, one must ensure that the record is not distorted by fire fighting demand, equipment malfunction, or watermain breaks. The peaking factor is determined by comparing the maximum day demand to the average day demand. The maximum day demand is used in determining the delivery capacity required of supply mains, treatment facilities, storage facilities, and pumping facilities. In conjunction with the fire flow, it is used to test the water system's capacity to supply the fire and maximum day demand.

Peak Hour Demand

The peak hour demand (PHD) is the expected maximum demand observed during a short period of the day. Most facilities are not equipped to record peak hour demands in such detail; therefore, the rate is established based on experience and judgment. The peak hour rate is used in determining pumping requirements.

Proposed Design Demands

Table 1 summarizes the design demands used in our assessment.

Table 1: Proposed Design Demands

Demand Scenario	Demand	Peaking Factor
Average Day Demand (ADD)	350 L/c/d	
Maximum Day Demand (MDD)	928 L/c/d	2.65
Peak Hour Demand (PHD)	1,313 L/c/d	3.75

The Development of WaterCad Model – Town of Oxford – Report (Dillon, 2024) indicates that the existing ADD for the Town is 180 L/c/d; however, the ACWWA Atlantic Canada Water Supply Guidelines recommends that an ADD of 350 L/c/d be used for proposed development. A review of the 2022 and 2023 well withdrawal records provide additional insight into the equivalent domestic unit demands observed for the Town. The 2022 domestic unit demand (omitting water delivered to Oxford Frozen Foods) was 710 L/c/d. In 2023, the same unit demand was calculated to be 264 L/c/d. This data was not available for the prior modelling report and requires an increase in domestic consumption from the prior value of 180 L/c/d.

As noted in **Table 1**, our assessment uses the ACWWA recommended value of 350 L/c/d for the ADD. The maximum day peaking factor of 2.65 is higher than that recommended in the ACWWA Atlantic Canada Water Supply Guidelines (2.5) but is based on water usage data for the Town as outlined in Development of WaterCad Model – Town of Oxford – Report (Dillon, 2024). The peak hour peaking factor is consistent with both the ACWWA guidelines and the 2024 Dillon report.

Table 2 summarizes the residential and commercial demands associated with the proposed development, with the commercial and residential population allowance of 850 and 110 people, respectively.

Table 2: Total Design Demands - Water

Demand Scenario	Residential Demand	Commercial Demand	Total Demand
Average Day Demand (ADD)	0.45 L/s	3.44 L/s	3.89 L/s
Maximum Day Demand (MDD)	1.18 L/s	9.12 L/s	10.3 L/s
Peak Hour Demand (PHD)	1.67 L/s	12.9 L/s	14.6 L/s

Recommended Fire Flows

Table 3 summarizes the recommended fire flow targets for the proposed development.

Table 3: Target Fire Flows for Distribution System Assessment

Land Use	Target Fire Flow
Residential	63 L/s
Commercial	116 L/s

The residential fire flow target of 63 L/s is consistent with the Development of WaterCad Model – Town of Oxford – Report (Dillon, 2024) and is cited as being the required fire flow for one- and two-family dwellings not exceeding 5,000 ft² as per the 2015 National Fire Protection Association (NFPA) 1 Fire Code.

The commercial fire flow target of 116 L/s was calculated in accordance with the Water Supply for Public Fire Protection (Fire Underwriters Survey, 2020) document based on the following assumptions:

- Type III Ordinary Construction; and
- An effective floor area of 1,000 m² per commercial building.

The Fire Underwriters Survey is conservatively used to provide a target allowance for fire flow to the proposed development. Actual fire flow for the development will be established according to building code requirements for life safety systems during detailed design of the building structures. The target fire flow is used as an expected maximum flow rate for the purpose of reviewing the distribution system’s performance under emergency conditions.

Operating Pressure

The operating pressures presented in **Table 4** were used in our assessment, in accordance with the ACWWA Atlantic Canada Water Supply Guidelines.

Table 4: Recommended Operating Pressures

Scenario	Pressure
Maximum allowable pressure in the system	700 kPa (100 psi)
Minimum residual pressure (PHD)	275 kPa (40 psi)
Minimum residual pressure in the system during a fire (MDD + fire flow)	140 kPa (20 psi)
Minimum residual pressure during a fire (MDD + fire flow) at the hydrant	150 kPa (22 psi)

C Factor

Our assessment used a Hazen-Williams roughness coefficient (C factor) of 150 for new high-density polyethylene (HDPE) pipe, which is consistent with Development of WaterCad Model – Town of Oxford – Report (Dillon, 2024).

Velocity

As recommended by the ACWWA Atlantic Canada Water Supply Guidelines, the maximum velocity should not exceed 1.5 m/s during normal system operation and 3.0 m/s during fire flow scenarios. High velocities and sudden changes in these velocities can result in pressure surges and negative pressure, which can cause serious pipe and/or equipment damage. Increased velocities require higher pumping heads and can result in higher energy costs due to the significant turbulent conditions at excessive velocities.

Minimum Pipe Size

Proposed pipe sizes have been determined based on the results of our hydraulic network analysis; however, the following minimum watermain diameters are recommended based on industry standard practice:

- 200 mm for watermains serving single family residential areas; and
- 250 mm for watermains servicing commercial areas.

Dillon observed that the water distribution system in the Town employs hydrants on watermains as small as 100 mm in diameter. This is below the recommended minimum diameter of 150 mm for watermains servicing hydrants.

Wastewater Collection System

Wastewater Generation

Wastewater is comprised of dry weather flow and wet weather flow. The dry weather flow is the wastewater generated by people during their day-to-day activities in their homes and businesses. Wet weather flow is generated through rainwater inflow and groundwater infiltration. Residential wastewater is calculated based on the estimated population determined by the proposed land use. Wastewater flows from commercial developments are generally based on the average daily rate of flow per area of development; however, when the nature of the commercial development is unknown, an equivalent population can be used to estimate commercial wastewater generation.

As indicated in the **Proposed Development** section, the equivalent population for the commercial portion of the proposed development is calculated to be 850 people and the population for the residential portion is calculated to be 110 people. The peak dry weather flow was calculated based on the following:

$Q_{PDW} = G * P * PF / 86,400$, where:

Q_{PDW} = peak dry weather flow (L/s)

G = average per capita wastewater generation flow rate (L/c/d)

P = population

PF = Harmon's peaking factor, where:

Harmon’s peaking factor is calculated as follows:

$$PF = 1 + [14 / (4 + P_{pf}^{0.5})], \text{ where:}$$

P_{pf} = population, thousands (i.e., $P / 1,000$)

An average wastewater generation rate (dry weather flow) of 350 L/c/d was conservatively used, consistent with the ADD for the water distribution system and omitting allowances for losses between water supply and wastewater collection. The present lagoon inflow data is insufficient to estimate actual sanitary flow rates for the Town due to the once-a-month records of instantaneous flow rate to the lagoon. It is our understanding that a flow meter on the inflow line to the existing lagoon will be installed by the Town to collect these operational data in the future. In lieu of accurate data, the sanitary sewer recovery rate is allowed to be 100% of the domestic potable water consumption.

The peak wet weather flow was calculated by adding a general inflow/infiltration (I/I) allowance of 0.3 L/s/ha, as per the ACWWA Atlantic Canada Wastewater Systems Guidelines, to the peak dry weather flow. The sanitary sewer extension will be a forcemain; however, we conservatively assumed that the proposed development may be serviced via a gravity system. Therefore, an I/I allowance for the proposed development was included in our calculation of the wastewater demand; however, no I/I allowance was included along the forcemain alignment. The following assumptions were made in the calculation of the I/I allowance:

- Residential lots will have a frontage of 12 m, in accordance with the Town’s Land Use Bylaw;
- New roadways within the proposed development will have an 18 m right-of-way; and
- Commercial lots will have a frontage of 100 m and a depth of 100 m.

Table 5 summarizes the residential and commercial wastewater demands.

Table 5: Total Design Demands – Wastewater

Parameter	Residential Demand	Commercial Demand	Total Demand
Average Dry Weather Demand	0.45 L/s	3.44 L/s	3.89 L/s
Peak Dry Weather Demand	1.89 L/s	13.2 L/s	15.1 L/s
I/I Allowance	0.16 L/s	0.27 L/s	0.43 L/s
Peak Wet Weather Demand	2.05 L/s	13.5 L/s	15.6 L/s

C Factor

Our assessment used a Hazen-Williams roughness coefficient (C factor) of 120 for new high-density polyethylene (HDPE) pipe, which is consistent with the ACWWA Atlantic Canada Wastewater Systems Guidelines.

Velocity

The minimum velocity within the forcemain should be at least 0.6 m/s to achieve self-cleansing, in accordance with the ACWWA Atlantic Canada Wastewater Systems Guidelines. The maximum velocity in the forcemain should not exceed 2.5 m/s, in accordance with industry standard practice to minimize headloss and pumping energy.

Minimum Pipe Size

Proposed pipe sizes have been determined based on the results of our analysis; however, the ACWWA Atlantic Canada Wastewater Systems Guidelines recommends a minimum forcemain diameter of 100 mm.

Lift Station

Table 6 summarizes the recommended design criteria for new lift stations, in accordance with the ACWWA Atlantic Canada Wastewater Systems Guidelines.

Table 6: Recommended Design Criteria for Lift Stations

Parameter	Design Criteria	Comments
Pump Cycle Time	5 < cycle < 10 (per hour)	Maximum starts-per-hour to meet pump vendor requirements
Number of Pumps	Minimum of 2 (duty/standby).	Must be able to pump design flow with largest pump out of service
Inlet Sewer	Maximum of 1	
Header Pipe Diameter	150 mm minimum	
Solids Handling	75 mm minimum	Smaller diameter may be permissible for macerator type pumps
Emergency Power Generation	To be provided for firm capacity of the facility	Option to run one pump if certain conditions are met
Wet Well Ventilation	Wet Well: 30 air changes/hour Valve Chamber: 12 air changes/hour	Based on intermittent activation when operating in the wet well

Nova Scotia Department of Public Works Requirements

Dillon met with the Nova Scotia Department of Public Works (NSDPW) on November 25, 2024, to discuss the requirements for crossing the Trans Canada Highway with water and sanitary mains. NSDPW indicated that no major issues are currently anticipated. The project will require a Work Within Highway Right-of-Way Permit, which can be applied for during the detailed design phase (this permit application

is not within our current scope of work). Additionally, record drawings will need to be submitted to NSDPW upon completion of construction.

NSDPW noted that there have been no recent crossings of the highway and highlighted the increased risk of sinkholes in the area. Trenchless installation methods, such as jack-and-bore and horizontal directional drilling were discussed, and NSDPW identified that a method with secondary containment (i.e., secondary liner, commonly known as a casing) would be ideal. Refer to the [Highway Crossing Considerations](#) section for more information.

Water Servicing Assessment

Water Distribution System

A 250 mm diameter watermain is recommended to service the proposed development tying into the existing distribution system on Main Street at Black River Road and crossing under Highway 104 to the boundary of the proposed development near Knol Drive. The length of the new 250 mm diameter watermain is approximately 380 m. An iterative analysis was undertaken to identify the following off-site upgrades that are recommended to support the proposed development:

- Main Street Upgrades:
 - Replacement of 249 m of 150 mm watermain on Main Street, from the intersection with Black River Road to in front of the Irving, with a 250 mm watermain; and
 - Replacement of 472 m of 200 mm watermain on Main Street, from in front of Oxford Frozen Foods to the intersection with Black River Road, with a 250 mm watermain.
- Distribution System Bottleneck Relief:
 - Replacement of 847 m of 150 mm watermain on Highway 204, from the 350 mm watermain (south of the PRV) to Sunset Avenue, with a 200 mm watermain.

Refer to **Figure 1** (enclosed) for the location of the proposed watermain extension and associated off-site upgrades. Refer to **Figure 2** (enclosed) for a conceptual plan/profile of the highway crossing. Off-site upgrades refer to those improvements required to the existing system that are outside the proposed development area.

Scenarios Assessed

Our assessment examined three options:

- Extension of the watermain across the highway with no off-site upgrades;
- Extension of the watermain across the highway with off-site watermain upgrades; and
- Extension of the watermain across the highway with off-site watermain upgrades and upgrades to the balancing tank (T-2) located to the east of Pugwash Road.

The ADD, MDD, PHD, and MDD plus Fire Flow demand scenarios were run for each of the three options. Pressure and available fire flow results are presented in the following sections.

Pressure Results

Under existing conditions, pressure requirements could not be met for the proposed watermain extension. The following sections assume that the proposed upgrades mentioned above would be carried out. In general, pressures are within the recommended operating range for the watermain extension to the proposed development, with all proposed upgrades. **Table 7** presents the pressure results for each of the demand scenarios for each of the options assessed.

Table 7: Pressure Results

Option	ADD	MDD	PHD
Watermain Extension only	400-421 kPa (58-61 psi)	386-414 kPa (56-60 psi)	372-393 kPa (54-57 psi)
Watermain Extension + Off-site Watermain Upgrades	407-434 kPa (59-63 psi)	393-421 kPa (57-61 psi)	386-414 kPa (56-60 psi)
Watermain Extension + Off-site Upgrades + Tank T-2 Upgrades	427-448 kPa (62-65 psi)	414-441 kPa (60-64 psi)	407-434 kPa (59-63 psi)

Available Fire Flow

Table 8 summarizes the results of the Maximum Day Plus Fire Flow demand scenario for each option.

Table 8: Available Fire Flow Results

Option	Available Fire Flow ¹	Velocity ²
Watermain Extension only	35 L/s	1.45 m/s
Watermain Extension + Off-site Watermain Upgrades	64 L/s	1.52 m/s
Watermain Extension + Off-site Upgrades + Tank T-2 Upgrades	67 L/s	1.57 m/s

Notes:

¹ At the end of the watermain extension (at Knol Drive).

² In the watermain extension, when fire flow is applied at the end of the watermain extension (at Knol Drive).

During our assessment, we noted that the 150 mm diameter watermain on Highway 204, from the 350 mm watermain (south of the PRV) to Sunset Avenue, currently experiences significant headloss (6 m). Increasing the diameter of this watermain to 200 mm greatly reduces the headloss (to 3.5 m). This recommended upgrade benefits the entire community, including the proposed development. It is very difficult to achieve non-residential fire flow within the Town as the system operates within a single pressure zone and much of the Town's existing watermains are undersized (i.e., 100 mm and 150 mm in diameter). Therefore, we recommend that each commercial development for the proposed

development be designed to include their own on-site cistern and fire pump, or common reservoir and fire pumps, to meet building code requirements for fire protection.

The commercial threshold for fire flow was not met in any of the water system assessment scenarios. The proposed development may require building-specific cistern and fire pumps for building code life safety systems design and rely on municipal water for domestic and external hose allowance fire flow only.

Balancing Tank (T-2)

The balancing tank (T-2) located to the east of Pugwash Road is understood to be in poor condition. If this tank is replaced, it is recommended that it be replaced with elevated storage. The Town of Oxford pressure zone is determined by the operating setpoint of the PRV-10 on Highway 204. The present setting of this valve establishes the Town's pressure zone at 64 m hydraulic grade line. The present elevation of balancing tank T-2 is well below this operating grade line. The tank is as currently not effective, from a system hydraulics perspective. Replacing the balancing with elevated storage will benefit the proposed development but does not significantly impact the pressure or fire flow results. Improvements to balancing tank T-2 would improve service performance to both the development (via reinforcement) and to the Town. If the proposed development achieves fire flow requirements through on-site cistern and fire pumps, then the upgrade to T-2 may not be required as a condition for development.

Water Treatment Plant

The original groundwater supply was replaced with a groundwater source located near McElmon Brook, approximately 14 km north of the Town, in 2001. The new groundwater source consists of four production wells:

- Wells P1 and P4 are rated for 1,297 m³/day (238 USgpm); and
- Wells P2 and P3 are rated for 2,590 m³/day (475 USgpm).

A 350 mm diameter, 12 km long, transmission main connects the wellfield to the distribution system, and is sized for a future expansion of the system to 6,545 m³/day (1,200 USgpm). A chlorination facility, constructed in 2003, is located on the transmission main near the Community of Leicester and advances chlorinated water to a 926 m³ (245,000 US gallon) bolted steel glass-lined pump balancing tank (T-4) located off Little River Road. The top water elevation of the balancing tank is approximately 100 m with outflow from the tank to the Town adjusted by a hydraulic pressure reducing valve (PRV-10) prior to feeding the distribution system. A secondary disinfection system is provided via re-chlorination after the storage tank, prior to distribution.

Permitting of the system is governed by two approvals from the Nova Scotia Department of Environment and Climate Change (NSECC):

- Approval to Withdraw No. 2000-016824-02 (expiring May 15, 2029); and

- Approval to Operate No. 2009-066282-01 (expiring June 8, 2029).

The water withdrawal for the wellfield was provided for 2022 and 2023 and was compared against the withdrawal approval to determine the available water the system would be capable of producing within the existing approval. **Table 9** outlines the approval limits and withdrawal rates for 2022 and 2023. Despite a 28% reduction in overall water use in 2023, the water withdrawals exceeded many of the approval limits in both years.

Table 9: Well Field Water Withdrawal

	Approval	2022	2023 ¹
Well #1 (P1) – Maximum (over 7 days)	1,300,000	1,605,565	1,367,028
Well #2 (P2) – Maximum (over 7 days)	2,600,000	2,785,025	2,802,966
Well #3 (P3) – Maximum (over 7 days)	2,600,000	3,289,900	3,202,467
Well #4 (P4) – Maximum (over 7 days)	1,300,000	1,635,023	1,805,753
Total Well Field – Maximum (over 7 days)	4,750,000	5,640,191	4,959,556
Total Well Field – Average (over 30 days)	4,500,000	5,361,990	4,461,380
Total Well Field – Average (Sep. to Nov.)	3,900,000	4,640,705	3,884,604
Total Well Field – Average (365 days)	1,950,000	3,016,179	2,159,891
Total Well Field – Annual Total	711,750,000	1,100,905,176	788,360,163

Notes:

¹ Adjusted, 4 events over 11 days the totalizer values were not recorded, very high reading identifies when totalizer began transmitting again. Each day was averaged over time totalizer was offline.

² Orange shading represents an exceedance of the withdrawal approval.

It was identified through discussion with the Town, and review of the original results provided, that the flow meters were not accurately scaled, leading to an underestimation of the actual water withdrawals, including those in 2022 and 2023. The flow meters were unable to record flows greater than the programmed maximum reading, resulting in a false maximum and inaccurate data collection. This calibration issue was rectified in October 2024. Following the correction of the flow meters, data collected over a 20-day period indicated that both the total wellfield maximum over 7 days and the average for 30 days were exceeded. If this trend continues throughout the year, it is likely that there will be further exceedances of the parameters set in the withdrawal approval.

Oxford Frozen Foods (OFF) represents 70-90% of the Town's existing overall water demand. OFF has shown a decrease in water consumption; however, the overall withdrawal from the system is still greater than the withdrawal limits. As such, it is recommended that the Town pursue expansion of the water system capacity to meet long term demands, independently of the proposed development south of Highway 104. The evaluation may require an aquifer safe yield study to support a request for alteration to the permits for water withdrawal.

The proposed development is estimated to require a 336 m³ per day increase to the water treatment plant production rate. This represents a 7.5% increase in water demand compared to 2023. An evaluation of the wellfield is recommended to determine if it can be expanded along with the withdrawal approval limit.

The maximum withdrawal recorded in the system was 6,072,200 L and occurred in 2022. **Table 10** outlines the existing flow through the system compared to flow with the addition of the proposed development, the design conditions, and the recommended average velocity for the transmission line. The chlorine contact calculations were confirmed based on the 350 mm diameter transmission line with a conservative total volume allowance of 770 m³ and a minimum contact time to achieve a concentration-time (CT) disinfection rate of 12 mg*min/L. The actual transmission distance between the primary chlorination and the balancing tank is not presently known to Dillon and should be confirmed for the Town to monitor and control contact time. We recommend that CT continue to be actively monitored and controlled. This requires that the contact time and residual chlorine continue to be monitored using the existing flow meters and residual chlorine sampling point located at the balancing tank.

Table 10: System Flow Rate and Required Residual

Condition	Flow (L/day)	Flow (m³/day)	Flow (L/min)	Required Residual (mg/L)
Maximum Withdrawal (2022)	6,072,200		4,217	0.66
Maximum Withdrawal + Proposed Development	6,408,200		4,450	0.70
Average 2022 + Proposed Development	3,352,179		2,328	0.37
Transmission Line Maximum Recommended Velocity (1.5 m/s) ¹		5,451	3,785	0.59
Transmission Line Design Rate		6,545	4,545	0.71

Note:

¹ If there is increased flow, there will be increased velocity.

It is recommended that the velocity in a watermain not exceed 1.5 m/s during normal operation. Based on the size of the transmission line from the wells to the elevated storage tank (350 mm), this corresponds to a maximum flow rate of 5,451 m³/day (7,850 L/min). The existing primary disinfection system is required to meet virus inactivation. Based on the recommended maximum flow rate in the transmission line, and exclusion of cysts from the primary disinfection criteria, then it is expected that the existing transmission contact pipe and chlorination system should be able to meet the disinfection CT requirements. Dillon understands that the primary disinfection system operates with a single duty injection pump and that the Town is in the process of installing a required standby injection pump.

Sanitary Servicing Assessment

Wastewater Collection System

A new lift station servicing the proposed development is recommended, with a 150 mm diameter forcemain from the new lift station to the Town's existing gravity sanitary sewer at the intersection of Main Street and Black River Road. At the time of preparing this technical memorandum, the capacities of the Town's existing gravity sewer system, downstream lift station (located near the Scotiabank on Main Street), and forcemain to the sewage lagoons are unknown. Further evaluation will be required during detailed design to determine the extents of off-site sanitary sewer upgrades required to support the proposed development.

Refer to **Figure 1** (enclosed) for the location of the proposed sanitary forcemain and associated off-site upgrades. Refer to **Figure 2** (enclosed) for a conceptual plan/profile of the highway crossing.

Lift Station

As discussed above, a new lift station will be required to convey wastewater from the proposed development to the Town's existing sanitary collection system. The lift station is recommended to be equipped with non-clog submersible sewage pumps with an underground wet well and a building to accommodate the piping, valves, electrical system, control systems, instrumentation, and back-up generator.

Design Capacity

We recommend the lift station be designed as a duty/standby configuration to pump the peak wet weather flow of 15.6 L/s from the proposed development with one pump out of service. All pumps should be supplied and operated with variable frequency drives (VFD). A VFD will provide the following benefits:

- Energy savings by operating the pump at its best efficiency point;
- Prevention of motor overload;
- Energy savings by eliminating surge at pump start up; and
- Mitigation of water hammer.

Lift Station

The proposed lift station will convey flow from the proposed development to the Town's existing gravity sanitary sewer system at the intersection of Main Street and Black River Road. The lift station is recommended to be a duplex station with one duty and one standby pump. Each pump is recommended to have a capacity of 16 L/s, with a total dynamic head of 6.5 m; refer to **Table 11** for more information.

Table 11: Lift Station Summary

Component	Value
Duty Pump	1
Standby Pump	1
Average Dry Weather Flow	3.89 L/s
Peak Wet Weather Flow (Interception Design Flow)	15.6 L/s
Pump Capacity (each pump)	16.0 L/s
Forcemain Diameter	150 mm
Total Dynamic Head (TDH) at Maximum Design Flow	8.8 m
Velocity (one pump running)	0.86 m/s
Approximate Motor Size (each pump)	2.4 kW

Wet Well

A circular precast concrete unit with a diameter of 2.4 m and overall depth of 4.0 m is recommended for the wet well. This recommendation is based on the incoming gravity sewer (from the proposed development) having a minimum depth of cover of 2.0 m. The wet well should be constructed with a benched floor to promote self-cleansing and to minimize any potential dead spots.

Lift Station Piping

Internal piping within the lift station is recommended to be Ductile Iron Class 350 with coal tar epoxy lining or stainless steel. Threaded flanges or Victaulic couplings are recommended to be used for ductile iron pipe joints, fittings, and connections within the station. Pressed or rolled vanstone neck flanges are recommended to be used for stainless steel pipe joints, fittings, and connections. A common flow meter is recommended to be included on the discharge header to monitor flows.

Emergency Power

A back-up generator sized to provide power to all equipment, lights, and other accessories during power interruptions is recommended, complete with an automatic power transfer switch to transfer the station's power supply to the generator during a power disruption and to return to normal operation when power has been restored. The generator is recommended to be supplied with noise suppression equipment to limit disruption to existing neighbours.

Controls

We recommend that all equipment be controlled through a local control panel mounted in the lift station building. A custom panel designed to be integrated into the Town's SCADA network will be

required. The panel will provide a Hand/Off/Auto control selector to allow for manual control of the station. The control system will be required to report remotely to the Town’s SCADA system including alarm conditions.

Ultrasonic level instruments in the wet well are recommended to control the operation of the pumps. Auxiliary floats are recommended to provide high- and low-level alarms as well as back-up control in the event of a failure in the ultrasonic equipment.

Forcemain

Three pipe materials (Ductile Iron, HDPE, and PVC) were considered for the sanitary forcemain. A summary of the advantages and disadvantages of these pipe materials is presented in **Table 12**.

Table 12: Comparison of Pipe Materials

Pipe Material	Benefits	Considerations
Ductile Iron	<ul style="list-style-type: none"> • Thinnest wall; greatest strength; and • Standard test method. 	<ul style="list-style-type: none"> • Pipe and fittings are susceptible to corrosion; • Heavy; and • Higher installation cost.
HDPE	<ul style="list-style-type: none"> • Excellent corrosion resistance; • Long laying length (where practical); • Relatively easy to handle; and • Ideal for horizontal directional drilling. 	<ul style="list-style-type: none"> • Requires butt fusing; • Careful handling required due to risk of abrasion; • Long distances of open trench; • Not designed for vacuum conditions; and • Increased installation cost if long lay lengths are not possible.
PVC	<ul style="list-style-type: none"> • Excellent corrosion resistance; • Lightweight; • High impact strength; • Standard test method; and • Cost competitive. 	<ul style="list-style-type: none"> • Must be handled carefully in freezing conditions; and • Fittings are susceptible to corrosion.

We recommend that the forcemain piping for the project be HDPE.

Sewage Treatment Plant

The Oxford Sewage Treatment Plant (STP) is located at 299 Station Street and is owned and operated by the Town. The system was originally designed in 1992 and it is understood that no significant upgrades have been completed, except for the implementation of a new flow meter. The STP is permitted under NSECC Approval No. 2020-2654053-00 which expires November 15, 2030.

The Town’s wastewater treatment system is supported by two aerated waste stabilization ponds (lagoons) and one ultraviolet (UV) irradiation disinfection channel. Most of the treated effluent exits to manhole (MH) #5 and is then conveyed to River Philip; excess effluent is contained by a 13.7 x 13.7 m retention pond.

Wastewater flows from the Town to Cell #1, and then to Cell #2 which is divided by a lagoon curtain. Piping and manholes allow the operator to divert water to either of the cells or around any cell. Aeration is provided by three 25 hp blowers which feed 100 static tube aerators from a 32.5 m² blower building.

Wastewater enters Cell #1 from the Town and industries within the service boundary of the Town. At the standard design depth, Cell #1 can contain approximately 34,000 m³ of wastewater. Sewage travels lengthwise through the 170 x 72 m cell containing 14 laterals with 5 aerators each (70 total).

Wastewater enters Cell #2 from the Cell #1 outlet and travels northeast past 6 laterals containing 4 aerators each (24 total) and can contain approximately 34,000 m³ of wastewater. A lagoon curtain sits 101 m from the back end of the second 170 x 72 m cell between 2 laterals. The pre-curtain lateral contains 2 aerators, and the post-curtain lateral contains 4 aerators (6 total).

Wastewater travels from Cell #2 to the UV irradiation system for disinfection and is combined by an overflow baffle to slow and spread the flow evenly. Water travels 12.2 m along the length of the UV channel past two banks of UV modules containing 4 modules per bank and 4 lamps per module (16 lamps per bank, 32 in total). Flow restricts at a 150 mm throat Parshall flume before exiting as effluent to MH #5 in a 300 mm PVC distribution pipe. Treated effluent is then discharged into River Philip.

Overall, there is limited data available on the operational capability of the STP. Correspondence in year 2020 by email between Dillon and the NSECC indicates that there are no specifications, design calculations, or design basis available.

Based on the lack of available information, we were not able to compare the current operation to the design for the STP; however, we were able to compare the addition of flows from the proposed development to the capacity as presented during the last permit application renewal to the NSECC and the to the size of the UV reactor as provided in the Operation and Maintenance Manual. Identified hydraulic rates include:

- Renewal Facility design flow: 2,568 m³/day;
- Renewal Facility annual average daily volume: 1,627 m³/day (21 days of storage); and
- UV peak design flow: 3,273 m³/day (500 imperial gpm).

Hydraulic review

Wastewater flows were provided for 2023, a portion of 2022 (3 months), and a portion of 2024 (9 months). A summary of the data is provided in **Table 13**. Flows were provided as a monthly total; however, these were based on a singular instantaneous flow reading converted to a monthly total by approximation. The Town currently does not have continual flow data logging equipment; therefore, in months of high rainfall or drought, these results may be skewed, depending on the day flow readings were captured. The available monitoring data for the existing lagoons was insufficient for Dillon to undertake a capacity and performance review.

Table 13: Lift Station Summary

	2023	2024
Yearly Total (m³)	218,285	(see Note ¹)
Yearly Average Day (m³/day)	598	659 ²
Maximum Month (m³)	46,646 (January)	61,471 (February)
Maximum Month Average Day (m³/day)	1,505	2,120

Notes:

¹ Not included as full year was not available at the time of preparation of this technical memorandum.

² Averaged over 9 months.

Due to the risk of inconsistencies with a single instantaneous reading each month, we estimated the current water discharge based on the average per capita wastewater generation rate of 350 L/c/d. With a current population of approximately 1,170 this would equate to an estimated wastewater production rate of 410 m³ per day. This total omits potential sewer discharge from non-residential users. This is less than the reported yearly values but does not include the additional precipitation in the lagoons and any stormwater runoff entering the system. With these considerations, the yearly average day appears to be the best available estimate of the flows; however, flow monitoring is recommended to provide a more detailed understating of the wastewater flows.

The system’s flow, based on the data provided, appears to be approximately 36-40% of the total hydraulic capacity of the wastewater lagoon based on the estimated average day. No flows have been reported to exceed the estimated maximum day design capacity. As described above, the proposed development is estimated to result in an equivalent population increase of 960 people (850 from the commercial properties and 110 from the residential properties). This results in an additional 336 m³ per day of wastewater being conveyed to the STP, which is approximately 21% of the capacity of the wastewater lagoons. Should this development move forward, the estimated wastewater entering the STP would be 61% of the wastewater lagoon’s capacity (based on 2024 existing discharge) to maintain the 21-day hydraulic retention time of the lagoons.

Overall, the STP is estimated to have sufficient hydraulic capacity to accommodate the additional wastewater that is estimated to be generated by the proposed development.

System Treatment

Water quality data was provided for the system discharge from January 2021 to October 2024. Over this time, there were exceedances of the discharge criteria outlined in the approval to operate. **Table 14** presents a summary of the results and **Figure 3** provides a visual representation of the data. **Table 14** highlights the inconsistent results for the exceedance of Escherichia coli (E. coli) and the seasonal variation with total suspended solids (TSS) and carbonaceous biochemical oxygen demand (CBOD).

Table 14: Summary of Effluent Water Quality (2021 to 2024)

Parameter	Units	Approval	Maximum	Average	Minimum	No. of Samples	No. of Limit Exceedances
E. coli	CFU/100 mL	200	570	70.8	< 10	68	2
TSS	mg/L	20	44	10.3	1.6	68	10
CBOD	mg/L	20	20	6.02	3.2	68	1

Note:

Results for pH were not provided.

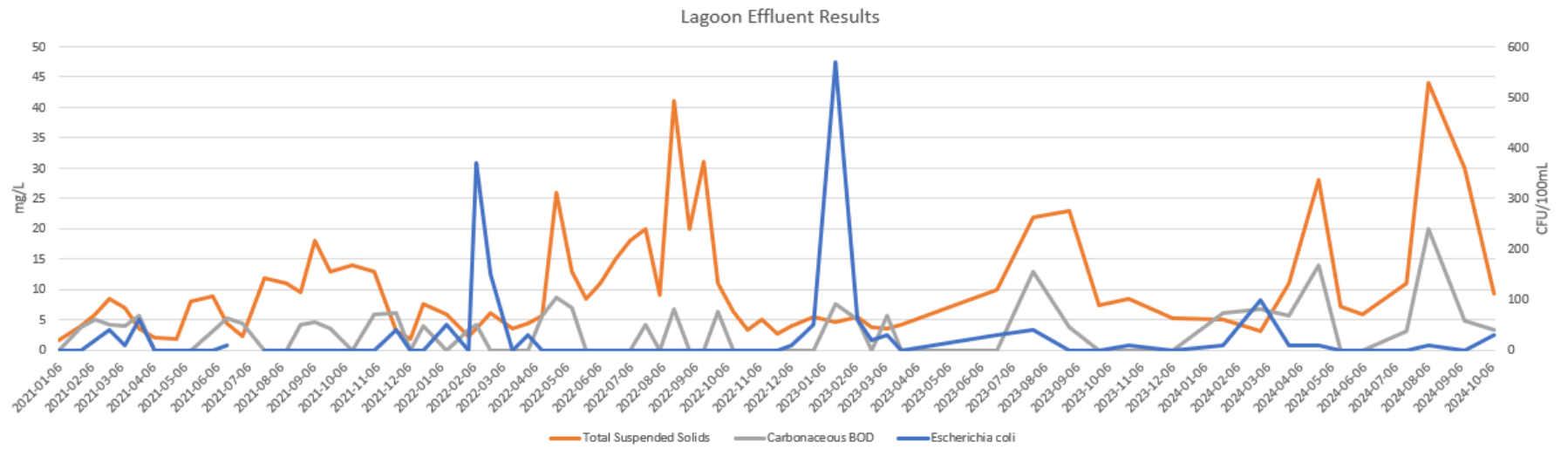


Figure 3: Effluent Water Quality (2021 to 2024)

Though there were exceedances to the approval limits, parameters in the approval are evaluated on an average quarterly basis. **Table 15** summarizes the average quarterly results for each quarter where exceedances to the limits were identified.

Table 15: Quarterly Effluent Water Quality (2021 to 2024)

Quarter	Parameter Limit Exceedance	No. of Samples	No. of Limit Exceedances	Average Concentration	Approval Exceedance?
2021	None				N/A
2022					
Q1	E. coli	5	1	110 CFU	No
Q2	TSS	6	1	13.2 mg/L	No
Q3	TSS	7	3	21.5 mg/L	Yes
2023					
Q1	E. coli	5	1	136 CFU	No
Q3	TSS	3	2	17.4 mg/L	No
2024					
Q2	TSS	6	1	13.7 mg/L	No
Q3	TSS	3	2	28.3 mg/L	Yes
Q3	CBOD	3	1	9.33 mg/L	No

Notes:

Q1: January to March

Q2: April to June

Q3: July to September

Q4: October to December

Overall, it appears that there is a seasonal trend in TSS concentrations exceeding the approval limit, with corresponding peaks in CBOD. In discussion with the Town’s Operations staff, there have been observed changes in the wastewater lagoons in the summer (Q3), with increases in algae in the lagoon which would impact the effluent in the warmer seasons.

With respect to the proposed development, there would not be a direct correlation between increased population and the effluent quality/treatability of the system. Generally, it would be expected that there would be increased nutrient loadings to the lagoons and possible variation in effluent discharge quality. A detailed engineering investigation is required to determine the impacts, including a review of current nutrient loading through influent sampling, detailed flow readings, and evaluation and operation of the existing equipment. Overall, the system generally operates well within the discharge criteria and would be capable of handling increased nutrient loading in the fall, winter, and spring based on the effluent water quality results. With effluent water quality exceedances in the summer months, we recommend

further investigation to confirm if improvements to the STP will be required to accommodate to proposed development.

Highway Crossing Considerations

We propose that the water and sanitary mains crossing the Trans Canada Highway be installed via trenchless methods (such as horizontal directional drilling (HDD) or jack-and-bore) to reduce potential impacts to the highway. The crossing location is located on the edge of an active Karst region, which has been the source of numerous sinkholes in recent history. This may create some issues with a trenchless crossing should voids be encountered during the bore.

As described above, the NSDPW has noted a preference for secondary containment (secondary liner, commonly known as a casing) without grouting of the annular space. It was also discussed that settlement and vibration monitoring may be required during and shortly after the installation of the secondary liner. The secondary liner would be required to be able to contain the pressure caused by a failure of the primary liner, to reduce the potential risk to the highway.

The proposed carrier pipes, or primary liner (watermain and sanitary forcemain) would each be installed within their respective casing pipes (secondary liners). The casing pipes could either be rigid (concrete or steel) or flexible (HDPE or PVC) based on the selected installation method. Rigid casing pipes would be more appropriate for jack-and-bore installations, whereas flexible liners would be appropriate for HDD applications. In each case, the carrier pipes would be joint restrained pipe systems supported within the casing pipe with appropriate spacers and end caps to prevent material migration into the void space between the mains and casing pipes.

The casing pipe is recommended to be slightly larger in inside diameter than the outside diameter of the carrier pipe. This is to allow for the support spacers and to align the carrier pipe within the casing pipe if adjustments are required due to grade. The design of the casing pipe is dependent on the chosen installation method, soil conditions, and liner length and diameter.

For either method, a launch and receiving area will be required on each side of the highway. For jack-and-bore installation, more substantial pits would be required to house the necessary equipment; for HDD, the equipment would sit at ground surface. Based on final design requirement and subsurface conditions, intermediate shafts may be required along the alignment. This is difficult to determine at this time, given the lack of site-specific geotechnical information.

A site-specific geotechnical investigation will be required prior to detailed design of the highway crossing. The geotechnical investigation must be completed to sufficient depths to properly assess the soil conditions for the crossing. The geotechnical engineer should provide recommendations regarding the recommended trenchless installation method and the details required for detailed design of the trenchless crossing. Given the potential presence of karsts within the project area, consideration should be given to using Ground Penetrating Radar (GPR) or other suitable means to identify potential voids along the proposed pipe alignments.

Refer to **Figure 2** (enclosed) for a conceptual plan/profile of the highway crossing.

Conclusions

Water Distribution System

A 250 mm watermain extension and off-site watermain upgrades are required to support the proposed residential and commercial development to the south of Highway 104. The following off-site upgrades are necessary in order to achieve the residential fire flow target of 63 L/s:

- Replacement of 249 m of 150 mm watermain on Main Street, from the intersection with Black River Road to in front of the Irving, with a 250 mm watermain;
- Replacement of 472 m of 200 mm watermain on Main Street, from in front of Oxford Frozen Foods to the intersection with Black River Road, with a 250 mm watermain; and
- Replacement of 847 m of 150 mm watermain on Highway 204, from the 350 mm watermain (south of the PRV) to Sunset Avenue, with a 200 mm watermain.

These off-site watermain upgrades are not sufficient for the proposed development to achieve the commercial fire flow target of 116 L/s, which would require extensive additional upgrades to the Town's existing water distribution system. It is very difficult to achieve non-residential fire flow within the Town as the system operates within a single pressure zone and much of the Town's existing watermains are undersized (i.e., 100 mm and 150 mm in diameter). Therefore, we recommend that each commercial development be designed to include their own on-site reservoir for fire protection.

Water Supply

The Town is currently exceeding the wellfield withdrawal limits and we recommend that the wellfield be investigated for expansion, which could be undertaken using a phased approach. We recommend a detailed analysis be conducted to determine the current conditions of the wells and to evaluate the current water level drawdown, to determine if the wells can be expanded. If the well level results indicate that there may be additional available yield, we anticipate that a 72-hr pumping test would be required to determine the new pumping rate of the wells. If the wellfield is determined to be at its capacity, we recommend a siting study be completed to identify a suitable location for an additional wellfield.

Investigating an expansion of or the development of an additional wellfield should also consider the Town's long-term plans for growth within the community in addition to the needs of the proposed development to the south of Highway 104. Impacts to the existing 350 mm diameter transmission line should also be considered to ensure it is sized appropriately to convey the additional demands.

Wastewater Collection System

A 150 mm sanitary forcemain extension and the following off-site sanitary sewer upgrades are required to support the proposed residential and commercial development to the south of Highway 104:

- Replacement of the existing lift station (near the Scotiabank) on Main Street. The exact scope of these upgrades was not determined based on the information that is currently available; and
- Replacement of the sanitary forcemain that conveys wastewater from the existing lift station to the STP. The exact scope of these upgrades was not determined based on the information that is currently available.

Additionally, the gravity sanitary sewer on Main Street, from the intersection of Black River Road to the existing lift station may need to be removed and replaced in order to support the proposed development. However, because the size and condition of this sewer is currently unknown, we are unable to determine the extents of any required upgrades.

Sewage Treatment

The Town's STP may have the hydraulic capacity for the increased flows that are estimated to be generated from the proposed development; however, continuous flow monitoring will be required to determine the peak flow rates and detailed operating flows. This will require the installation of continuous flow monitoring equipment as required by the approval to operate.

There are existing issues with the system's compliance to the discharge approval in the summer months, which may be due to algae in the lagoons. We recommend that the Town contact NSECC to discuss if an exception could be made in the summer months as the system is compliant at other times of the year. A detailed engineering assessment of the treatment system is required to confirm if the increase in wastewater flows will impact the effluent; however, there appears to be treatment capacity available, provided that the issues with summer compliance are addressed. A detailed engineering assessment would include:

- Review of the influent loading, which would require influent sampling;
- Review of influent and effluent flows through continuous flow monitoring;
- Possible evaluation of sludge depth in the lagoons;
- Confirmation of treatment capacity of the lagoons, including aeration equipment and settling zones, to provide maximum flows at set nutrient loading rate to meet approval limits; and
- Recommendation on system upgrades, which may include changes to the treatment system or upgrades. This could include tertiary treatment options should it be required.

Opinion of Probable Cost Estimate

Table 16 presents conceptual opinion of probable cost estimates for capital costs associated with the construction of new water and sanitary sewer mains to service the proposed development on the south side of Highway 104 as well as off-site upgrades to support the proposed development. Due to the conceptual nature of this study and understanding that there are unknown variables beyond the scope of this study, the estimates presented include a contingency allowance of 30% and an engineering allowance of 15% of the total estimated capital costs. Note that the estimates presented do not include HST. The costs are based on 2024 construction dollars.

Table 16: Opinion of Probable Cost Estimate

Item	Quantity	Unit	Unit Rate	Cost
Water Servicing & Off-site Upgrades				
250 mm watermain extension – open trench	522	m	\$1,500	\$783,000
250 mm watermain extension – trenchless	225	m	\$2,500	\$562,000
ARV Chamber	1	ea	\$25,000	\$25,000
Remove 150 mm watermain and replace with 250 mm watermain	249	m	\$1,500	\$373,500
Remove 200 mm watermain and replace with 250 mm watermain	472	m	\$1,500	\$708,000
Remove 150 mm watermain and replace with 200 mm watermain	847	m	\$1,500	\$1,270,500
Sanitary Servicing & Off-site Upgrades				
150 mm forcemain – open trench	801	m	\$1,500	\$1,201,500
150 mm forcemain – trenchless	225	m	\$2,500	\$562,500
ARV Chamber	1	ea	\$25,000	\$25,000
New Lift Station (Proposed Development)	1	LS	\$1,000,000	\$1,000,000
Upgrade Existing Lift Station ¹	1	LS	\$1,000,000	\$1,000,000
Replace Existing Forcemain ²	1	LS	\$1,000,000	\$1,000,000
Remove and Replace Existing Gravity Sewer ³	1	LS	\$500,000	\$500,000
Subtotal (rounded)				\$9,000,000
Contingency (30%) (rounded)				\$2,700,000
Engineering (15%) (rounded)				\$1,400,000
Total (excl. HST) (rounded)				\$13,100,000

Notes:

¹ The details of the existing lift station are unknown; therefore, this is an allowance for budgetary purposes.

² The details of the existing forcemain are unknown; therefore, this is an allowance for budgetary purposes.

³ The details of the existing gravity sanitary sewer are unknown; therefore, this is an allowance for budgetary purposes.

Recommended Next Steps

Based on the results of our assessment, we recommend that the Town undertake the following:

- Request additional information from the developer regarding the exact nature of the proposed development (i.e., confirmation of the number of single-family homes and confirmation of the size and nature of the planned commercial lots);
- Conduct a site-specific geotechnical investigation to confirm the subsurface conditions and to select a trenchless installation method for the watermain and sanitary forcemain crossings of Highway 104;
- Conduct a CCTV inspection of the gravity sanitary sewer system on Main Street to verify the system's size and condition, to confirm if off-site upgrades are required to support the proposed development;
- Verify the pumping capacity and wet well volume of the existing lift station (near Scotiabank on Main Street), to confirm the scope of upgrades that are required;
- Verify the capacity of the forcemain from the existing lift station to the STP, to confirm if off-site upgrades are required to support the proposed development;
- Investigate the capacity of the current wellfield, with consideration of long-term development within the Town;
- Conduct a detailed engineering assessment of the wastewater treatment system, to confirm if upgrades are required to support the proposed development; and
- Consider the implementation of an off-site levy or other cost-sharing method to recoup some of the costs of upgrading the Town's infrastructure which will benefit future developers.

Closure

This technical memorandum was prepared for the Town of Oxford to outline the water and sanitary sewer extensions, and off-site upgrades required to support the proposed development on the south side of Highway 104. For further discussion, please contact the undersigned by email (mrodgers@dillon.ca) or phone (506.633.5000 ext. 5432).

Respectfully submitted,

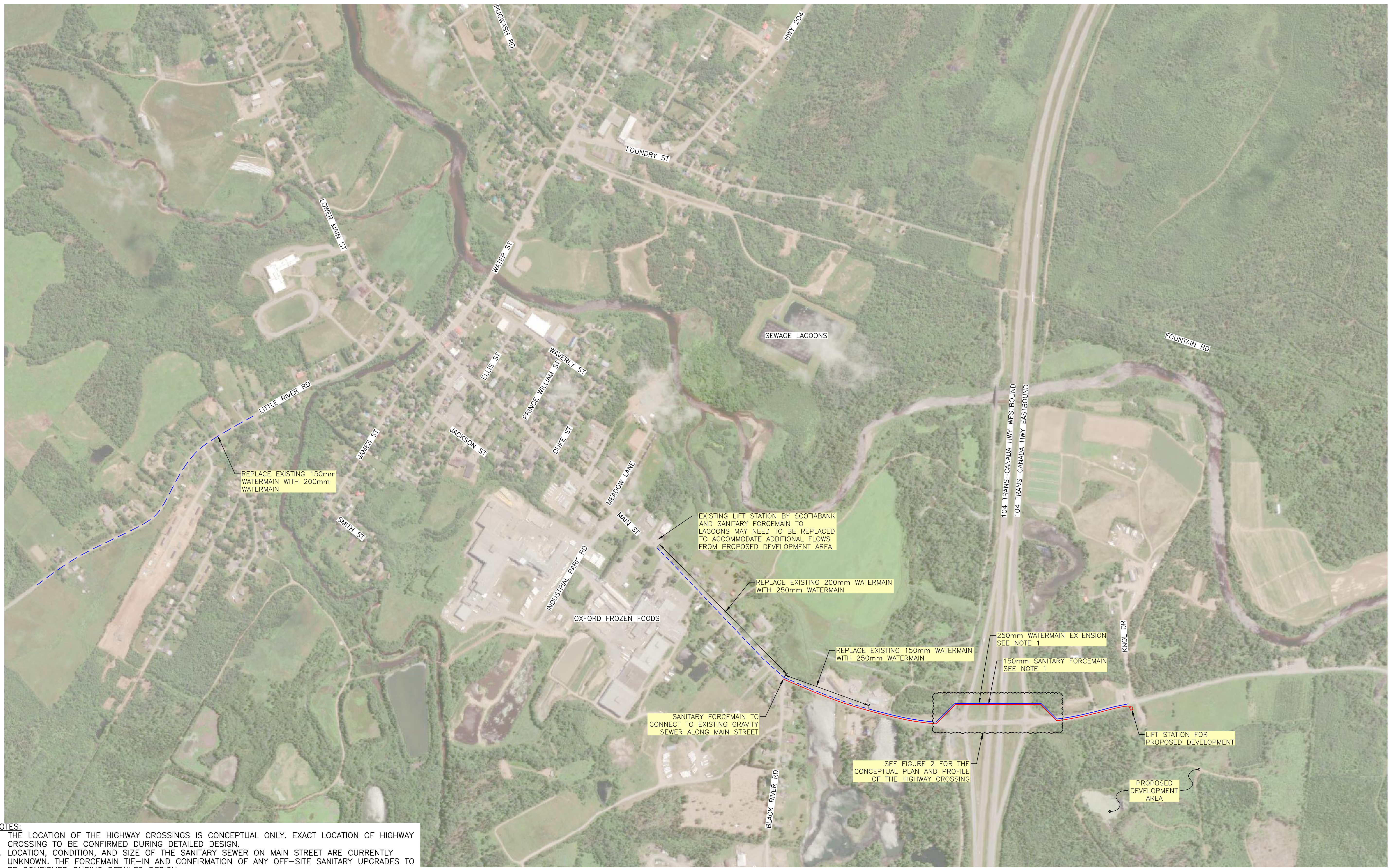
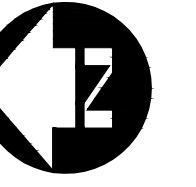
DILLON CONSULTING LIMITED



Matt Rodgers, P.Eng.
Project Manager

APPENDIX A

OXFORD MEMO FIGURE 1 & 2



NOTES:
 1. THE LOCATION OF THE HIGHWAY CROSSINGS IS CONCEPTUAL ONLY. EXACT LOCATION OF HIGHWAY CROSSING TO BE CONFIRMED DURING DETAILED DESIGN.
 2. LOCATION, CONDITION, AND SIZE OF THE SANITARY SEWER ON MAIN STREET ARE CURRENTLY UNKNOWN. THE FORCEMAIN TIE-IN AND CONFIRMATION OF ANY OFF-SITE SANITARY UPGRADES TO BE CONFIRMED DURING DETAILED DESIGN.



FILENAME: C:\PW\WORKING DIRECTORY\PROJECTS\2024\OXFORD\4610\DWG\8172\IMAGE SKETCHING PLOTTED BY: WILKINSON, JESSI
 PLOT DATE: 2024-12-20 12:55:36 PM PLOT SCALE: 1:25.4 PLOT STYLE: DILLON_STANDARD.CTB

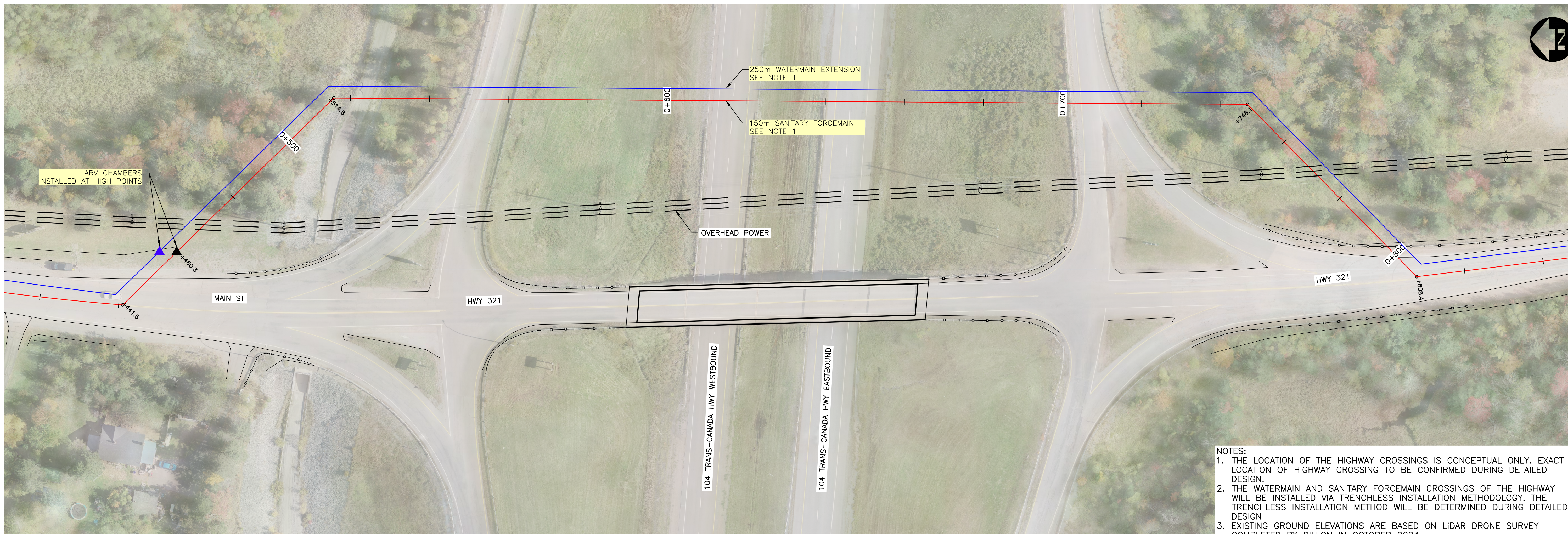
Conditions of Use
 Verify elevations and/or dimensions on drawing prior to use. Report any discrepancies to Dillon Consulting Limited.
 Do not scale dimensions from drawing.
 Do not modify drawing, re-use it, or use it for purposes other than those intended at the time of its preparation without prior written permission from Dillon Consulting Limited.

NOT FOR CONSTRUCTION

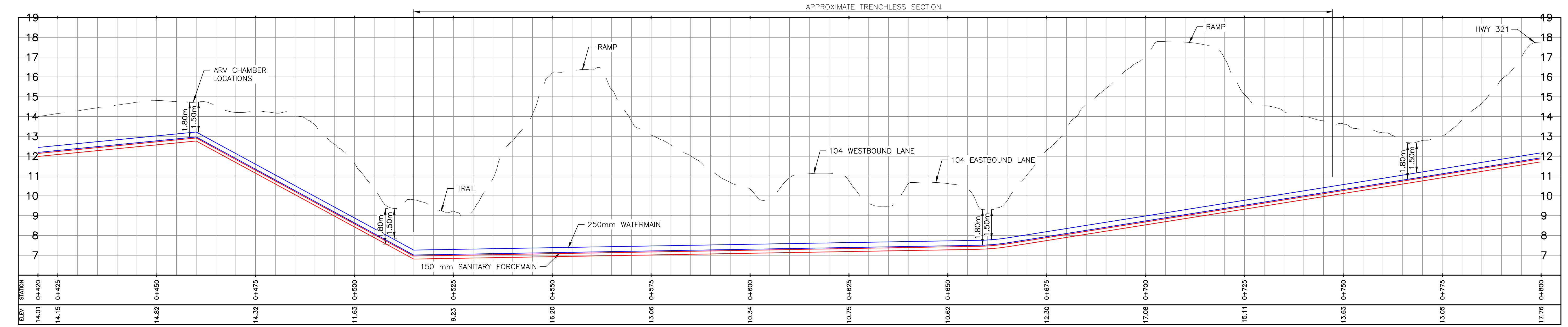
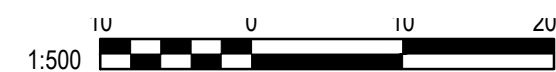


DESIGN	KS	REVIEWED BY	MW
DRAWN	JRW	CHECKED BY	MR
DATE	DECEMBER 2024		
SCALE	AS SHOWN		
A	ISSUED FOR REVIEW	2024.12.20	KS
No.	ISSUED FOR	DATE	BY

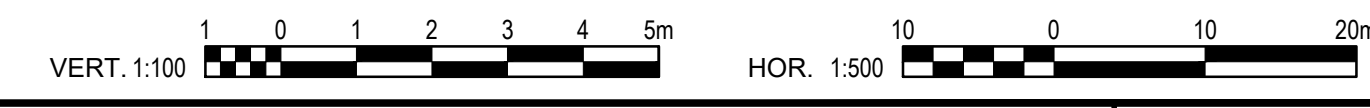
249041 TOWN OF OXFORD WATER & SEWER EXTENSIONS	PROJECT NO. 24-9041
FIGURE 1 - PROPOSED SERVICING CONCEPT AND OFF-SITE UPGRADES	SHEET NO. 01



- NOTES:
1. THE LOCATION OF THE HIGHWAY CROSSINGS IS CONCEPTUAL ONLY. EXACT LOCATION OF HIGHWAY CROSSING TO BE CONFIRMED DURING DETAILED DESIGN.
 2. THE WATERMAIN AND SANITARY FORCEMAIN CROSSINGS OF THE HIGHWAY WILL BE INSTALLED VIA TRENCHLESS INSTALLATION METHODOLOGY. THE TRENCHLESS INSTALLATION METHOD WILL BE DETERMINED DURING DETAILED DESIGN.
 3. EXISTING GROUND ELEVATIONS ARE BASED ON LIDAR DRONE SURVEY COMPLETED BY DILLON IN OCTOBER 2024.



PROFILE ALONG SANITARY LINE



FILENAME: C:\PW\WORKING DIRECTORY\PROJECTS\2024\DILLON_46104\249041-02-DES-SITE PLAN & PROFILES.DWG PLOTTED BY: WILKINSON, JESSIE
 PLOT DATE: 2024-12-20 12:22:30 PM PLOT SCALE: 1:25.4 PLOT STYLE: DILLON-STANDARD.ctb

Conditions of Use

Verify elevations and/or dimensions on drawing prior to use. Report any discrepancies to Dillon Consulting Limited.

Do not scale dimensions from drawing.

Do not modify drawing, re-use it, or use it for purposes other than those intended at the time of its preparation without prior written permission from Dillon Consulting Limited.

NOT FOR CONSTRUCTION



DESIGN	KS	REVIEWED BY	MW
DRAWN	JRW	CHECKED BY	MR
DATE	DECEMBER 2024		
SCALE	AS SHOWN		
A	ISSUED FOR REVIEW	2024.12.20	KS
No.	ISSUED FOR	DATE	BY

**249041 TOWN OF OXFORD
 WATER & SEWER EXTENSIONS**

**FIGURE 2 - PLAN / PROFILE
 CONCEPTUAL HIGHWAY CROSSING**

PROJECT NO.
24-9041

SHEET NO.
02

July 17, 2024

Town of Oxford
168 Water Street
P.O. Box 670
Oxford, Nova Scotia
B0T 1W0

Attention: CAO - Linda Cloney

Development of WaterCAD Model – Town of Oxford – Report

Dillon Consulting Limited (Dillon) was retained by the Town of Oxford (Town) to develop a WaterCAD model to represent the Town's existing water distribution system. The objectives of this project included confirming existing conditions through on-site investigations, the creation of a Steady-State WaterCAD model, and scenario analysis to identify opportunities for system improvements and optimization.

The model was used to identify areas of concern within the existing water distribution system so that recommendations could be made to enhance the system's performance. It is intended that this model will also be used in the future to analyze the impact of future developments to the existing system and to make recommendations on the design characteristics of these developments. As part of this project, the Town requested that Dillon use the WaterCAD model to analyze the impact and make recommendations for a potential new development of an additional nine (9) single detached homes off of Horton Street, located on the east end of the Town.

This report presents a review of the steady-state computational hydraulic model, using WaterCAD software, that has been developed by Dillon and validated using hydrant testing provided by Aqua Data Atlantic. Also included in this report are recommendations to mitigate several reported issues within the existing system and the findings and recommendations from the future development scenario analysis that was conducted for the addition of nine (9) homes on Horton Street.

Background

When attempting to add an additional watermain connection to the 50 mm galvanized steel watermain on Horton, the Town determined that the existing steel line was almost completely closed off by tuberculation (a build up of iron oxide precipitation) and would not be able to provide enough water to the planned new housing development of currently four (4) homes. The Town eventually planned on adding a total of nine new homes to this area, and reached out to Dillon expressing concern that the existing water distribution system can not meet residential pressure requirements in this area under existing conditions.



1149 Smythe Street
Suite 200
Fredericton
New Brunswick
Canada
E3B 3H4
Telephone
506.444.8820
Fax
506.444.8821



The Town also received complaints about low water pressure on the neighbouring Handel Street. During discussions, it was also noted that adequate fire flows may not be able to be obtained throughout the Town due to inadequate transmission mains. Dillon determined that in order to properly make recommendations to address these concerns, a WaterCAD model of the existing water distribution system would be required.

Data Collection

To create the model, Dillon collected available existing information and data on the system. This included a site visit on April 3, 2024 where a topographic survey was conducted and the locations and elevations of the existing tanks, valve chambers and select fire hydrants that were used by Aqua Data Atlantic to validate the model were collected.

The following is a list of resources that were used during the creation of the model that were received from the Town:

- 23-6115_2021-2023 Master Datasheet: Main Tank (Route 204) Flow Data (Date, GPM Flow) provided Average Day Demand (ADD) and Max Day Demand (MDD).
- Oxford Water Utility – Water Consumption Report: Provided 2019, 2020, 2021, 2022, and 2023 metered water consumption within the Town.
- Tank level Max and Min Datasheets: Provided Route 204 Tank Water Level elevations (Date, Time, Water Level Elevation).
- Valve and Tank details: Provided water storage tank details (Route 204 Tank & Pugwash Road Tank) and pressure reducing valve (PRV) chamber details.

The following resources were collected from the Dillon archives of past projects completed for the Town:

- “Town of Oxford Water System Assessment – Dillon Consulting Final Report (2023)”: System assessment report for the Town provided the existing Distribution System Schematic used to create the layout of the existing water distribution system.
- “Town of Oxford Operation and Maintenance Manual Water Treatment System – Dillon Consulting (2021)”: Provided information on the two tanks supplying the town (Route 204 Tank & Pugwash Road Tank).

Water CAD Model Development

The WaterCAD model of the existing water distribution system was created with the following design parameters, water demands, assumptions, and model validation



process. Also presented are the final modelled system pressure and fire flow analysis results.

Design Parameters

The key water system design parameters used in the development of the model are summarized in **Table 1**.

Table 1: Water System Design Parameters

Parameter	Value
¹ Population (2021 Census)	1100
Average # of People/House	2.2 (2016 Stats Canada)
² Average Daily Demands (2021-2023) (Large Consumer + Residential)	2,137,577 L/day
Existing Residential Demand	180 L/cap/day
Proposed Development Residential Demand	350 L/cap/day (ACWWA Guidelines)
³ Peaking Factors	2.65 (Max Day Demand) 3.75 (Peak Hour Demand)
⁴ Fire Flow	3785 L/min (1000 GPM)
Minimum System Pressure	275 kPa (40 PSI) (ACWWA Guidelines)
Maximum System Pressure	700 kPa (100 PSI) (ACWWA Guidelines)

Note:

1. The 2021 Census in the Town of Oxford had a total population of 1170 people. In the Oxford Water Utility – Water Consumption Report, apartment buildings and senior housing was included under consumer demand. In order to model the per capita residential demand more accurately, a total population of 1100 people was used in the residential demand calculations to account for the metered flow for apartment buildings and senior housing that is already included in the total consumer demands.
2. Average Daily Demand was calculated using the annual metered consumption data in the Oxford Water Utility – Water Consumption Report provided by the Town.
3. The Peak Hour Demand Peaking Factor was selected based on ACWWA Water Supply Guidelines since no hourly flow data was available. The Max Day Demand peaking factor was determined using the Main Tank Flow Data (2021-2023) for the Tank on Route 204.
4. The required fire flow for one- and two-family Dwellings not exceeding 5000 ft² shall be 3785 L/min for 1 hour. This required fire flow is cited from the 2015 National Fire Protection Association (NFPA) 1 Fire Code.

Water Demands

Most of the Town’s water supply comes from the Main Supply Tank (926 m³) located on Route 204; and a concrete Balancing Tank located off Pugwash Road (910 m³) provides the rest when needed, generally during periods of Oxford Frozen Food high demand.

The Average Day Demand (ADD) was calculated using the annual metered consumption data found in the Oxford Water Utility – Water Consumption Report



(2019-2023). The Max Day Demand (MDD) and MDD peaking factor was determined using the Main Tank Flow Data (2021-2023) for the Tank on Route 204. Both the Oxford Water Utility – Water Consumption Report (2019-2023) and the Main Tank Flow Data (2021-2023) were provided by the Town. The peak hour factor was selected based on the ACWWA Water Supply Guidelines since no hourly flow data was available.

Water demands were allocated to different junctions within the model. Water demands for large consumers were allocated to junctions closest to their respective location and residential demands were allocated to junctions that best represented the portion of residential consumers in that area.

Table 2 summarizes the residential demand and **Table 3** summarizes the consumer demand within the Town.

Table 2: Residential Demands

Junction	# of Houses	# of People	Average Day Demand (ADD) (L/day)	Average Day Demand (ADD) (L/s)	¹ Peak Hour Demand (PHD) (L/s)	¹ Max Day Demand (MDD) (L/s)
J-38 (6267 Route 204)	18	40	7144	0.08	0.31	0.22
J-159 (6361 Route 204)	22	48	8731	0.10	0.38	0.27
J-47 (471 Sunset Ave)	46	101	18256	0.21	0.79	0.56
J-51 (661 Lower Main St)	40	88	15875	0.18	0.69	0.49
J-61 (1720 Black River Rd)	20	44	7938	0.09	0.34	0.24
J-63 (4484 Main St)	3	7	1191	0.01	0.05	0.04
J-62 (Black River Rd – Main St Intersection)	28	62	11113	0.13	0.48	0.34
J-154 (14 Duke St)	12	26	4763	0.06	0.21	0.15
J-155 (390 Pugwash Rd)	28	62	11113	0.13	0.48	0.34
J-66 (Town Hall)	6	13	2381	0.03	0.10	0.07
J-102 (145 Thompson Rd)	29	64	11509	0.13	0.50	0.35
J-106 (7800 Birchwood Rd)	25	55	9922	0.11	0.43	0.30



Junction	# of Houses	# of People	Average Day Demand (ADD) (L/day)	Average Day Demand (ADD) (L/s)	¹ Peak Hour Demand (PHD) (L/s)	¹ Max Day Demand (MDD) (L/s)
J-105 (136 Foundry St)	27	59	10716	0.12	0.47	0.33
J-86 (154 Handel St)	20	44	7938	0.09	0.34	0.24
J-92 (433 Water St)	14	31	5556	0.06	0.24	0.17
J-94 (91 New Hansford Rd)	19	42	7541	0.09	0.33	0.23
J-71 (61 River Ave)	51	112	20241	0.23	0.88	0.62
J-67 (129 Smith St)	92	202	36513	0.42	1.58	1.12
Total	500	1100	198439	2.30	8.61	6.09

Note:

- The MDD and PHDs are calculated by multiplying the ADD by the PHD (3.75) and MDD (2.65) peaking factors.

Table 3: Large Consumer Demands

Junction	Average Day Demand (ADD) (L/day)	Average Day Demand (ADD) (L/s)	¹ Peak Hour Demand (PHD) (L/s)	¹ Max Day Demand (MDD) (L/s)
J-149 (School)	2655	0.03	0.12	0.08
J-150 (Senior Housing)	2655	0.03	0.12	0.08
J-66 (Town Hall)	2655	0.03	0.12	0.08
J-151 (Canada Post)	4	0.000042	0.00016	0.00011
J-57 (Arena)	2655	0.03	0.12	0.08
J-65 (Oxford Frozen Foods (OFF))	1918731	22.21	83.28	58.85
J-148 (Police Station)	2655	0.03	0.12	0.08
J-153 (Parkview Restaurant and Motel)	504	0.0058	0.02	0.02
J-152 (Tim Hortons)	6622	0.08	0.29	0.20
Total	1939138	22.44	84.16	59.48

Note:

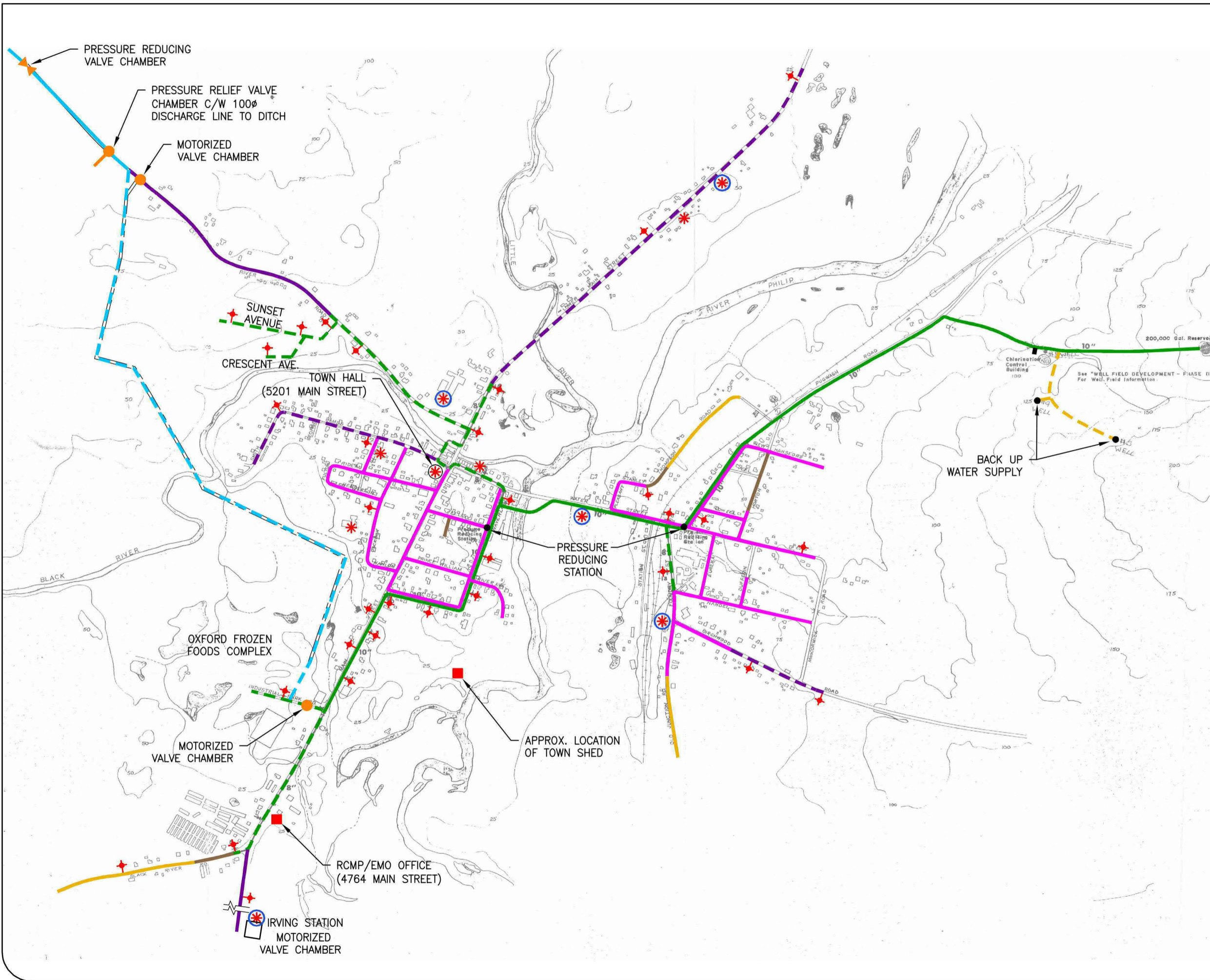
- The MDD and PHDs are calculated by multiplying the ADD by the PHD (3.75) and MDD (2.65) peaking factors.



Assumptions

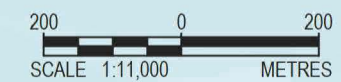
There was very limited up to date information available for the actual layout and characteristics of the existing water distribution system resulting in several unknowns when creating the model. Below is a list of the assumptions that were made throughout the model creation process.

- **Figure 1** is the Distribution System Schematic collected from the “Town of Oxford Water System Assessment – Dillon Consulting Final Report”. The information presented in this figure is from a 2004/2005 system map that was provided by the Town. Being the most recent map available, this figure was used to create the model of the existing water distribution system. This figure was used to identify pipe location, size and material, tank locations, valve chamber locations and hydrant locations. When this schematic was created the Town was aware that there was inconsistency with the figure and the actual water distribution system, however field investigations were not practical at the time. This figure was used as a starting point and then the model was updated based on Fire Flow testing results and further discussions with the Town.



DISTRIBUTION SYSTEM SCHEMATIC
 FIGURE 1

- 50mm GALVANIZED STEEL
- 50mm PLASTIC
- 100mm HDPE
- 100mm CAST IRON
- 100mm PVC
- 150mm PVC
- 200mm HDPE
- 250mm HDPE
- 300mm PVC
- 350mm PVC
- FIRE HYDRANTS
- EXISTING SAMPLE LOCATIONS
- RECOMMENDED SAMPLE LOCATIONS



MAP/DRAWING INFORMATION
 W. N. Horner and Associates, Water System Layout (Sept. 1977)
 and Dillon Consulting Limited.

CREATED BY: TLR
 CHECKED BY: KRM
 DESIGNED BY: KAM/SRH

File Location:
 c:\pw working directory\projects 2020\dillon_54tp\dms21188\202649-05-03-fig3.dwg
 July, 16, 2024 12:42 PM





- After a site visit and discussions with the Town, the location, type and status of the valve chambers within the Town were determined. **Table 4** is a breakdown of the valve chambers within the Town and how they were modelled.

Table 4: Valve Chambers – Town of Oxford

Valve Chamber	Location	Pressure Setting	^{1,2} Notes
Pressure Reducing Valve (PRV)	Route 204 (PRV-10)	140 kPa (20 PSI)	Main PRV in Town
Gate Valve	Water Street - Pugwash Road Intersection	NA	Isolation valve. Not included in model (minor head losses can be ignored)
Motorized Gate Valve	Route 204 towards OFF	NA	Modelled as open at all times
Gate Valve	OFF (From Main Street)	NA	³ Modelled as partially open at all times
Air Release Valve	Route 204	NA	Not included in model (minor head losses can be ignored)
Gate Valve	Waverly Street	NA	Isolation valve. Not included in model (minor head losses can be ignored)

Note:

1. Individual street shut off valves were not included in the model and were assumed to be open.
 2. Gate valves and air release valves were not included in the model
 3. The motorized gate valve to OFF from Main Street is currently not operational so it now functions as a regular gate valve and the Town manually opens and closes the Gate Valve when they see fit. The town described the gate valve as “partially open” meaning the gate valve is closed to a certain degree but it is unknown as to how much.
- Hydrant leads were assumed to be, on average, 5 m long, 150 mm in diameter and to be the same material as the transmission main the lead is connected to.
 - **Table 5** presents the pipes that were inserted into the model as a different material than what was shown on the Distribution System Schematic due to these materials not being available within the software.



Table 5: Pipe Material in Model

Distribution System Schematic	Pipe Material in Model	Hazen-Williams Pipe Roughness Coefficient (New Pipe)
Galvanized Steel	Steel	140
Plastic	PVC	150
HDPE	PVC	150
Cast Iron	Cast Iron	130
PVC	PVC	150

- Junction elevations were assumed to be 1.8 m below ground surface elevation. Ground surface elevations were determined using Google Earth since no LiDAR data was available. Google Earth imagery typically has an accuracy of +/- 1-2 metres, however, is generally reliable for exercises of this nature.
- Hydrant nozzle elevations were assumed to be 0.47 m above ground surface elevation. During the site visit, ground elevation shots were collected for select hydrants. This data was used to determine the nozzle elevation for these select hydrants. For hydrants that did not have ground elevation shots, the ground surface elevations were determined using Google Earth since no LiDAR data was available.
- The elevation of the PRV was assumed to be 1.5 m below ground surface. The ground surface elevation was collected during the site visit for this PRV location.
- The Town informed Dillon that the OFF gate valve (located off of the main line from Main Street towards OFF) is completely open during the fresh blueberry season (August – December) and then “partially open” the rest of the time. In the model, the pipe to OFF (P-204) was set as a 20 mm pipe to represent the head loss and flow restrictions of a partially open valve at this location.

Model Validation

Updated and accurate information on the Town’s existing water distribution system was limited. Dillon engaged Aqua Data Tech to perform hydrant flow testing in select areas to validate the water distribution system. Model validation includes comparing observed values (from field tests) to the modelled values. Parameters such as tank water levels, pipe roughness coefficients, and pipe diameters are adjusted within the model until the modelled values closely match the observed values. Information gathered during discussion with the Town, such as the observed low water pressure on Horton Street and Handel Street was also used to validate the model. Changes within the model were made so that it represented these known issues.



All of the adjustments and changes made to the model were based on hydrant testing and information from the Town for low pressure zones. It was not feasible to test every hydrant in the system, so a representative sample were selected for testing.

Dillon reviewed six hydrant flow tests, provided by Aqua Data Tech, that were performed on December 28, 2023, to validate the model constraints. These hydrants were selected for model validation based on their location within the Town. With a limited number of tests available, Dillon selected the hydrants at locations that best represented a large section of the system. The results from the hydrant flow tests are shown in **Table 6**.

Table 6: Fire Flow Test Results

Fire Flow Test	Flow Hydrant	Normal Pressure at Flow Hydrant (kPa (PSI))	Residual Hydrant	Flow (GPM)	Flow (L/s)	Residual Pressure at Residual Hydrant (kPa (PSI))
1	F1 (H-20)	510.21 (74)	R1 (H-16)	1531	96.6	358.53 (52)
2	F2 (H-30)	393 (57)	R2 (H-29)	NO FLOW	NO FLOW	13.79 (2)
3	F3 (H-26)	455.05 (66)	R3 (H-24)	1158	73.05	330.95 (48)
4	F4 (H-8)	510.21 (74)	R4 (H-7)	1227	77.41	289.58 (42)
5	F5 (H-31)	482.63 (70)	R5 (H-1)	1227	77.41	262 (38)
6	F6 (H-12)	503.32 (73)	R6 (H-11)	1295	81.70	372.32 (54)

The model constraints were determined by the validation as follows:

- High water reservoir elevations set to validate for static pressures in the system:
 - Tank Route 204 = 18 m
 - Tank Pugwash Road = 4.8 m
- Pipes 5 and 7 roughness coefficients reduced to 100.
- Pipes 47, 49, 57, 125 and 126 roughness coefficients reduced to 50 to represent the tuberculation of the existing pipes.
- Roughness coefficients in all remaining cast-iron pipes and steel pipes in the northern area were reduced to 50. This area includes the cast iron pipes on Water Street, Pugwash Road, Powell Street, Peel Street, and New Hansford Road.



- The roughness coefficients from the PVC pipes coming from the Pugwash Road Balancing Tank were reduced to 120 to account for the age of these pipes.
- Reduced the roughness coefficients in pipes 143(1) and 143(2) (Horton Street) to 50 to represent tuberculation of the existing pipes due to age and reduced the diameter of these pipes to 10 mm due to the confirmed build up of rust found in these pipes when the Town cut into the line and did not receive any flow.
- Reduced the diameter of pipes 45 and 48 (Handel Street) to 50 mm due to the Town receiving complaints of low-pressure issues being experienced in this area.

Figure 2 displays the pipes described above with labels shown and **Figure 3** is a visual representation of the alignment and pipe diameter sizes in the existing water distribution system model after model validation changes

Figure 2: Existing Water Distribution System - Modified Pipes

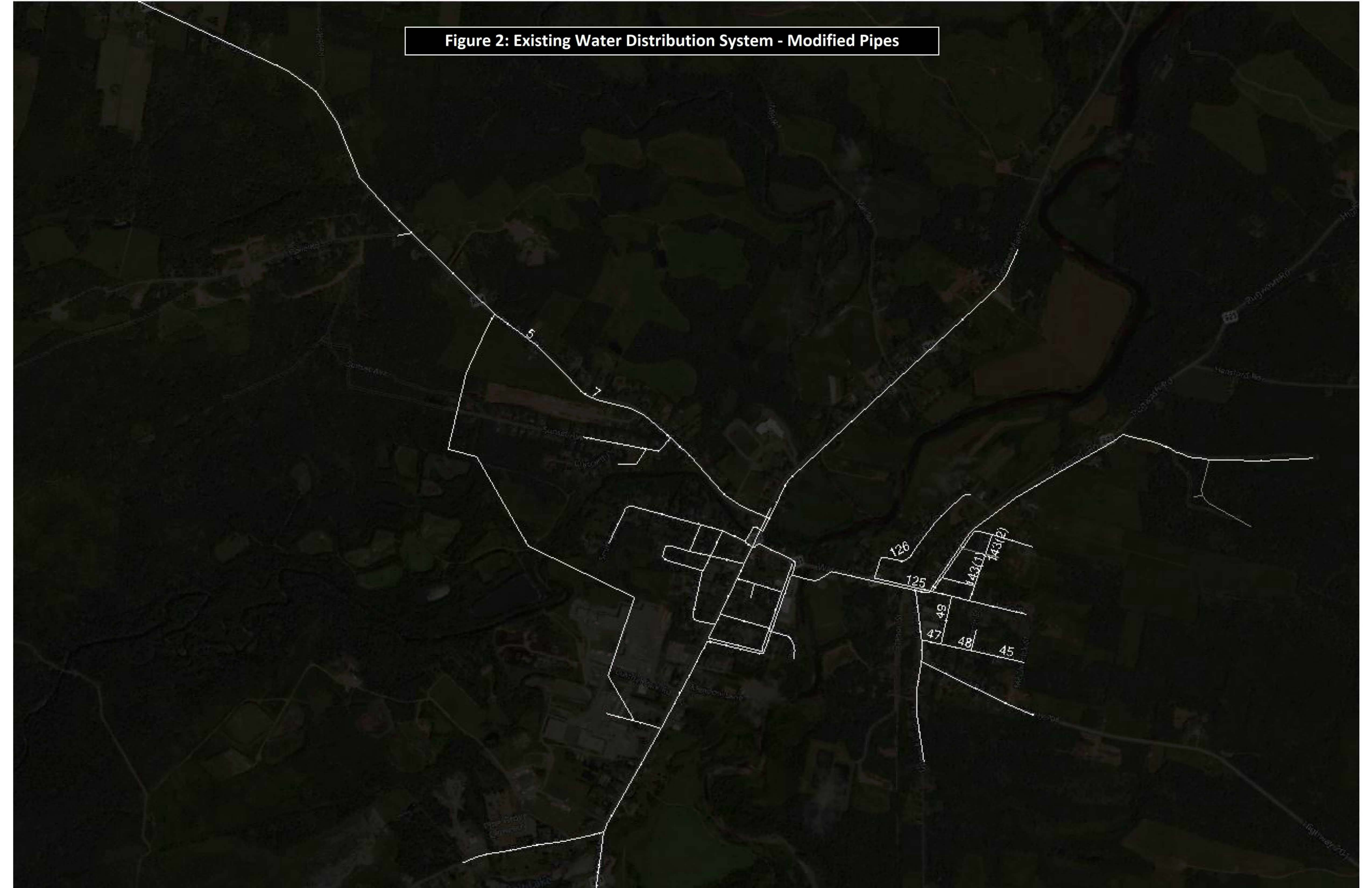
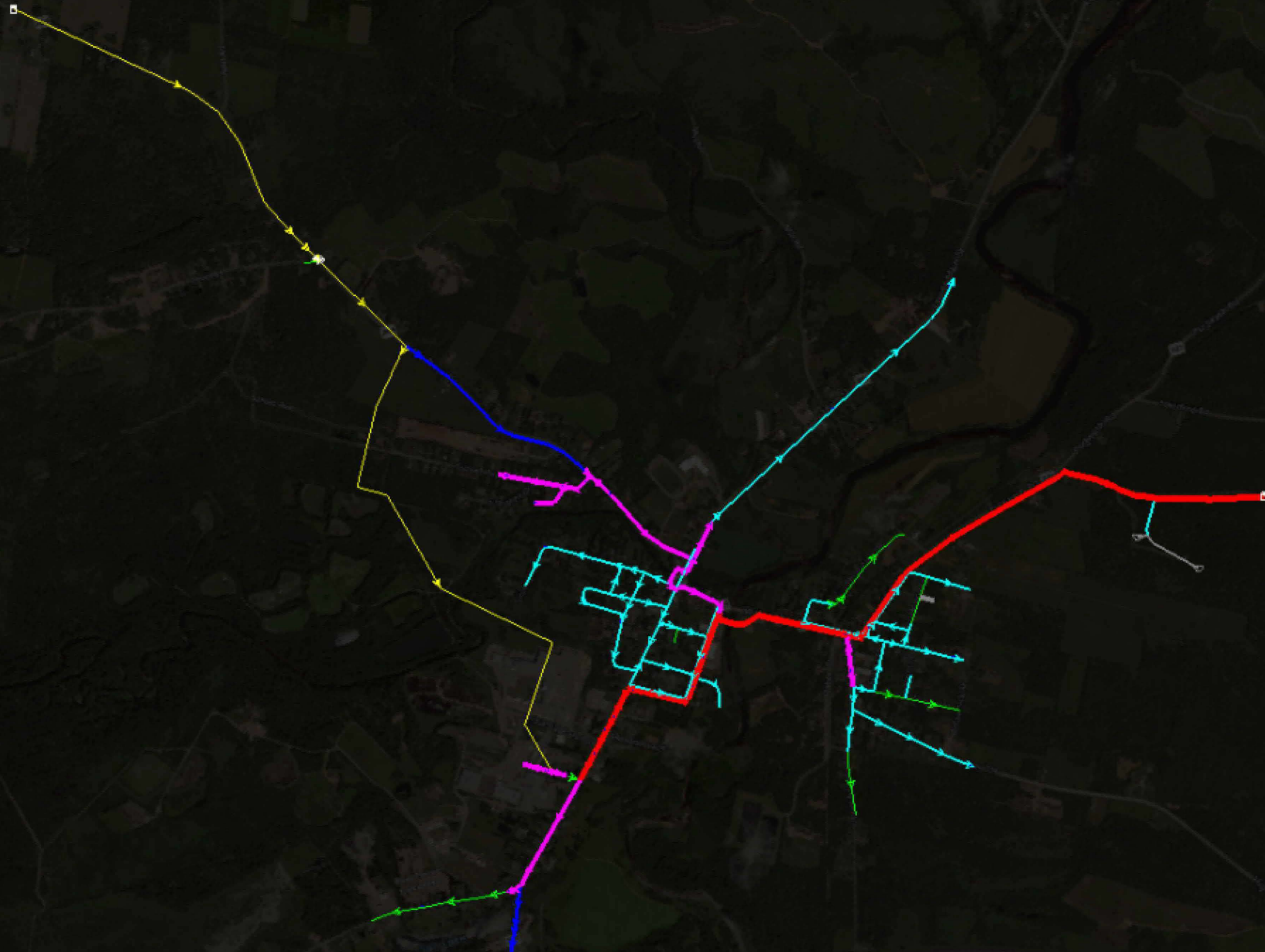


Figure 3: Existing Water Distribution System - Pipe Diameter



Color Coding Legend
Pipe: Diameter (mm)

-  ≤ 50.0
-  ≤ 100.0
-  ≤ 150.0
-  ≤ 200.0
-  ≤ 250.0
-  ≤ 350.0
-  Other



The hydraulic model validation – based on the available data – is assessed against the error between model results and physical measurements. The threshold of model acceptance following validation is based on $\pm 10\%$. A threshold between 6-10% is considered as good and a threshold between 0-5% is considered as very good. The model validation results meet the threshold for hydrant tests 3, 4, 5, and 6.

Table 7 presents a visual legend for the results and **Tables 8 - 13** present a breakdown of the measure data vs the modelled data.

Table 7: Legend – Measured Data vs Modelled Data

Status	Threshold	
Very Good	0 – 5%	
Good	6 – 10%	
Caution	> 10%	

Table 8: Fire Flow Test 1

Flow Hydrant: H-20 Main Street

Flow = 96.6 L/s

Residual Hydrant: H-16 Duke Street

	Measured Data	Modelled Data	Comparison Results	
Static Pressure (PSI)	74	76	3%	
Residual Pressure (PSI)	52	34	35%	

Table 9: Fire Flow Test 2

Flow Hydrant: H-30 Highway 204

Flow = No Flow

Residual Hydrant: H-29 Birchwood Road

	Measured Data	Modelled Data	Comparison Results	
Static Pressure (PSI)	57	55	4%	
Residual Pressure (PSI)	Hydrant not operational, no measured data available.			

Table 10: Fire Flow Test 3

Flow Hydrant: H-26 Pugwash Road

Flow = 77.41 L/s

Residual Hydrant: H-24 Stanley Street

	Measured Data	Modelled Data	Comparison Results	
Static Pressure (PSI)	76	71	7%	
Residual Pressure (PSI)	48	51	6%	



Table 11: Fire Flow Test 4

Flow Hydrant: H-8 Lower Main Street

Flow = 77.41 L/s

Residual Hydrant: H-7 Lower Main Street

	Measured Data	Modelled Data	Comparison Results	
Static Pressure (PSI)	74	79	6%	
Residual Pressure (PSI)	42	44	5%	

Table 12: Fire Flow Test 5

Flow Hydrant: H-31 Little River Road

Flow = 77.41 L/s

Residual Hydrant: H-1 Sunset Avenue

	Measured Data	Modelled Data	Comparison Results	
Static Pressure (PSI)	70	75	7%	
Residual Pressure (PSI)	38	40	5%	

Table 13: Fire Flow Test 6

Flow Hydrant: H-12 Waverly Street

Flow = 81.7 L/s

Residual Hydrant: H-11 Jackson Street

	Measured Data	Modelled Data	Comparison Results	
Static Pressure (PSI)	73	76	4%	
Residual Pressure (PSI)	54	53	2%	

The residual pressure comparison results for Fire Flow Test 1 showed a difference of 35% between the measured data and the modelled data. These measured results show a greater difference in residual pressures in the measured results vs the modelled results. The actual measured residual pressure is significantly greater than the modelled result, indicating that the modelled results in this area are conservative. Dillon suspects that the difference is mainly due to the test being located near the OFF-gate valve coming from Main Street. Due to the status of the gate valve being “partially opened” with no confirmation as to how open the gate valve is, there is uncertainty present within these results. Other factors that could contribute to the difference could be related to unknown connections within the system that are not present in the model. Due to this, Fire Flow Test 1 was ignored during the model validation process.

The Results for Fire Flow test 2 were ignored during the model validation process due to the fact that at the time of the testing the residual hydrant selected was not



operational and there was no flow present. No flow testing was completed for this hydrant.

Model Results

The existing water distribution system was modelled in Average Day Demand (ADD), Peak Hour Demand (PHD), Max Day Demand (MDD), and MDD + Fire Flow scenarios. **Table 13** represents the pressure within the system during the ADD, PHD and MDD scenarios and **Figure 4** is a visual representation of the pressure at each node within the system during the ADD scenario.

Table 13: Existing Water Distribution System - Pressure

Junction	ADD Pressure (kPa (PSI))	PHD Pressure (kPa (PSI))	MDD Pressure (kPa (PSI))
J-38	510.6 (74)	483 (70)	496.8 (72)
J-39	372.6 (54)	372.6 (54)	372.6 (54)
J-42	579.6 (84)	503.7 (73)	545.1 (79)
J-45	531.3 (77)	524.4 (76)	524.4 (76)
J-46	531.3 (77)	524.4 (76)	524.4 (76)
J-47	462.3 (67)	455.4 (66)	455.4 (66)
J-48	483 (70)	476.1 (69)	476.1 (69)
J-49	489.9 (71)	483 (70)	489.9 (71)
J-50	545.1 (79)	545.1 (79)	545.1 (79)
J-51	524.4 (76)	524.4 (76)	524.4 (76)
J-52	565.8 (82)	558.9 (81)	565.8 (82)
J-54	324.3 (47)	324.3 (47)	324.3 (47)
J-57	545.1 (79)	538.2 (78)	545.1 (79)
J-59	524.4 (76)	524.4 (76)	524.4 (76)
J-60	503.7 (73)	503.7 (73)	503.7 (73)
J-61	483 (70)	476.1 (69)	483 (70)
J-62	531.3 (77)	531.3 (77)	531.3 (77)
J-63	552 (80)	552 (80)	552 (80)
J-64	545.1 (79)	538.2 (78)	545.1 (79)
J-65	572.7 (83)	476.1 (69)	524.4 (76)
J-66	545.1 (79)	545.1 (79)	545.1 (79)
J-67	503.7 (73)	496.8 (72)	503.7 (73)
J-68	538.2 (78)	531.3 (77)	531.3 (77)
J-69	545.1 (79)	538.2 (78)	545.1 (79)



Junction	ADD Pressure (kPa (PSI))	PHD Pressure (kPa (PSI))	MDD Pressure (kPa (PSI))
J-70	545.1 (79)	538.2 (78)	545.1 (79)
J-71	565.8 (82)	558.9 (81)	558.9 (81)
J-72	565.8 (82)	558.9 (81)	558.9 (81)
J-73	565.8 (82)	558.9 (81)	558.9 (81)
J-74	545.1 (79)	538.2 (78)	545.1 (79)
J-75	552 (80)	552 (80)	552 (80)
J-76	565.8 (82)	558.9 (81)	558.9 (81)
J-77	545.1 (79)	545.1 (79)	545.1 (79)
J-78	565.8 (82)	558.9 (81)	558.9 (81)
J-79	565.8 (82)	558.9 (81)	558.9 (81)
J-80	565.8 (82)	558.9 (81)	558.9 (81)
J-81	545.1 (79)	538.2 (78)	545.1 (79)
J-82	538.2 (78)	531.3 (77)	531.3 (77)
J-83	545.1 (79)	538.2 (78)	545.1 (79)
J-84	496.8 (72)	489.9 (71)	489.9 (71)
J-85	462.3 (67)	462.3 (67)	462.3 (67)
J-86	393.3 (57)	372.6 (54)	379.5 (55)
J-87	427.8 (62)	414 (60)	420.9 (61)
J-88	455.4 (66)	441.6 (64)	448.5 (65)
J-89	455.4 (66)	448.5 (65)	455.4 (66)
J-90	476.1 (69)	469.2 (68)	469.2 (68)
J-91	455.4 (66)	448.5 (65)	448.5 (65)
J-92	393.3 (57)	386.4 (56)	393.3 (57)
J-93	462.3 (67)	455.4 (66)	462.3 (67)
J-94	393.3 (57)	386.4 (56)	393.3 (57)
J-95	503.7 (73)	496.8 (72)	496.8 (72)
J-97	455.4 (66)	448.5 (65)	448.5 (65)
J-99	483 (70)	476.1 (69)	483 (70)
J-100	503.7 (73)	496.8 (72)	496.8 (72)
J-101	510.6 (74)	503.7 (73)	510.6 (74)
J-102	483 (70)	469.2 (68)	476.1 (69)
J-103	455.4 (66)	455.4 (66)	455.4 (66)
J-104	448.5 (65)	441.6 (64)	441.6 (64)



Junction	ADD Pressure (kPa (PSI))	PHD Pressure (kPa (PSI))	MDD Pressure (kPa (PSI))
J-105	462.3 (67)	462.3 (67)	462.3 (67)
J-106	358.8 (52)	351.9 (51)	358.8 (52)
J-107	538.2 (78)	531.3 (77)	538.2 (78)
J-108	483 (70)	476.1 (69)	476.1 (69)
J-109	489.9 (71)	483 (70)	489.9 (71)
J-110	462.3 (67)	455.4 (66)	455.4 (66)
J-111	517.5 (75)	510.6 (74)	510.6 (74)
J-112	469.2 (68)	462.3 (67)	462.3 (67)
J-113	545.1 (79)	545.1 (79)	545.1 (79)
J-114	565.8 (82)	558.9 (81)	565.8 (82)
J-115	538.2 (78)	531.3 (77)	531.3 (77)
J-116	503.7 (73)	496.8 (72)	503.7 (73)
J-117	565.8 (82)	558.9 (81)	558.9 (81)
J-118	545.1 (79)	538.2 (78)	545.1 (79)
J-119	545.1 (79)	538.2 (78)	545.1 (79)
J-120	545.1 (79)	538.2 (78)	545.1 (79)
J-121	545.1 (79)	538.2 (78)	545.1 (79)
J-122	545.1 (79)	538.2 (78)	545.1 (79)
J-123	552 (80)	545.1 (79)	552 (80)
J-124	538.2 (78)	538.2 (78)	538.2 (78)
J-125	552 (80)	545.1 (79)	552 (80)
J-126	552 (80)	545.1 (79)	552 (80)
J-127	579.6 (84)	496.8 (72)	538.2 (78)
J-129	524.4 (76)	524.4 (76)	524.4 (76)
J-130	483 (70)	483 (70)	483 (70)
J-131	545.1 (79)	538.2 (78)	545.1 (79)
J-132	503.7 (73)	496.8 (72)	496.8 (72)
J-133	496.8 (72)	483 (70)	489.9 (71)
J-134	496.8 (72)	483 (70)	489.9 (71)
J-135	393.3 (57)	386.4 (56)	393.3 (57)
J-136	496.8 (72)	489.9 (71)	489.9 (71)
J-137	427.8 (62)	420.9 (61)	420.9 (61)
J-138	358.8 (52)	351.9 (51)	358.8 (52)



Junction	ADD Pressure (kPa (PSI))	PHD Pressure (kPa (PSI))	MDD Pressure (kPa (PSI))
J-140	427.8 (62)	420.9 (61)	420.9 (61)
J-141	455.4 (66)	448.5 (65)	448.5 (65)
J-142	565.8 (82)	565.8 (82)	565.8 (82)
J-147	496.8 (72)	489.9 (71)	489.9 (71)
J-148	538.2 (78)	531.3 (77)	538.2 (78)
J-149	538.2 (78)	531.3 (77)	531.3 (77)
J-150	545.1 (79)	538.2 (78)	545.1 (79)
J-151	558.9 (81)	552 (80)	552 (80)
J-152	545.1 (79)	545.1 (79)	545.1 (79)
J-153	545.1 (79)	538.2 (78)	538.2 (78)
J-154	552 (80)	545.1 (79)	552 (80)
J-155	372.6 (54)	372.6 (54)	372.6 (54)
J-159	324.3 (47)	317.4 (46)	324.3 (47)
J-160	324.3 (47)	317.4 (46)	317.4 (46)
J-162	510.6 (74)	483 (70)	496.8 (72)
J-163	565.8 (82)	496.8 (72)	531.3 (77)
J-164	462.3 (67)	455.4 (66)	455.4 (66)
J-166	324.3 (47)	317.4 (46)	324.3 (47)
J-167	565.8 (82)	558.9 (81)	558.9 (81)
J-168	552 (80)	545.1 (79)	545.1 (79)
J-169	503.7 (73)	496.8 (72)	496.8 (72)
J-170	138 (20)	138 (20)	138 (20)
J-171	503.7 (73)	503.7 (73)	503.7 (73)
J-173	496.8 (72)	489.9 (71)	489.9 (71)
J-178	483 (70)	483 (70)	483 (70)

Figure 4: Existing Water Distribution System - System Pressure (ADD)





The demand scenario determined to govern design is the Max Day Demand (MDD) plus fire flows. The available fire flow is evaluated in the hydraulic model using set model boundary conditions and each junction is evaluated under the required fire flow demands in addition to the max day demand. The model analysis demonstrated that residential fire flows can be satisfied under the described boundary conditions within all pipes with a diameter greater than 150 mm. The pipes within the system with a diameter smaller than 150 mm are unable to provide adequate fire flow. The fire flow analysis results are summarized in **Table 14**

Table 14: Fire Flow Analysis Results

Junction	Fire Flow Needed (L/s (GPM))	Fire Flow Available (L/s (GPM))	Pressure (Residual Lower Limit) (kPa (PSI))	Pressure (Residual Calculated) (kPa (PSI))
J-38	63.1 (1000)	220.878 (3506)	138 (20)	289.8 (42)
J-39	63.1 (1000)	9.639 (153)	138 (20)	138 (20)
J-42	63.1 (1000)	105.462 (1674)	138 (20)	303.6 (44)
J-45	63.1 (1000)	84.672 (1344)	138 (20)	227.7 (33)
J-46	63.1 (1000)	84.42 (1340)	138 (20)	227.7 (33)
J-47	63.1 (1000)	70.371 (1117)	138 (20)	151.8 (22)
J-48	63.1 (1000)	78.687 (1249)	138 (20)	179.4 (26)
J-49	63.1 (1000)	76.986 (1222)	138 (20)	158.7 (23)
J-50	63.1 (1000)	83.538 (1326)	138 (20)	241.5 (35)
J-51	63.1 (1000)	13.482 (214)	138 (20)	158.7 (23)
J-52	63.1 (1000)	93.681 (1487)	138 (20)	255.3 (37)
J-54	63.1 (1000)	162.729 (2583)	138 (20)	172.5 (25)
J-57	63.1 (1000)	100.737 (1599)	138 (20)	282.9 (41)
J-59	63.1 (1000)	74.277 (1179)	138 (20)	200.1 (29)
J-60	63.1 (1000)	5.67 (90)	138 (20)	282.9 (41)
J-61	63.1 (1000)	3.276 (52)	138 (20)	144.9 (21)
J-62	63.1 (1000)	75.411 (1197)	138 (20)	213.9 (31)
J-63	63.1 (1000)	52.668 (836)	138 (20)	276 (40)
J-64	63.1 (1000)	82.53 (1310)	138 (20)	282.9 (41)
J-65	63.1 (1000)	35.343 (561)	138 (20)	448.5 (65)
J-66	63.1 (1000)	99.792 (1584)	138 (20)	227.7 (33)
J-67	63.1 (1000)	19.782 (314)	138 (20)	138 (20)
J-68	63.1 (1000)	21.798 (346)	138 (20)	414 (60)
J-69	63.1 (1000)	21.798 (346)	138 (20)	213.9 (31)
J-70	63.1 (1000)	21.798 (346)	138 (20)	324.3 (47)



Junction	Fire Flow Needed (L/s (GPM))	Fire Flow Available (L/s (GPM))	Pressure (Residual Lower Limit) (kPa (PSI))	Pressure (Residual Calculated) (kPa (PSI))
J-71	63.1 (1000)	21.798 (346)	138 (20)	193.2 (28)
J-72	63.1 (1000)	21.798 (346)	138 (20)	365.7 (53)
J-73	63.1 (1000)	21.798 (346)	138 (20)	365.7 (53)
J-74	63.1 (1000)	21.798 (346)	138 (20)	324.3 (47)
J-75	63.1 (1000)	21.798 (346)	138 (20)	365.7 (53)
J-76	63.1 (1000)	21.798 (346)	138 (20)	386.4 (56)
J-77	63.1 (1000)	101.745 (1615)	138 (20)	227.7 (33)
J-78	63.1 (1000)	21.798 (346)	138 (20)	345 (50)
J-79	63.1 (1000)	5.859 (93)	138 (20)	427.8 (62)
J-80	63.1 (1000)	21.798 (346)	138 (20)	420.9 (61)
J-81	63.1 (1000)	21.798 (346)	138 (20)	414 (60)
J-82	63.1 (1000)	21.798 (346)	138 (20)	441.6 (64)
J-83	63.1 (1000)	21.798 (346)	138 (20)	414 (60)
J-84	63.1 (1000)	100.233 (1591)	138 (20)	276 (40)
J-85	63.1 (1000)	85.554 (1358)	138 (20)	248.4 (36)
J-86	63.1 (1000)	1.071 (17)	138 (20)	144.9 (21)
J-87	63.1 (1000)	1.953 (31)	138 (20)	179.4 (26)
J-88	63.1 (1000)	1.953 (31)	138 (20)	200.1 (29)
J-89	63.1 (1000)	15.561 (247)	138 (20)	220.8 (32)
J-90	63.1 (1000)	7.812 (124)	138 (20)	241.5 (35)
J-91	63.1 (1000)	7.308 (116)	138 (20)	220.8 (32)
J-92	63.1 (1000)	5.67 (90)	138 (20)	144.9 (21)
J-93	63.1 (1000)	5.355 (85)	138 (20)	207 (30)
J-94	63.1 (1000)	4.662 (74)	138 (20)	138 (20)
J-95	63.1 (1000)	7.497 (119)	138 (20)	248.4 (36)
J-97	63.1 (1000)	7.434 (118)	138 (20)	200.1 (29)
J-99	63.1 (1000)	7.686 (122)	138 (20)	227.7 (33)
J-100	63.1 (1000)	5.733 (91)	138 (20)	165.6 (24)
J-101	63.1 (1000)	4.536 (72)	138 (20)	172.5 (25)
J-102	63.1 (1000)	3.024 (48)	138 (20)	138 (20)
J-103	63.1 (1000)	22.932 (364)	138 (20)	351.9 (51)
J-104	63.1 (1000)	22.932 (364)	138 (20)	200.1 (29)
J-105	63.1 (1000)	4.851 (77)	138 (20)	144.9 (21)
J-106	63.1 (1000)	14.742 (234)	138 (20)	138 (20)



Junction	Fire Flow Needed (L/s (GPM))	Fire Flow Available (L/s (GPM))	Pressure (Residual Lower Limit) (kPa (PSI))	Pressure (Residual Calculated) (kPa (PSI))
J-107	63.1 (1000)	83.034 (1318)	138 (20)	241.5 (35)
J-108	63.1 (1000)	78.057 (1239)	138 (20)	179.4 (26)
J-109	63.1 (1000)	76.986 (1222)	138 (20)	158.7 (23)
J-110	63.1 (1000)	70.434 (1118)	138 (20)	158.7 (23)
J-111	63.1 (1000)	13.419 (213)	138 (20)	158.7 (23)
J-112	63.1 (1000)	17.955 (285)	138 (20)	158.7 (23)
J-113	63.1 (1000)	83.853 (1331)	138 (20)	241.5 (35)
J-114	63.1 (1000)	93.555 (1485)	138 (20)	255.3 (37)
J-115	63.1 (1000)	21.798 (346)	138 (20)	393.3 (57)
J-116	63.1 (1000)	21.798 (346)	138 (20)	186.3 (27)
J-117	63.1 (1000)	21.798 (346)	138 (20)	407.1 (59)
J-118	63.1 (1000)	100.926 (1602)	138 (20)	276 (40)
J-119	63.1 (1000)	96.957 (1539)	138 (20)	282.9 (41)
J-120	63.1 (1000)	94.311 (1497)	138 (20)	282.9 (41)
J-121	63.1 (1000)	91.287 (1449)	138 (20)	282.9 (41)
J-122	63.1 (1000)	89.082 (1414)	138 (20)	282.9 (41)
J-123	63.1 (1000)	87.696 (1392)	138 (20)	289.8 (42)
J-124	63.1 (1000)	86.688 (1376)	138 (20)	276 (40)
J-125	63.1 (1000)	85.68 (1360)	138 (20)	289.8 (42)
J-126	63.1 (1000)	84.231 (1337)	138 (20)	289.8 (42)
J-127	63.1 (1000)	105.462 (1674)	138 (20)	282.9 (41)
J-129	63.1 (1000)	74.466 (1182)	138 (20)	200.1 (29)
J-130	63.1 (1000)	4.095 (65)	138 (20)	165.6 (24)
J-131	63.1 (1000)	52.668 (836)	138 (20)	310.5 (45)
J-132	63.1 (1000)	5.733 (91)	138 (20)	165.6 (24)
J-133	63.1 (1000)	7.686 (122)	138 (20)	186.3 (27)
J-134	63.1 (1000)	7.56 (120)	138 (20)	234.6 (34)
J-135	63.1 (1000)	5.67 (90)	138 (20)	158.7 (23)
J-136	63.1 (1000)	89.586 (1422)	138 (20)	276 (40)
J-137	63.1 (1000)	18.333 (291)	138 (20)	207 (30)
J-138	63.1 (1000)	14.805 (235)	138 (20)	138 (20)
J-140	63.1 (1000)	19.215 (305)	138 (20)	207 (30)
J-141	63.1 (1000)	7.434 (118)	138 (20)	186.3 (27)
J-142	63.1 (1000)	86.499 (1373)	138 (20)	262.2 (38)



Junction	Fire Flow Needed (L/s (GPM))	Fire Flow Available (L/s (GPM))	Pressure (Residual Lower Limit) (kPa (PSI))	Pressure (Residual Calculated) (kPa (PSI))
J-147	63.1 (1000)	101.745 (1615)	138 (20)	276 (40)
J-148	63.1 (1000)	79.443 (1261)	138 (20)	213.9 (31)
J-149	63.1 (1000)	22.995 (365)	138 (20)	441.6 (64)
J-150	63.1 (1000)	102.06 (1620)	138 (20)	262.2 (38)
J-151	63.1 (1000)	21.798 (346)	138 (20)	358.8 (52)
J-152	63.1 (1000)	52.668 (836)	138 (20)	296.7 (43)
J-153	63.1 (1000)	52.668 (836)	138 (20)	317.4 (46)
J-154	63.1 (1000)	88.83 (1410)	138 (20)	289.8 (42)
J-155	63.1 (1000)	150.696 (2392)	138 (20)	144.9 (21)
J-159	63.1 (1000)	237.636 (3772)	138 (20)	255.3 (37)
J-160	63.1 (1000)	67.536 (1072)	138 (20)	193.2 (28)
J-162	63.1 (1000)	220.878 (3506)	138 (20)	276 (40)
J-163	63.1 (1000)	95.004 (1508)	138 (20)	310.5 (45)
J-164	63.1 (1000)	0.063 (1)	138 (20)	282.9 (41)
J-166	63.1 (1000)	153.405 (2435)	138 (20)	276 (40)
J-167	63.1 (1000)	21.798 (346)	138 (20)	186.3 (27)
J-168	63.1 (1000)	21.798 (346)	138 (20)	317.4 (46)
J-169	63.1 (1000)	101.556 (1612)	138 (20)	282.9 (41)
J-171	63.1 (1000)	102.942 (1634)	138 (20)	282.9 (41)
J-173	63.1 (1000)	100.233 (1591)	138 (20)	276 (40)
J-178	63.1 (1000)	107.856 (1712)	138 (20)	262.2 (38)

Scenario Analysis

Dillon used the model of the existing water distribution system to perform an analysis on the following scenarios.

Scenario 1 – Both Tanks Full

The model was tested with both the Route 204 Tank and Pugwash Road Tank full for ADD, PHD, and MDD scenarios. The model presented no demand or pressure concerns in this scenario.



Scenario 2 – Both Tanks at Minimum Levels

The model was tested with both of the Route 204 Tank and Pugwash Road Tank at minimum water levels for ADD, PHD, and MDD scenarios. The model presented no demand or pressure concerns in this scenario. Both tanks are still able to provide adequate demand to the system even when close to empty. These results are based on a steady state analysis.

Scenario 3 – Route 204 Tank Offline vs Pugwash Road Tank Offline

The model was tested with the Route 204 Tank offline. The model showed that if the Route 204 Tank was to go offline, the tank on Pugwash Road would not be able to supply adequate demand to the water distribution system.

The model was also tested with the Pugwash Road Tank offline. The model showed that if the Pugwash Road Tank was to go off line, the tank on Route 204 would be able to continue to provide adequate ADD, PHD, and MDD flows to the entire system even at minimum water levels. However, the Route 204 tank alone would not be able to provide enough supply in an MDD + Fire Flow scenario even when the tank is full.

Scenario 4 – OFF Demand Limit

The model was used to test how much demand could be satisfied at OFF before other issues presented themselves within the system. Under the ADD scenario OFF uses an average of 22.21 L/s. The model was tested with OFF taking 5 times its ADD (111.05 L/s) with both tanks at a minimum level. When running this scenario, there were no supply or pressure issues present showing that the system has the capacity under the ADD scenario to provide 5 times the ADD of OFF without causing any concern within the system. Demands above 5 times the ADD of OFF were not tested.

Under the PHD (83.28 L/s) scenario, with both tanks at minimum level, the model showed no issues within the system at 2.5 times the PHD (208.2 L/s) of OFF but at 3 times the PHD (249.84 L/s) of OFF pressure issues within the distribution network were present. This showed that the demand limit of OFF from the existing system falls somewhere between 2.5 to 3 times the PHD of OFF.

It should be noted that the scenarios tested only provide results for a snapshot in time during ADD and PHD scenarios. These scenarios did not consider the supply capacity of the wells to provide these demands.

Opportunities for Improvement and Optimization

After performing the scenario analysis described above, Dillon recommends the following for system improvement and optimization.



Low Pressure Zones – Horton Street and Handel Street

Due to the current conditions of the pipes on Horton Street and Handel Street, in order to address the low-pressure zones, it is recommended that the cast iron and steel pipes within this area be upsized and replaced. The existing pipes are currently showing signs of tuberculation and, with time, will only worsen. It is also noted that with these undersized pipes there is also no fire protection within these areas. The Atlantic Canada Water Supply Guidelines require a minimum of 150 mm for service mains providing fire protection and a minimum of 100 mm for service mains not providing fire protection. Dillon recommends that the pipes be replaced with 150 mm PVC pipes so that fire hydrants can be added to the system in these areas. If additional development beyond the nine homes is planned, this may need to be increased even further.

It is also recommended that the diameter of the pipes located in the middle of Town (Main Street, Duke Street, Waverly Street, Prince William Street, Ellis Street, Hanlon Street, Rideau Street, Henderson Street, Jackson Street, Fulton Street, Elm Street, James Street, Smith Street) also be increased since these are currently also undersized for fire flow. The risk associated with unsupported fire flow within the Town could be detrimental to residents within these areas and present an insurance risk. These upgrades could be completed piecemeal as the infrastructure in general is needing to be replaced due to its current age.

Scenario 3 – Route 204 Tank Offline vs Pugwash Road Tank Offline

If the Route 204 Tank was to go offline the remaining tank on Pugwash Road would not be able to provide adequate demand to the entire system. To address this concern, another water supply would need to be added to the system or the tank on Pugwash Road would need to be upgraded/replaced in order to add more supply to the system. Overall, these upgrades would require developing a reliable secondary water supply. These system upgrades are costly and would require further investigation and design work. A secondary water supply would provide redundancy to the system and increase the systems capability of supplying increased demands in emergency and future growth scenarios.

Although the Route 204 tank can provide adequate supply under ADD, PHD, and MDD scenarios, it cannot meet MDD + Fire Flow demand requirements. The existing model is set up with the gate valve to OFF from Main Street “partially open”. To try and mitigate this issue, the model was tested under the MDD + Fire Flow scenario with the Pugwash Road tank offline and the gate valve to OFF completely open. In this scenario, the Town experienced an increased supply of fire flow. With the gate valve completely open, the system pulled more water through the 300 mm PVC main line which feeds OFF from Route 204. It is recommended that if the tank on Pugwash Road is ever to go offline, the gate valve to OFF from Main Street be completely opened to increase the supply within the Town. Although with the gate valve



completely open there are improvements to fire flow, it should be noted that this will not address the concerns surrounding the undersized pipes within the system.

Scenario 4 – OFF Demand Limit

Regarding the concern of OFF pulling too much demand from the system, the steady state analysis conducted showed no requirements for system improvements to satisfy increased demands of OFF but the steady state analysis has its limitations when analyzing tank capacities.

Route 204 Pressure Reducing Valve

Since the PRV on Route 204 is the only PRV in the entire system, if this PRV was to fail the community would experience very high pressures and this could cause the fittings and pipes downstream to break apart and cause major leaks in the system. It is very common for PRVs in a water distribution system to have issues given all the different mechanisms at play. It is recommended that regular maintenance be performed on these valves as per manufacturer's recommendations.

If the Town is interested in exploring these concerns, Dillon can be engaged to provide further observations and recommendations.

Required Fire Flow

Many pipes within the system have a diameter less than 150 mm and are undersized for Fire flow. This provides limited fire protection and a risk to the residents located in these areas. If fire flow requirements are required, a minimum pipe size of 150 mm is required.

Future Development: Nine Homes on Horton Street

When attempting to add an additional watermain connection to the 50 mm galvanized steel watermain on Horton, the Town determined that the existing 50 mm galvanized steel line was almost completely plugged off with tuberculation and would not be able to provide enough water supply to the planned new housing development of four homes.

After a discussion with the Town, it was noted that the Town would eventually like to add a total of nine homes to this area.

Model Results

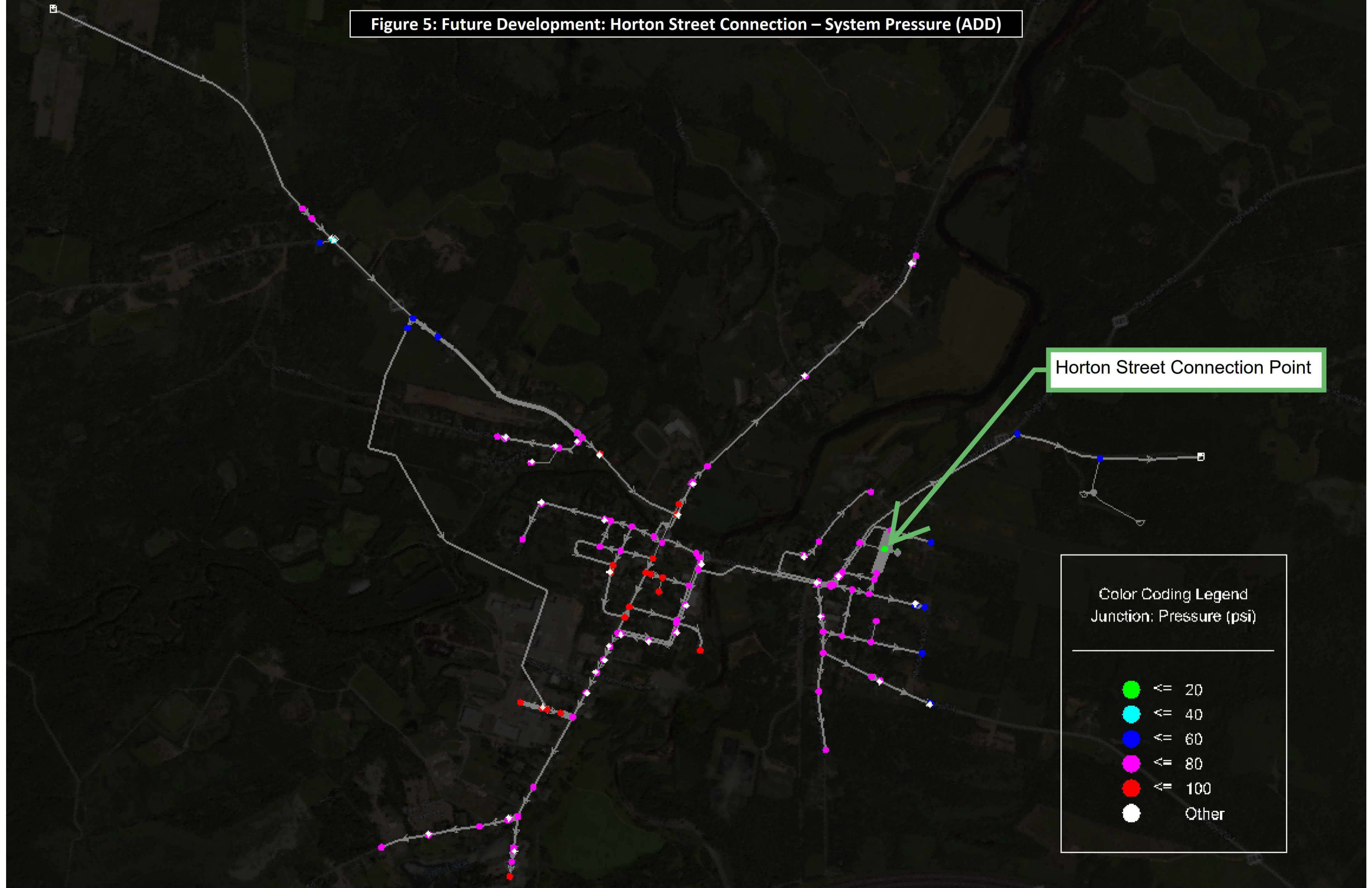
The addition of nine homes off of the 50 mm galvanized steel line on Horton Street was modelled and confirmed that the demand for the nine homes could not be satisfied though this connection point on Horton Street. **Figure 5** is a visual



representation of the pressure at each node within the system during the ADD scenario with the connection on Horton Street.



Figure 5: Future Development: Horton Street Connection – System Pressure (ADD)





The model was then tested with the additional nine homes connected to the 250 mm PVC main line on Pugwash Road in Average Day Demand (ADD), Peak Hour Demand (PHD), Max Day Demand (MDD), and MDD + Fire Flow scenarios. The model determined that the system could meet the demand of the additional nine homes at this connection location in all scenarios. **Table 15** represents the pressure within the system during the ADD, PHD and MDD scenarios with the connection to the 250 mm PVC water main on Pugwash Road and **Figure 6** is a visual representation of the pressure at each node within the system during the ADD scenario with the connection on Pugwash Road.

Table 15: Future Development: Pugwash Road Connection - Pressure

Junction	ADD Pressure (kPa (PSI))	PHD Pressure (kPa (PSI))	MDD Pressure (kPa (PSI))
J-38	510.6 (74)	483 (70)	496.8 (72)
J-39	372.6 (54)	372.6 (54)	372.6 (54)
J-42	579.6 (84)	503.7 (73)	545.1 (79)
J-45	531.3 (77)	524.4 (76)	524.4 (76)
J-46	531.3 (77)	524.4 (76)	524.4 (76)
J-47	462.3 (67)	455.4 (66)	455.4 (66)
J-48	483 (70)	476.1 (69)	476.1 (69)
J-49	489.9 (71)	483 (70)	489.9 (71)
J-50	545.1 (79)	545.1 (79)	545.1 (79)
J-51	524.4 (76)	524.4 (76)	524.4 (76)
J-52	565.8 (82)	558.9 (81)	565.8 (82)
J-54	324.3 (47)	324.3 (47)	324.3 (47)
J-57	545.1 (79)	538.2 (78)	545.1 (79)
J-59	524.4 (76)	524.4 (76)	524.4 (76)
J-60	503.7 (73)	503.7 (73)	503.7 (73)
J-61	483 (70)	476.1 (69)	483 (70)
J-62	531.3 (77)	531.3 (77)	531.3 (77)
J-63	552 (80)	552 (80)	552 (80)
J-64	545.1 (79)	538.2 (78)	545.1 (79)
J-65	572.7 (83)	476.1 (69)	524.4 (76)
J-66	545.1 (79)	545.1 (79)	545.1 (79)
J-67	503.7 (73)	496.8 (72)	503.7 (73)
J-68	538.2 (78)	531.3 (77)	531.3 (77)
J-69	545.1 (79)	538.2 (78)	545.1 (79)



Junction	ADD Pressure (kPa (PSI))	PHD Pressure (kPa (PSI))	MDD Pressure (kPa (PSI))
J-70	545.1 (79)	538.2 (78)	545.1 (79)
J-71	565.8 (82)	558.9 (81)	558.9 (81)
J-72	565.8 (82)	558.9 (81)	558.9 (81)
J-73	565.8 (82)	558.9 (81)	558.9 (81)
J-74	545.1 (79)	538.2 (78)	545.1 (79)
J-75	552 (80)	552 (80)	552 (80)
J-76	565.8 (82)	558.9 (81)	558.9 (81)
J-77	545.1 (79)	545.1 (79)	545.1 (79)
J-78	565.8 (82)	558.9 (81)	558.9 (81)
J-79	565.8 (82)	558.9 (81)	558.9 (81)
J-80	565.8 (82)	558.9 (81)	558.9 (81)
J-81	545.1 (79)	538.2 (78)	545.1 (79)
J-82	538.2 (78)	531.3 (77)	531.3 (77)
J-83	545.1 (79)	538.2 (78)	545.1 (79)
J-84	496.8 (72)	489.9 (71)	489.9 (71)
J-85	462.3 (67)	462.3 (67)	462.3 (67)
J-86	393.3 (57)	372.6 (54)	379.5 (55)
J-87	427.8 (62)	414 (60)	420.9 (61)
J-88	455.4 (66)	441.6 (64)	448.5 (65)
J-89	455.4 (66)	448.5 (65)	455.4 (66)
J-90	476.1 (69)	469.2 (68)	469.2 (68)
J-91	455.4 (66)	448.5 (65)	448.5 (65)
J-92	393.3 (57)	386.4 (56)	393.3 (57)
J-93	462.3 (67)	455.4 (66)	462.3 (67)
J-94	393.3 (57)	386.4 (56)	393.3 (57)
J-95	503.7 (73)	496.8 (72)	496.8 (72)
J-97	455.4 (66)	448.5 (65)	448.5 (65)
J-99	483 (70)	476.1 (69)	483 (70)
J-100	503.7 (73)	496.8 (72)	496.8 (72)
J-101	510.6 (74)	503.7 (73)	510.6 (74)
J-102	483 (70)	469.2 (68)	476.1 (69)
J-103	455.4 (66)	455.4 (66)	455.4 (66)
J-104	448.5 (65)	441.6 (64)	441.6 (64)
J-105	462.3 (67)	462.3 (67)	462.3 (67)

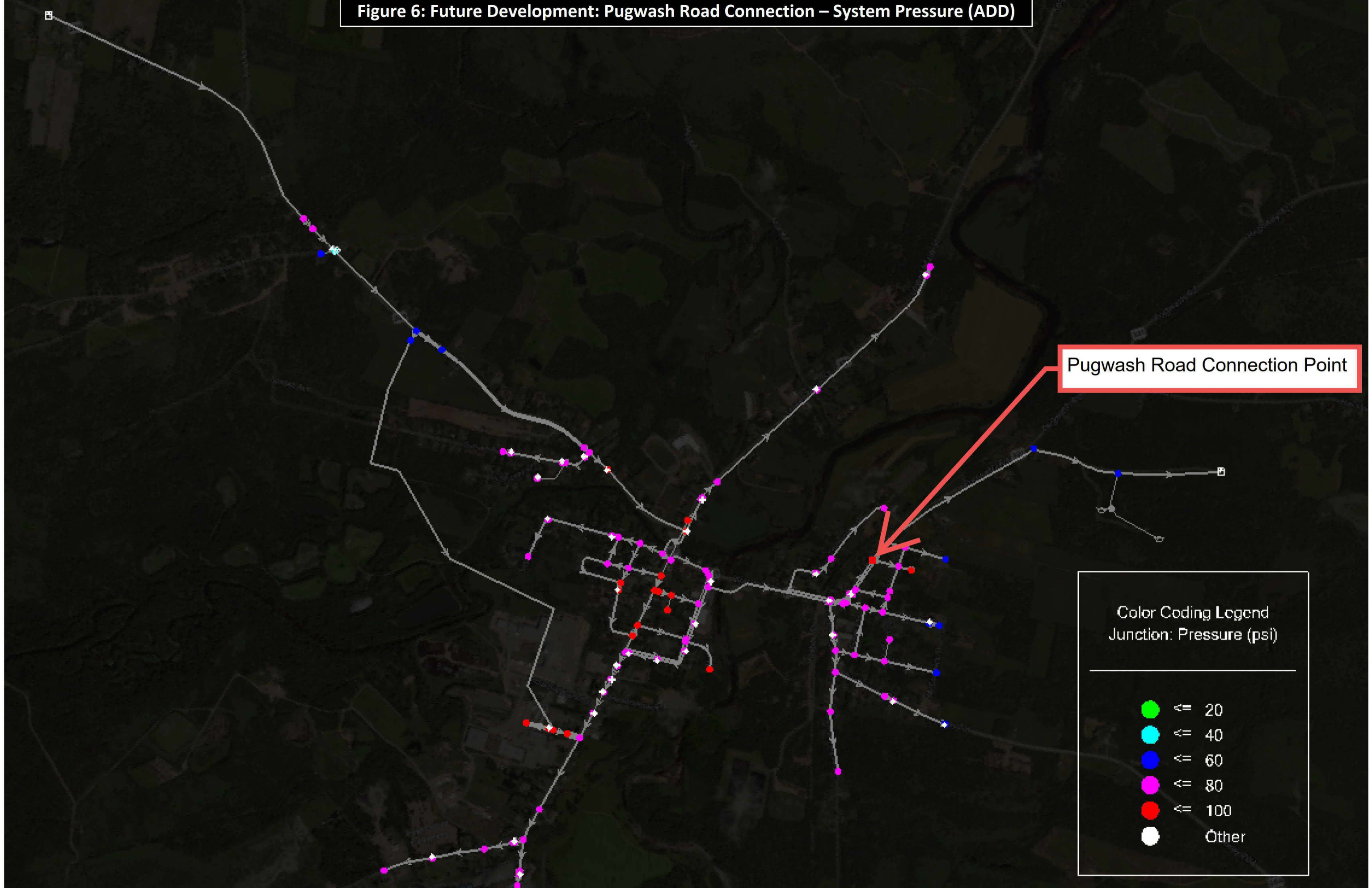


Junction	ADD Pressure (kPa (PSI))	PHD Pressure (kPa (PSI))	MDD Pressure (kPa (PSI))
J-106	358.8 (52)	351.9 (51)	358.8 (52)
J-107	538.2 (78)	531.3 (77)	538.2 (78)
J-108	483 (70)	476.1 (69)	476.1 (69)
J-109	489.9 (71)	483 (70)	489.9 (71)
J-110	462.3 (67)	455.4 (66)	455.4 (66)
J-111	517.5 (75)	510.6 (74)	510.6 (74)
J-112	469.2 (68)	462.3 (67)	462.3 (67)
J-113	545.1 (79)	545.1 (79)	545.1 (79)
J-114	565.8 (82)	558.9 (81)	565.8 (82)
J-115	538.2 (78)	531.3 (77)	531.3 (77)
J-116	503.7 (73)	496.8 (72)	503.7 (73)
J-117	565.8 (82)	558.9 (81)	558.9 (81)
J-118	545.1 (79)	538.2 (78)	545.1 (79)
J-119	545.1 (79)	538.2 (78)	545.1 (79)
J-120	545.1 (79)	538.2 (78)	545.1 (79)
J-121	545.1 (79)	538.2 (78)	545.1 (79)
J-122	545.1 (79)	538.2 (78)	545.1 (79)
J-123	552 (80)	545.1 (79)	552 (80)
J-124	538.2 (78)	538.2 (78)	538.2 (78)
J-125	552 (80)	545.1 (79)	552 (80)
J-126	552 (80)	545.1 (79)	552 (80)
J-127	579.6 (84)	496.8 (72)	538.2 (78)
J-129	524.4 (76)	524.4 (76)	524.4 (76)
J-130	483 (70)	483 (70)	483 (70)
J-131	545.1 (79)	538.2 (78)	545.1 (79)
J-132	503.7 (73)	496.8 (72)	496.8 (72)
J-133	496.8 (72)	483 (70)	489.9 (71)
J-134	496.8 (72)	483 (70)	489.9 (71)
J-135	393.3 (57)	386.4 (56)	393.3 (57)
J-136	496.8 (72)	489.9 (71)	489.9 (71)
J-137	427.8 (62)	420.9 (61)	420.9 (61)
J-138	358.8 (52)	351.9 (51)	358.8 (52)
J-140	427.8 (62)	420.9 (61)	420.9 (61)
J-141	455.4 (66)	448.5 (65)	448.5 (65)



Junction	ADD Pressure (kPa (PSI))	PHD Pressure (kPa (PSI))	MDD Pressure (kPa (PSI))
J-142	565.8 (82)	565.8 (82)	565.8 (82)
J-147	496.8 (72)	489.9 (71)	489.9 (71)
J-148	538.2 (78)	531.3 (77)	538.2 (78)
J-149	538.2 (78)	531.3 (77)	531.3 (77)
J-150	545.1 (79)	538.2 (78)	545.1 (79)
J-151	558.9 (81)	552 (80)	552 (80)
J-152	545.1 (79)	545.1 (79)	545.1 (79)
J-153	545.1 (79)	538.2 (78)	538.2 (78)
J-154	552 (80)	545.1 (79)	552 (80)
J-155	372.6 (54)	372.6 (54)	372.6 (54)
J-159	324.3 (47)	317.4 (46)	324.3 (47)
J-160	324.3 (47)	317.4 (46)	317.4 (46)
J-162	510.6 (74)	483 (70)	496.8 (72)
J-163	565.8 (82)	496.8 (72)	531.3 (77)
J-164	462.3 (67)	455.4 (66)	455.4 (66)
J-166	324.3 (47)	317.4 (46)	324.3 (47)
J-167	565.8 (82)	558.9 (81)	558.9 (81)
J-168	552 (80)	545.1 (79)	545.1 (79)
J-169	503.7 (73)	496.8 (72)	496.8 (72)
J-170	138 (20)	138 (20)	138 (20)
J-171	503.7 (73)	503.7 (73)	503.7 (73)
J-173	496.8 (72)	489.9 (71)	489.9 (71)
J-178	483 (70)	483 (70)	483 (70)
J-179	593.4 (86)	593.4 (86)	593.4 (86)

Figure 6: Future Development: Pugwash Road Connection – System Pressure (ADD)





The model analysis of the future development demonstrated that residential fire flows can be satisfied under the described boundary conditions within all pipes with a diameter greater than 150 mm. The pipes within the system with a diameter smaller than 150 mm are unable to provide adequate fire flow. The fire flow analysis results are summarized in **Table 16**.

Table 16: Future Development: Pugwash Road Connection - Fire Flow Analysis Results

Junction	Fire Flow Needed (L/s (GPM))	Fire Flow Available (L/s (GPM))	Pressure (Residual Lower Limit) (kPa (PSI))	Pressure (Residual Calculated) (kPa (PSI))
J-38	63 (1000)	220.878 (3506)	138 (20)	289.8 (42)
J-39	63 (1000)	9.639 (153)	138 (20)	138 (20)
J-42	63 (1000)	105.462 (1674)	138 (20)	303.6 (44)
J-45	63 (1000)	84.546 (1342)	138 (20)	227.7 (33)
J-46	63 (1000)	84.357 (1339)	138 (20)	227.7 (33)
J-47	63 (1000)	70.308 (1116)	138 (20)	151.8 (22)
J-48	63 (1000)	78.624 (1248)	138 (20)	179.4 (26)
J-49	63 (1000)	76.923 (1221)	138 (20)	158.7 (23)
J-50	63 (1000)	83.475 (1325)	138 (20)	241.5 (35)
J-51	63 (1000)	13.419 (213)	138 (20)	158.7 (23)
J-52	63 (1000)	93.618 (1486)	138 (20)	255.3 (37)
J-54	63 (1000)	162.477 (2579)	138 (20)	172.5 (25)
J-57	63 (1000)	100.611 (1597)	138 (20)	282.9 (41)
J-59	63 (1000)	74.214 (1178)	138 (20)	200.1 (29)
J-60	63 (1000)	5.67 (90)	138 (20)	282.9 (41)
J-61	63 (1000)	3.276 (52)	138 (20)	144.9 (21)
J-62	63 (1000)	75.348 (1196)	138 (20)	213.9 (31)
J-63	63 (1000)	52.668 (836)	138 (20)	276 (40)
J-64	63 (1000)	82.404 (1308)	138 (20)	282.9 (41)
J-65	63 (1000)	35.343 (561)	138 (20)	448.5 (65)
J-66	63 (1000)	99.729 (1583)	138 (20)	227.7 (33)
J-67	63 (1000)	19.782 (314)	138 (20)	138 (20)
J-68	63 (1000)	21.798 (346)	138 (20)	414 (60)
J-69	63 (1000)	21.798 (346)	138 (20)	213.9 (31)
J-70	63 (1000)	21.798 (346)	138 (20)	324.3 (47)
J-71	63 (1000)	21.798 (346)	138 (20)	193.2 (28)



Junction	Fire Flow Needed (L/s (GPM))	Fire Flow Available (L/s (GPM))	Pressure (Residual Lower Limit) (kPa (PSI))	Pressure (Residual Calculated) (kPa (PSI))
J-72	63 (1000)	21.798 (346)	138 (20)	365.7 (53)
J-73	63 (1000)	21.798 (346)	138 (20)	365.7 (53)
J-74	63 (1000)	21.798 (346)	138 (20)	324.3 (47)
J-75	63 (1000)	21.798 (346)	138 (20)	365.7 (53)
J-76	63 (1000)	21.798 (346)	138 (20)	386.4 (56)
J-77	63 (1000)	101.682 (1614)	138 (20)	227.7 (33)
J-78	63 (1000)	21.798 (346)	138 (20)	345 (50)
J-79	63 (1000)	5.859 (93)	138 (20)	427.8 (62)
J-80	63 (1000)	21.798 (346)	138 (20)	420.9 (61)
J-81	63 (1000)	21.798 (346)	138 (20)	414 (60)
J-82	63 (1000)	21.798 (346)	138 (20)	441.6 (64)
J-83	63 (1000)	21.798 (346)	138 (20)	414 (60)
J-84	63 (1000)	100.044 (1588)	138 (20)	276 (40)
J-85	63 (1000)	85.428 (1356)	138 (20)	248.4 (36)
J-86	63 (1000)	1.071 (17)	138 (20)	144.9 (21)
J-87	63 (1000)	1.953 (31)	138 (20)	179.4 (26)
J-88	63 (1000)	1.953 (31)	138 (20)	200.1 (29)
J-89	63 (1000)	15.561 (247)	138 (20)	220.8 (32)
J-90	63 (1000)	7.812 (124)	138 (20)	241.5 (35)
J-91	63 (1000)	7.308 (116)	138 (20)	220.8 (32)
J-92	63 (1000)	5.67 (90)	138 (20)	144.9 (21)
J-93	63 (1000)	5.355 (85)	138 (20)	207 (30)
J-94	63 (1000)	4.662 (74)	138 (20)	138 (20)
J-95	63 (1000)	7.497 (119)	138 (20)	248.4 (36)
J-97	63 (1000)	7.434 (118)	138 (20)	200.1 (29)
J-99	63 (1000)	7.686 (122)	138 (20)	227.7 (33)
J-100	63 (1000)	5.733 (91)	138 (20)	165.6 (24)
J-101	63 (1000)	4.536 (72)	138 (20)	172.5 (25)
J-102	63 (1000)	3.024 (48)	138 (20)	138 (20)
J-103	63 (1000)	22.932 (364)	138 (20)	351.9 (51)
J-104	63 (1000)	22.932 (364)	138 (20)	200.1 (29)
J-105	63 (1000)	4.851 (77)	138 (20)	144.9 (21)
J-106	63 (1000)	14.742 (234)	138 (20)	138 (20)



Junction	Fire Flow Needed (L/s (GPM))	Fire Flow Available (L/s (GPM))	Pressure (Residual Lower Limit) (kPa (PSI))	Pressure (Residual Calculated) (kPa (PSI))
J-107	63 (1000)	82.971 (1317)	138 (20)	241.5 (35)
J-108	63 (1000)	77.994 (1238)	138 (20)	179.4 (26)
J-109	63 (1000)	76.923 (1221)	138 (20)	158.7 (23)
J-110	63 (1000)	70.371 (1117)	138 (20)	158.7 (23)
J-111	63 (1000)	13.419 (213)	138 (20)	158.7 (23)
J-112	63 (1000)	17.955 (285)	138 (20)	158.7 (23)
J-113	63 (1000)	83.727 (1329)	138 (20)	241.5 (35)
J-114	63 (1000)	93.492 (1484)	138 (20)	255.3 (37)
J-115	63 (1000)	21.798 (346)	138 (20)	393.3 (57)
J-116	63 (1000)	21.798 (346)	138 (20)	186.3 (27)
J-117	63 (1000)	21.798 (346)	138 (20)	407.1 (59)
J-118	63 (1000)	100.8 (1600)	138 (20)	276 (40)
J-119	63 (1000)	96.831 (1537)	138 (20)	282.9 (41)
J-120	63 (1000)	94.185 (1495)	138 (20)	282.9 (41)
J-121	63 (1000)	91.161 (1447)	138 (20)	282.9 (41)
J-122	63 (1000)	88.956 (1412)	138 (20)	282.9 (41)
J-123	63 (1000)	87.57 (1390)	138 (20)	289.8 (42)
J-124	63 (1000)	86.562 (1374)	138 (20)	276 (40)
J-125	63 (1000)	85.554 (1358)	138 (20)	289.8 (42)
J-126	63 (1000)	84.105 (1335)	138 (20)	289.8 (42)
J-127	63 (1000)	105.462 (1674)	138 (20)	282.9 (41)
J-129	63 (1000)	74.34 (1180)	138 (20)	200.1 (29)
J-130	63 (1000)	4.095 (65)	138 (20)	165.6 (24)
J-131	63 (1000)	52.668 (836)	138 (20)	310.5 (45)
J-132	63 (1000)	5.733 (91)	138 (20)	165.6 (24)
J-133	63 (1000)	7.686 (122)	138 (20)	186.3 (27)
J-134	63 (1000)	7.56 (120)	138 (20)	234.6 (34)
J-135	63 (1000)	5.67 (90)	138 (20)	158.7 (23)
J-136	63 (1000)	89.397 (1419)	138 (20)	276 (40)
J-137	63 (1000)	18.333 (291)	138 (20)	207 (30)
J-138	63 (1000)	14.805 (235)	138 (20)	138 (20)
J-140	63 (1000)	19.215 (305)	138 (20)	207 (30)
J-141	63 (1000)	7.434 (118)	138 (20)	186.3 (27)



Junction	Fire Flow Needed (L/s (GPM))	Fire Flow Available (L/s (GPM))	Pressure (Residual Lower Limit) (kPa (PSI))	Pressure (Residual Calculated) (kPa (PSI))
J-142	63 (1000)	86.373 (1371)	138 (20)	262.2 (38)
J-147	63 (1000)	101.556 (1612)	138 (20)	276 (40)
J-148	63 (1000)	79.38 (1260)	138 (20)	213.9 (31)
J-149	63 (1000)	22.995 (365)	138 (20)	441.6 (64)
J-150	63 (1000)	101.871 (1617)	138 (20)	262.2 (38)
J-151	63 (1000)	21.798 (346)	138 (20)	358.8 (52)
J-152	63 (1000)	52.668 (836)	138 (20)	296.7 (43)
J-153	63 (1000)	52.668 (836)	138 (20)	317.4 (46)
J-154	63 (1000)	88.704 (1408)	138 (20)	289.8 (42)
J-155	63 (1000)	150.444 (2388)	138 (20)	144.9 (21)
J-159	63 (1000)	237.636 (3772)	138 (20)	255.3 (37)
J-160	63 (1000)	67.536 (1072)	138 (20)	193.2 (28)
J-162	63 (1000)	220.878 (3506)	138 (20)	276 (40)
J-163	63 (1000)	95.004 (1508)	138 (20)	310.5 (45)
J-164	63 (1000)	0.063 (1)	138 (20)	282.9 (41)
J-166	63 (1000)	153.405 (2435)	138 (20)	276 (40)
J-167	63 (1000)	21.798 (346)	138 (20)	186.3 (27)
J-168	63 (1000)	21.798 (346)	138 (20)	317.4 (46)
J-169	63 (1000)	101.367 (1609)	138 (20)	282.9 (41)
J-171	63 (1000)	102.753 (1631)	138 (20)	282.9 (41)
J-173	63 (1000)	100.044 (1588)	138 (20)	276 (40)
J-178	63 (1000)	107.604 (1708)	138 (20)	262.2 (38)
J-179	63 (1000)	103.95 (1650)	138 (20)	138 (20)

Optimization Recommendations

Since the existing 50 mm galvanized steel watermain on Horton cannot satisfy the required additional demand of a new development, the two following options are recommended.

1. Upsize and replace all cast iron and steel pipes in the area with 150 mm PVC pipes to allow for fire flow protection within the area; or
2. Make the connection for these nine homes off of the 250 mm PVC main line on Pugwash Road. It is recommended that this connection be a 150 mm PVC pipe to allow for fire flow protection within the area.



Conclusion

Dillon has developed a Steady-State WaterCAD model of the existing water distribution system in the Town of Oxford. This model has been used to perform an analysis of several different scenarios and recommendations of opportunities for system improvements and optimization have been identified. This model can be used in the future to conduct tests of other scenarios including future growth and developments.

The results obtained by the WaterCAD model analysis are limited by the information available on the existing water distribution system. The elevation data is also based on ground elevation and will vary from the actual centerline pipe elevations. This analysis is based on an estimation of the existing Town supply as validated based on hydrant flow tests on the existing distribution system and discussion with the Town.

Overall, the existing water distribution system is experiencing supply and low-pressure issues within several areas of the Town due to the existing infrastructure being old and undersized. The undersized pipes also provide concerns surrounding adequate fire flow protection. Dillon recommends that the Town begin looking at potential infrastructure upgrades within the system such as replacing and upsizing the tuberculated and undersized pipes within the system.

When looking at the potential of adding nine homes to Horton Street, it is recommended that the Town either upsize and replace the existing infrastructure in this area so that it can provide adequate supply, or it is recommended that the Town make the connection for the nine homes to the 250 mm PVC water main on Pugwash Road. The Town can look at the two available options presented in this report and decide on how to proceed with this development.

The Town expressed concern regarding an increase of demand at OFF. An increased demand of five (5) times the ADD of OFF was tested and the model confirmed that an increased demand of this size could be met without causing any operational issues in the system at ADD. The model was also tested under the PHD scenario and the model showed no issues within the system at 2.5 times the PHD of OFF.

Regarding water supply, the tanks at full or minimum water levels are currently providing adequate supply to the system but if either tank was to become non-operational the entire system would experience supply and pressure issues. Dillon recommends that upgrades to a reliable secondary water supply or additional tankage be considered. A secondary water supply would provide redundancy to the system and increase the systems capability of supplying increased demands in emergency and future growth scenarios.



If the Town would like to conduct any further scenario analysis or simulations with the finalized WaterCAD model, Dillon can be engaged to perform these requests.

Sincerely,

DILLON CONSULTING LIMITED

Taylor Price, EIT

Kyle MacIntyre, P.Eng.

TP:jmt

Our file: 23-7219

Commercial Confidentiality Statement

This document contains trade secrets or scientific, technical, commercial, financial and labour or employee relations information which is considered to be confidential to Dillon Consulting Limited ("Dillon"). Dillon does not consent to the disclosure of this information to any third party or person not in your employ. Additionally, you should not disclose such confidential information to anyone in your organization except on a "need-to-know" basis and after such individual has agreed to maintain the confidentiality of the information and with the understanding that you remain responsible for the maintenance of such confidentiality by people within your organization. If the head or any other party within any government institution intends to disclose this information, or any part thereof, then Dillon requires that it first be notified of that intention. Such notice should be addressed to: Dillon Consulting Limited, 235 Yorkland Boulevard, Suite 800, Toronto, Ontario M2J 4Y8, Attention: Legal Department.



References

Atlantic Canada Water and Wastewater Association. (n.d.). *Atlantic Canada Water Supply Guidelines 2022*. ACWWA - Design Guidelines.
<https://www.acwwa.ca/resources/water-wastewater-guidelines/kmp/design-guidelines>

Government of Canada, S. C. (2021, October 27). *Census profile, 2016 census Oxford, town, Nova Scotia and Nunavut*. Census Profile, 2016 Census - Oxford, Town, Nova Scotia and Nunavut. <https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/details/page.cfm?Lang=E&Geo1=CSD&Code1=1211012&Geo2=PR&Code2=62&Data=Count&SearchText=Oxford&SearchType=Begins&SearchPR=01&B1=All&TABID=1>

Government of Canada, S. C. (2023, February 1). *Census Profile, 2021 Census of Population*. Census Profile, 2021 Census of Population - Oxford, Town, Nova Scotia. <https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/details/page.cfm?Lang=E&SearchText=Oxford&DGUIDlist=2021A00051211012&GENDERlist=1%2C2%2C3&STATISTIClist=1&HEADERlist=0>

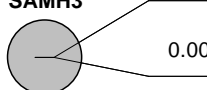

National Fire Protection Association (NFPA). (2015). *NFPA 1 Fire Code 2015 Edition*.

Inspection report

Date: 2025-11-28	Work Order:	Weather:	Surveyed By: Justin Leblanc	Certificate Number: P0040114-112022	Pipe Segment Ref.: <small>Main, SAMH3 To SAMH4 Nov 28 2025</small>
Year laid:	Pre-cleaning: Heavy Cleaning	Direction: <small>Downstream (camera pointing with flow)</small>	Pipe Joint Length:	Total Length: 90.20 m	Length Surveyed: 90.20 m

City: Oxford	Drainage Area:	Upstream MH: SAMH3
Street: Main St	Media Label:	Up Rim to Invert: 0.0
Location Code:	Flow Control:	Downstream MH: SAMH4
Location Details:	Sheet Number:	Down Rim to Invert: 0.0
Pipe shape: Circular	Sewer Use: Sanitary Sewage Pipe	Total gallons used: 0.0
Pipe size: 200 mm	Sewer Category: SEC	Joints passed: 0
Pipe material: Polyvinyl Chloride	Purpose:	Joints failed: 0
Lining Method:	Owner:	

Additional Info:

1:457	Distance	Code	Observation	Counter	Grade
	0.00	AMH	Manhole / SAMH3	00:00:00	
	0.00	MWL	Miscellaneous Water Level, 10% of the vertical dimension	00:00:02	
	4.70	TFD	Tap Factory Made Defective at 11 o'clock, 100mm dim	00:00:39	3
	4.70	MWL	Miscellaneous Water Level, 20% of the vertical dimension	00:00:40	
	7.20	TBI	Tap Break-In Intruding at 10 o'clock, 100mm dim, 50mm intrusion	00:00:58	4
	13.50	MWL	Miscellaneous Water Level, 5% of the vertical dimension	00:01:42	
	27.80	IGL	Infiltration Gusher Lateral at 10 o'clock	00:02:39	5
	27.80	TFD	Tap Factory Made Defective at 11 o'clock, 100mm dim / water infiltration	00:02:53	3
	37.90	MWLS	Miscellaneous Water Level, Sag, 15% of the vertical dimension	00:03:36	2
	39.00	MWL	Miscellaneous Water Level, 5% of the vertical dimension	00:03:40	
	42.60	MWLS	Miscellaneous Water Level, Sag, 25% of the vertical dimension	00:03:53	2
	47.40	TFI	Tap Factory Made Intruding at 12 o'clock, 100mm dim, 50mm intrusion	00:04:24	
	47.40	IRL	Infiltration Runner Lateral at 12 o'clock	00:05:03	4
	50.60	MWLS	Miscellaneous Water Level, Sag, 50% of the vertical dimension	00:04:43	3
	53.80	IDL	Infiltration Dripper Lateral at 2 o'clock	00:05:42	3
	57.10	MWL	Miscellaneous Water Level, 10% of the vertical dimension	00:05:09	



Inspection report

Date: 2025-11-28	Work Order:	Weather:	Surveyed By: Justin Leblanc	Certificate Number: P0040114-112022	Pipe Segment Ref.: <small>Main, SAMH3 To SAMH4 Nov 28 2025</small>
Year laid:	Pre-cleaning: Heavy Cleaning	Direction: <small>Downstream (camera pointing with flow)</small>	Pipe Joint Length:	Total Length: 90.20 m	Length Surveyed: 90.20 m

	Distance	Code	Observation	Counter	Grade
	63.80	TF	Tap Factory Made at 2 o'clock, 100mm dim	00:05:40	
	69.80	TBD	Tap Break-In Defective at 12 o'clock, 100mm dim	00:06:12	
	69.80	IRL	Infiltration Runner Lateral at 12 o'clock	00:07:07	4
	90.20	MSA	Miscellaneous Survey Abandoned / Unable to pass due to debris in line	00:08:44	

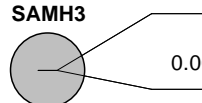

QSR	QMR	QOR	SPR	MPR	OPR	SPRI	MPRI	OPRI
3122	5143	5143	7.0	26.0	33.0	2.3	3.7	3.3

Inspection report

Date: 2025-11-28	Work Order:	Weather:	Surveyed By: Justin Leblanc	Certificate Number: P0040114-112022	Pipe Segment Ref.: <small>Main, SAMH3 To SAMH4 Nov 28 2025</small>
Year laid:	Pre-cleaning: Heavy Cleaning	Direction: <small>Downstream (camera pointing with flow)</small>	Pipe Joint Length:	Total Length: 93.00 m	Length Surveyed: 93.00 m

City: Oxford	Drainage Area:	Upstream MH: SAMH3
Street: Main St	Media Label:	Up Rim to Invert: 0.0
Location Code:	Flow Control:	Downstream MH: SAMH4
Location Details:	Sheet Number:	Down Rim to Invert: 0.0
Pipe shape: Circular	Sewer Use: Sanitary Sewage Pipe	Total gallons used: 0.0
Pipe size: 200 mm	Sewer Category: SEC	Joints passed: 0
Pipe material: Polyvinyl Chloride	Purpose:	Joints failed: 0
Lining Method:	Owner:	

Additional Info:

1:615	Distance	Code	Observation	Counter	Grade
	0.00	AMH	Manhole / SAMH3	00:00:00	
	0.00	MWL	Miscellaneous Water Level, 10% of the vertical dimension	00:00:01	
	4.80	TFD	Tap Factory Made Defective at 11 o'clock, 100mm dim	00:00:30	3
	7.10	TBI	Tap Break-In Intruding at 10 o'clock, 100mm dim, 50mm intrusion	00:00:46	4
	12.20	MWLS	Miscellaneous Water Level, Sag, 20% of the vertical dimension	00:01:08	2
	13.80	MWL	Miscellaneous Water Level, 10% of the vertical dimension	00:01:16	
	27.60	TFD	Tap Factory Made Defective at 11 o'clock, 100mm dim	00:02:17	
	27.60	IGL	Infiltration Gusher Lateral at 10 o'clock	00:02:17	5
	36.10	MWLS	Miscellaneous Water Level, Sag, 30% of the vertical dimension	00:02:55	2
	42.60	MWLS	Miscellaneous Water Level, Sag, 40% of the vertical dimension	00:03:22	3
	47.30	TBI	Tap Break-In Intruding at 12 o'clock, 100mm dim, 50mm intrusion	00:03:49	4
	47.30	IRL	Infiltration Runner Lateral at 12 o'clock	00:04:37	4
	63.70	IDL	Infiltration Dripper Lateral at 2 o'clock	00:05:05	3
	63.70	TFD	Tap Factory Made Defective at 2 o'clock, 100mm dim	00:05:05	
	69.80	TFD	Tap Factory Made Defective at 12 o'clock, 100mm dim	00:05:34	
	69.80	IDL	Infiltration Dripper Lateral at 12 o'clock	00:06:33	3



Inspection report

Date: 2025-11-28	Work Order:	Weather:	Surveyed By: Justin Leblanc	Certificate Number: P0040114-112022	Pipe Segment Ref.: <small>Main, SAMH3 To SAMH4 Nov 28 2025</small>
Year laid:	Pre-cleaning: Heavy Cleaning	Direction: <small>Downstream (camera pointing with flow</small>	Pipe Joint Length:	Total Length: 93.00 m	Length Surveyed: 93.00 m

	Distance	Code	Observation	Counter	Grade			
	93.00	MGO	Miscellaneous General Observation / Buried Manhole	00:07:23				
	93.00	AMH	Manhole / SAMH4	00:07:23				
QSR	QMR	QOR	SPR	MPR	OPR	SPRI	MPRI	OPRI
3122	5143	5143	7.0	26.0	33.0	2.3	3.7	3.3



Inspection report

Date: 2025-11-28	Work Order:	Weather:	Surveyed By: Justin Leblanc	Certificate Number: P0040114-112022	Pipe Segment Ref.: <small>Main, SAMH4 To SAMH5 Nov 28 2025</small>
Year laid:	Pre-cleaning: Heavy Cleaning	Direction: <small>Downstream (camera pointing with flow)</small>	Pipe Joint Length:	Total Length: 93.00 m	Length Surveyed: 93.00 m

City: Oxford	Drainage Area:	Upstream MH: SAMH4
Street: Main St	Media Label:	Up Rim to Invert: 0.0
Location Code:	Flow Control:	Downstream MH: SAMH5
Location Details:	Sheet Number:	Down Rim to Invert: 0.0
Pipe shape: Circular	Sewer Use: Sanitary Sewage Pipe	Total gallons used: 0.0
Pipe size: 200 mm	Sewer Category: SEC	Joints passed: 0
Pipe material: Polyvinyl Chloride	Purpose:	Joints failed: 0
Lining Method:	Owner:	

Additional Info:

1:702	Distance	Code	Observation	Counter	Grade			
			SAMH4					
	0.00	AMH	Manhole / SAMH4	00:00:00				
	0.00	MWL	Miscellaneous Water Level, 5% of the vertical dimension	00:00:01				
	5.10	TF	Tap Factory Made at 2 o'clock, 100mm dim	00:00:42				
	7.40	MWLS	Miscellaneous Water Level, Sag, 35% of the vertical dimension	00:00:55	3			
	11.60	ISSRH	Intruding Sealing Material Sealing Ring Hanging, 5% of cross sectional area from 2 o'clock to 3 o'clock	00:01:26	2			
	11.60	TFD	Tap Factory Made Defective at 1 o'clock, 100mm dim	00:01:30	3			
	11.60	IDL	Infiltration Dripper Lateral at 1 o'clock	00:01:42	3			
	40.20	ISSRL	Intruding Sealing Material Sealing Ring Loose/Poorly Fitting from 10 o'clock to 11 o'clock	00:03:30				
	40.20	TFD	Tap Factory Made Defective at 10 o'clock, 100mm dim	00:03:31				
	40.20	IRL	Infiltration Runner Lateral at 10 o'clock	00:04:19	4			
	52.50	MWLS	Miscellaneous Water Level, Sag, 20% of the vertical dimension	00:04:30	2			
	66.10	TF	Tap Factory Made at 2 o'clock, 100mm dim	00:05:27				
	89.50	TF	Tap Factory Made at 2 o'clock, 100mm dim	00:07:10				
	89.50	IDL	Infiltration Dripper Lateral at 2 o'clock	00:08:42	3			
	93.00	AMH	Manhole / SAMH5	00:07:33				
			SAMH5					
QSR	QMR	QOR	SPR	MPR	OPR	SPRI	MPRI	OPRI
3121	4133	4134	5.0	15.0	20.0	2.5	3.0	2.9

Inspection report

Date: 2025-11-28	Work Order:	Weather:	Surveyed By: Justin Leblanc	Certificate Number: P0040114-112022	Pipe Segment Ref.: <small>Main, SAMH6 To SAMH5 Nov 28 2025</small>
Year laid:	Pre-cleaning: Heavy Cleaning	Direction: <small>Upstream (camera pointing against flow)</small>	Pipe Joint Length:	Total Length: 76.70 m	Length Surveyed: 76.70 m

City: Oxford	Drainage Area:	Upstream MH: SAMH5
Street: Main St	Media Label:	Up Rim to Invert: 0.0
Location Code:	Flow Control:	Downstream MH: SAMH6
Location Details:	Sheet Number:	Down Rim to Invert: 0.0
Pipe shape: Circular	Sewer Use: Sanitary Sewage Pipe	Total gallons used: 0.0
Pipe size: 200 mm	Sewer Category: SEC	Joints passed: 0
Pipe material: Polyvinyl Chloride	Purpose:	Joints failed: 0
Lining Method:	Owner:	

Additional Info:

1:579	Distance	Code	Observation	Counter	Grade
	0.00	MWL	Miscellaneous Water Level, 10% of the vertical dimension	00:00:00	
	0.00	AMH	Manhole / SAMH6	00:05:00	
	12.10	IRL	Infiltration Runner Lateral at 10 o'clock	00:00:54	4
	12.10	TBI	Tap Break-In Intruding at 10 o'clock, 100mm dim, 50mm intrusion	00:00:54	4
	18.60	MWLS	Miscellaneous Water Level, Sag, 30% of the vertical dimension	00:01:22	2
	30.80	IDL	Infiltration Dripper Lateral at 2 o'clock	00:02:17	3
	30.80	TFD	Tap Factory Made Defective at 2 o'clock, 100mm dim	00:02:18	
	44.00	S01 MCU	Miscellaneous Camera Underwater, Start	00:04:23	5
	73.00	F01 MCU	Miscellaneous Camera Underwater, Finish	00:05:46	4
	73.70	IGL	Infiltration Gusher Lateral at 2 o'clock	00:05:32	5
	73.70	TFD	Tap Factory Made Defective at 2 o'clock, 100mm dim	00:05:32	
	75.50	MWL	Miscellaneous Water Level, 10% of the vertical dimension	00:05:42	
	76.70	AMH	Manhole / SAMH5	00:05:50	



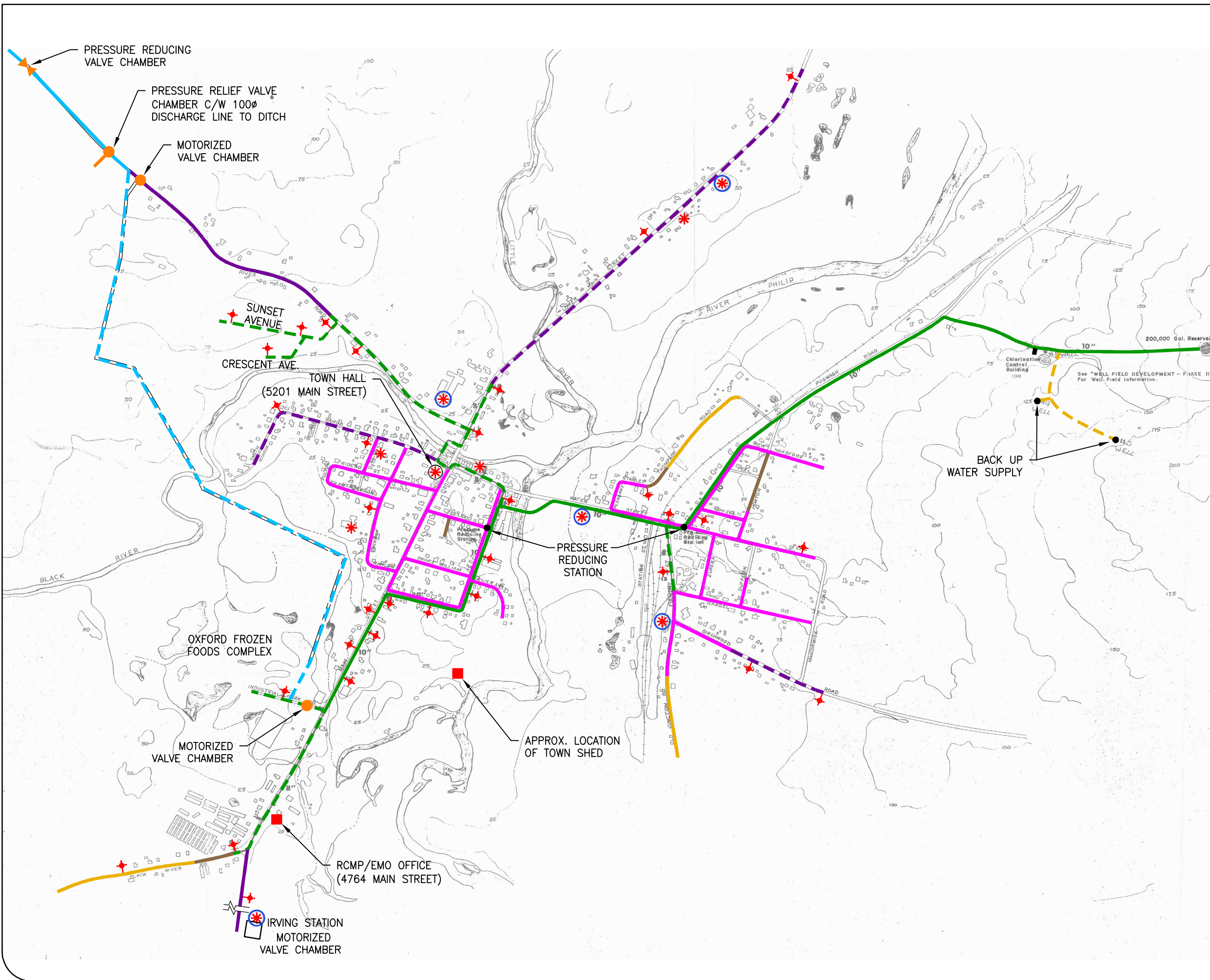
Inspection report

Date: 2025-11-28	Work Order:	Weather:	Surveyed By: Justin Leblanc	Certificate Number: P0040114-112022	Pipe Segment Ref.: <small>Main, SAMH6 To Lift Station Nov 28 2025</small>
Year laid:	Pre-cleaning: Heavy Cleaning	Direction: <small>Downstream (camera pointing with flow)</small>	Pipe Joint Length:	Total Length: 0.00 m	Length Surveyed: 0.00 m

City: Oxford	Drainage Area:	Upstream MH: SAMH6
Street: Main St	Media Label:	Up Rim to Invert: 0.0
Location Code:	Flow Control:	Downstream MH: Lift Station
Location Details:	Sheet Number:	Down Rim to Invert: 0.0
Pipe shape: Circular	Sewer Use: Sanitary Sewage Pipe	Total gallons used: 0.0
Pipe size: 200 mm	Sewer Category: SEC	Joints passed: 0
Pipe material: Polyvinyl Chloride	Purpose:	Joints failed: 0
Lining Method:	Owner:	

Additional Info:

	1:50	Distance	Code	Observation	Counter	Grade			
		0.00	AMH	Manhole / SAMH6	00:00:00				
		0.00	MWL	Miscellaneous Water Level, 30% of the vertical dimension	00:00:01				
	QSR	QMR	QOR	SPR	MPR	OPR	SPRI	MPRI	OPRI



DISTRIBUTION SYSTEM SCHEMATIC
 FIGURE 3

- 50mm GALVANIZED STEEL
- 50mm PLASTIC
- 100mm HDPE
- 100mm CAST IRON
- 100mm PVC
- 150mm PVC
- 200mm HDPE
- 250mm HDPE
- 300mm PVC
- 350mm PVC
- FIRE HYDRANTS
- EXISTING SAMPLE LOCATIONS
- RECOMMENDED SAMPLE LOCATIONS

200 0 200
 SCALE 1:11,000 METRES



MAP/DRAWING INFORMATION
 W. N. Horner and Associates, Water System Layout (Sept. 1977)
 and Dillon Consulting Limited.

CREATED BY: TLR
 CHECKED BY: KRM
 DESIGNED BY: KAM/SRH

File Location:
 c:\project\working directory\projects 2020\5011\dms21188\202649-05-03-fig3.dwg
 May. 28, 2020 8:39 PM



Appendix E Proposal Declaration Form

This Proposal Declaration must be executed by the Proponent and included with the Technical Submission. By executing this Declaration, the Proponent agrees to all terms and conditions of this RFP.

TO: Town of Oxford, Attention: Linda Cloney, CAO

**RE: RFP 2026-05-02-TOO Service Renewal to Support Community Growth Project
Phase 1 Detailed Design and Construction Administration Services**

The undersigned Proponent, having carefully reviewed this RFP including all appendices and any addenda issued, hereby declares as follows:

1. The Proponent has the legal capacity to enter into a contract and to fulfill all obligations under this RFP.
2. This proposal has been prepared without collusion or fraud, and the Proponent has not communicated or agreed with any other Proponent regarding pricing or proposal content.
3. The Proponent and all key team members have reviewed all background documents provided in this RFP, including the Dillon feasibility study (**Appendix A**) and the WaterCAD model report (**Appendix B**).
4. The Proponent acknowledges receipt of all addenda issued as of the submission deadline. Addenda acknowledged (list by number):

5. The Proponent declares the following actual or potential conflicts of interest (if none, state 'None'):

6. The Proponent agrees that this proposal will remain valid and irrevocable for a period of ninety (90) days from the submission deadline.
7. The Proponent authorizes the Town to conduct reference checks and background inquiries as it deems appropriate.

Signed this _____ day of _____, 2026

Name of Firm:

Authorized Signatory Name:

Signature:

Title:

Address:

Telephone:

Email: