Township of Wellington North

Schedule 'B'
Municipal Class Environmental Assessment

Arthur Water System Supply Redundancy and Storage

Project File Report

December 4, 2025

TRITON ENGINEERING SERVICES LIMITED
Consulting Engineers

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1.0 INTRODUCTION

The Township of Wellington North (Township) initiated a Municipal Class Environmental Assessment (Class EA) in July 2023 to evaluate feasible solutions to address the need for water supply redundancy and additional water storage to support the expected population growth in the urban community of Arthur (project). The Class EA process followed the procedures as set out in the Municipal Engineers Association (MEA) Municipal Class Environmental Assessment document, dated 2024 (previous editions published in 2000, 2007, 2011, 2015, and 2023). Triton Engineering Services Limited (Triton) was retained to administer the Class EA on behalf of the Township.

This Class EA Project File Report (herein referred to as Project File or Report) has been prepared to document the Class EA planning and evaluation process followed for this project, and includes the following major components:

- A summary of relevant background information associated with the project and justification for addressing existing conditions.
- An overview of the general project/study area and environmental setting.
- A description of the alternative solutions considered.
- Documentation of the decision-making process used in selection of the preferred alternative.
- A summary of the public and Indigenous consultation process.
- A description of the preferred alternative and next steps.

2.0 CLASS ENVIRONMENTAL ASSESSMENT PROCESS

2.1 Ontario Environmental Assessment Act

In accordance with the Ontario Environmental Assessment Act (EAA), its purpose *is the betterment of the people of the whole or any part of Ontario by providing for the protection, conservation, and wise management in Ontario of the environment* (R.S.O. 1990, c. E. 18, s.2). The EA Act sets out a planning and decision-making process for environmental assessment (EA) projects initiated by the public sector (i.e., provincial ministries and agencies, municipalities, and public bodies) so that all potential environmental effects of the feasible alternative solutions for a project are identified and considered before the preferred alternative solution is implemented. Public consultation is a mandatory component of the process.

There are two types of assessments within the EA Act; Individual EAs and streamlined EAs. Individual EAs require approval from the Ministry of the Environment, Conservation and Parks (MECP), as these large-scale, complex projects have the potential for significant effects on the environment. Routine, smaller-scale projects that are expected to result in predictable and manageable effects on the environment are categorized as streamlined EAs. Streamlined EAs follow a streamlined self-assessment and decision-making process. They do not require formal approval from MECP (i.e., are pre-approved or exempt) unless an elevation request (i.e., Section

16 Order) for preparation of an Individual EA is made or if environmental concerns cannot be resolved through the Class EA process.

Types of Streamlined EA projects include Class EAs by regulation and Class EAS by activity. Class EAs by regulation include electricity projects, waste management projects, and transit projects. There are 11 Class EA categories/activities within Ontario, as follows:

1. Ministry of Northern Development and Mines Under the Mining Act
2. Forest Management on Crown Lands in Ontario
3. GO Transit
4. Minor Transmission Facilities
5. Municipal Infrastructure Projects
6. Provincial Parks and Conservation Reserves
7. Provincial Transportation Facilities
8. Public Works
9. Remedial Flood and Erosion Control Projects
10. Resource Stewardship and Facility Development Projects
11. Waterpower Projects

Proponents must follow the approved class environmental assessment document corresponding to the activity/project being planned. It should be noted that requirements of applicable regulatory agencies must be completed in addition to the Class EA process; however, some overlap may exist.

This Project is categorized as a Municipal Infrastructure Project and follows the streamlined self-assessment and decision-making process as set out in the MEA Class EA document (October 2000, and as amended in 2007, 2011, 2015, 2023 and 2024).

2.2 Municipal Class EA Process

Municipal Class EA (herein referred to as Class EA) projects involve municipal sewage (sanitary and storm), potable water, road, and transit projects that are carried out routinely, follow the same EA planning process, and have a common set of alternatives with recurrent, predictable environmental effects and mitigation measures.

In addition to providing Municipalities with an approved self-assessment process, the Class EA serves as a public statement of the decision-making process under which municipal projects are planned and implemented. The Municipal Class EA process reflects the following five key principles for successful environmental assessment planning under the EAA:

- consultation with affected parties early on and throughout the process such that the planning process is a cooperative venture.
- consideration of a reasonable range of alternatives, both the functionally different “alternatives to” and the “alternative methods” of implementing the solution.

- identification and consideration of the effects of each alternative on all aspects of the environment.
- systematic evaluation of alternatives in terms of their advantages and disadvantages to determine their net environmental effects.
- provision of clear and complete documentation of the planning process followed, to allow "traceability" of decision-making with respect to the project.

The Municipal Class EA categorizes projects according to their potential impact on the environment. This has resulted in the development of the following four Class EA project schedules:

Exempt – Exempt from the EA Process: Exempt activities include maintenance, operation, rehabilitation, and other small projects that are limited in scale and have minimal adverse environmental effects. As an exempt project, it may proceed to implementation without following the Class EA planning process; however, the proponent should address any concerns regarding the project, as needed. Consultation/notice of the project is at the proponent's discretion. The proponent must still obtain any applicable permits, approvals, and authorizations for the project.

Eligible for Screening to Exempt – Exempt Subject to Screening Process: Some projects must use a screening process to determine whether the project is eligible for exemption or to proceed under Schedule 'B' or 'C' Class EA process. Projects eligible for the screening process are identified in the Project Tables (MEA Class EA document, Appendix 1). Proponents of projects eligible for exemption through the screening process must still obtain any applicable permits, approvals and authorizations for the project and should address any concerns regarding the project, as needed. Consultation/notice beyond the requirements of the screening process are at the proponent's discretion. Projects not eligible for exemption must follow the applicable Schedule 'B' or 'C' process.

Schedule 'B' - Projects Subject to Phases 1 and 2 of the Class EA Planning Process: Schedule 'B' projects have the potential for some adverse environmental effects. Schedule 'B' projects must complete phases 1 and 2 of the Class EA planning process, which includes mandatory contact with Indigenous Communities, directly affected public and relevant review agencies, to ensure that they are aware of the project and that their concerns are acknowledged, considered, and documented. A Project File Report must be prepared and filed for review by the public, Indigenous Communities, and review agencies. Activities under this Schedule include improvements and minor expansions to existing facilities or new small scale projects. A person may request for a higher level of Study through a Section 16 order request to the Minister of the Environment, Conservation and Parks; however, only if it applies to potential adverse impacts to constitutionally protected Aboriginal and treaty rights. The Minister makes the final decision on all comments/concerns/input, if any, as to whether the project requires a higher level of assessment, if it should be approved with conditions, or if it can proceed without conditions.

Schedule 'C' - Project Subject to the Full Class EA Planning Process: Activities under this Schedule have the potential for significant environmental effects and must proceed under the full planning and documentation procedures specified in the Class EA document. An Environmental Study Report (ESR) must be prepared and filed for review by the public, Indigenous Communities, and review agencies. Schedule C projects include the construction of new facilities and major expansions to existing facilities. A person may request for a higher level of Study through a Section 16 order request to the Minister of the Environment, Conservation and Parks; however, only if it applies to potential adverse impacts to constitutionally protected Aboriginal and treaty rights. Ultimately, the Minister makes the final decision on all comments/concerns/input, if any, as to whether the project requires a higher level of assessment, if it should be approved with conditions, or if it can proceed without conditions.

The Class EA process includes five main phases, as depicted in Figure 1 and summarized as follows:

***Phase 1* – <u>Problem or Opportunity:</u>** The problem or opportunity statement that is to be addressed by the project is developed. Notification of the project undertaking to Indigenous Communities, public, review agencies and interested parties is optional in this Phase.

***Phase 2* – <u>Alternative Solutions:</u>** Alternatives to address the problem or opportunity are identified and evaluated in the context of potential natural, social, and environmental impacts, resulting in the selection of a preliminary preferred solution. Consultation with the public, review agencies and interested parties is mandatory in Phase 2 to solicit input and comment and consider in confirmation of the selected project schedule and preferred solution. Phase 2 concludes the planning process for Schedule ‘B’ projects and includes mandatory documentation in a Project File Report to detail the planning process. Schedule ‘C’ projects continue with Phases 3 and 4 of the planning process. The Project File Report is to be made available for review by Indigenous Communities, public, review agencies and interested parties for at least 30 days. The project may proceed to Phase 5 after concerns are addressed, if any.

***Phase 3* – <u>Alternative Design Concepts for the Preferred Solution:</u>** Alternative design concepts for the implementation of the preferred solution identified in Phase 2 are developed and evaluated, with mitigation measures identified through additional mandatory consultation with Indigenous Communities, public, review agencies, and interested parties.

***Phase 4* – <u>Environmental Study Report:</u>** Phase 4 concludes the planning process for Schedule ‘C’ projects and includes documentation of the rationale, planning and design process, including the consultation, in an Environmental Study Report, which is to be made available for review by Indigenous Communities, public, review agencies and interested parties for at least 30 days. The project may proceed to Phase 5 after concerns are addressed, if any.

***Phase 5* – <u>Implementation:</u>** The preferred solution, including applicable mitigation measures as identified through the Class EA process, are designed for and proceed to construction, operation, and monitoring.

TOWNSHIP OF WELLINGTON NORTH

ARTHUR WATER SYSTEM SUPPLY REDUNDANCY AND STORAGE CLASS EA

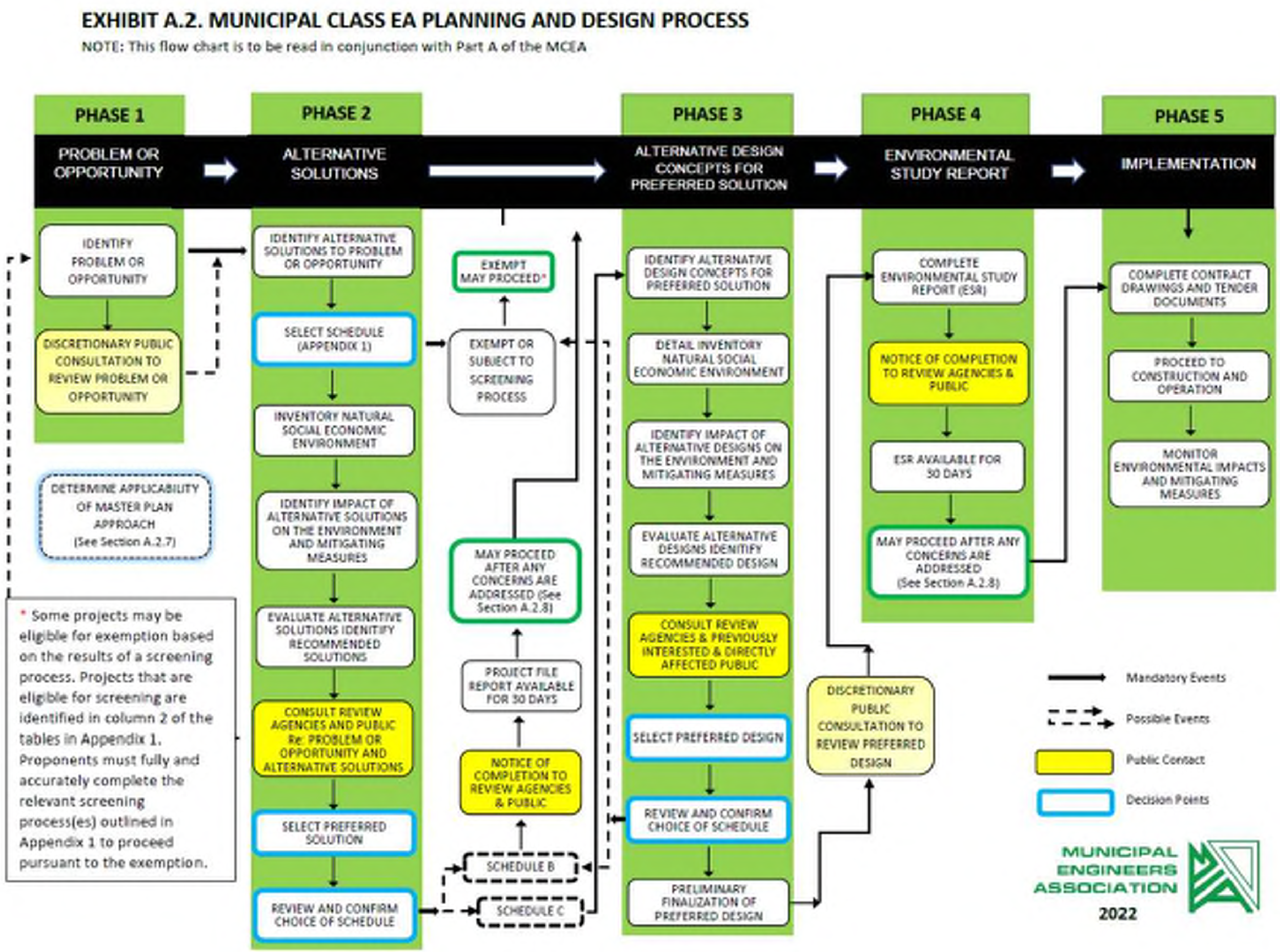

FIGURE 1

CLASS EA PLANNING PROCESS

NOT TO SCALE
T4003A

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2.3 Schedule B Class EA Approach

In reviewing Table B: Municipal Water and Wastewater Projects found in Appendix 1 of the 2023 MEA Class EA document, this project is considered to be a Schedule ‘B’ undertaking. The Schedule ‘B’ Class EA process requires completion of Phases 1 and 2 of the planning process (refer to Figure 1), which includes identification of the Problem/Opportunity Statement, two mandatory points of contact with Indigenous Communities, public and review agencies, evaluation of a reasonable range of alternative solutions to address the Problem/Opportunity Statement and preparation of a Project File Report for review by Indigenous Community, public and review agencies for a period of at least 30 days.

Following the initial 30 calendar day review period, the project is subject to an additional 30 calendar day review period by MECP to review the project. The MECP will decide if the Minister requires a higher level of assessment on the project or if it should be approved with conditions, or if it can proceed without conditions. Consistent with the *COVID-19 Economic Recovery Act*, passed by the Province on July 21, 2020, a project can only be subject to a higher level of assessment (i.e., Section 16 order of the EAA) if there are concerns regarding potential adverse impacts to constitutionally protected Aboriginal and treaty rights.

2.4 Consultation

Consultation with approval agencies, Indigenous Communities, interest groups, municipal council, stakeholders, and the public is a key element in responsible environmental decision making. Two-way communication should begin early and throughout the planning process (to meet the minimum mandatory contact points) to ensure consulted parties are provided with opportunities to contribute to the decision-making process and so that proponents are aware of requirements that need to be considered and/or addressed by the project. The Class EA process provides consultation requirements for project category. These requirements are a minimum only and it is up to the proponent to tailor the consultation plan to the project and interested parties.

As per the Code of Practice titled: *Consultation in Ontario’s Environmental Assessment Process*, the purpose of consultation is as follows:

- to provide information to the public;
- to consult with Indigenous Communities;
- to identify persons, groups and communities who may be affected by or have an interest in the undertaking;
- to ensure that government agencies and ministries are notified and consulted early in the process;
- to identify concerns that might arise from the undertaking;
- to create an opportunity to develop proponent commitments in response to local input;
- to focus on and address public concerns rather than regulatory procedures and administration;
- to provide appropriate information to the MECP to enable a fair and balanced decision; and,
- to expedite decision making.

Consultation for Schedule 'B' projects must include at least two mandatory contact points. The first mandatory point of contact is near the end of Phase 2, when Indigenous Communities, public, stakeholders, and review agencies are invited to provide comment and input on the problem/opportunity, alternative solutions, and selection of the preferred solution. The second mandatory point of contact is at the completion of Phase 2, to notify Indigenous Communities, public, stakeholders, and review agencies that the planning process has been completed and that the Project File Report is available for review and comment for a period of at least 30 calendar days.

3.0 PROJECT BACKGROUND

3.1 Provincial Policy Statement, 2020

The Provincial Policy Statement (PPS), 2020 provides direction on the main land use planning issues affecting communities in Ontario, including:

- *Efficient use and management of land and infrastructure.*
- *The provision of sufficient housing to meet changing needs, including affordable housing.*
- *The protection of the environment and resources including farmland, natural resources and water.*
- *Opportunities for economic development and job creation.*
- *The appropriate transportation, water, sewer and other infrastructure needed to accommodate current and future needs.*
- *The protection of people, property and community resources by directing development away from natural or human-made hazards, such as flood prone areas.*

Implementation of the provincial policies are through municipalities for local communities (i.e., Wellington County Official Plan and local planning documents).

With respect to water servicing, the PPS provides the following policies, which is applicable to this Class EA:

Section 1.0 – Building Strong Healthy Communities, 1.6.6 – Sewage, Water and Stormwater

1.6.6.1 Planning for sewage and water services shall:

a) accommodate forecasted growth in a manner that promotes the efficient use and optimization of existing:
   1. *municipal sewage services and municipal water services; and*
   2. *private communal sewage services and private communal water services, where municipal sewage services and municipal water services are not available or feasible;*

b) ensure that these systems are provided in a manner that:
   1. *can be sustained by the water resources upon which such services rely;*
   2. *prepares for the impacts of a changing climate;*
   3. *is feasible and financially viable over their lifecycle; and*
   4. *protects human health and safety, and the natural environment;*

c) *promote water conservation and water use efficiency;*
d) *integrate servicing and land use considerations at all stages of the planning process; and*
e) *be in accordance with the servicing hierarchy outlined through policies 1.6.6.2, 1.6.6.3, 1.6.6.4 and 1.6.6.5. For clarity, where municipal sewage services and municipal water services are not available, planned or feasible, planning authorities have the ability to consider the use of the servicing options set out through policies 1.6.6.3, 1.6.6.4, and 1.6.6.5 provided that the specified conditions are met.*

1.6.6.2 Municipal sewage services and municipal water services are the preferred form of servicing for settlement areas to support protection of the environment and minimize potential risks to human health and safety. Within settlement areas with existing municipal sewage services and municipal water services, intensification and redevelopment shall be promoted wherever feasible to optimize the use of the services.

1.6.6.3 Where municipal sewage services and municipal water services are not available, planned or feasible, private communal sewage services and private communal water services are the preferred form of servicing for multi-unit/lot development to support protection of the environment and minimize potential risks to human health and safety.

1.6.6.4 Where municipal sewage services and municipal water services or private communal sewage services and private communal water services are not available, planned or feasible, individual on-site sewage services and individual on-site water services may be used provided that site conditions are suitable for the long-term provision of such services with no negative impacts. In settlement areas, individual on-site sewage services and individual on-site water services may be used for infilling and minor rounding out of existing development. At the time of the official plan review or update, planning authorities should assess the long-term impacts of individual on-site sewage services and individual on-site water services on the environmental health and the character of rural settlement areas. Where planning is conducted by an upper-tier municipality, the upper-tier municipality should work with lower-tier municipalities at the time of the official plan review or update to assess the long-term impacts of individual on-site sewage services and individual on-site water services on the environmental health and the desired character of rural settlement areas and the feasibility of other forms of servicing set out in policies 1.6.6.2 and 1.6.6.3.

1.6.6.5 Partial services shall only be permitted in the following circumstances:

a) *where they are necessary to address failed individual on-site sewage services and individual on-site water services in existing development; or*
b) *within settlement areas, to allow for infilling and minor rounding out of existing development on partial services provided that site conditions are suitable for the long-term provision of such services with no negative impacts. Where partial services have been provided to address failed services in accordance with subsection (a), infilling on existing lots of record in rural areas in municipalities may be permitted where this would represent a logical and financially viable connection to the existing partial service and provided that site conditions are suitable for the long-term provision of such services with no negative impacts. In accordance with subsection (a),*

the extension of partial services into rural areas is only permitted to address failed individual on-site sewage and individual on-site water services for existing development.

1.6.6.6 Subject to the hierarchy of services provided in policies 1.6.6.2, 1.6.6.3, 1.6.6.4 and 1.6.6.5, planning authorities may allow lot creation only if there is confirmation of sufficient reserve sewage system capacity and reserve water system capacity within municipal sewage services and municipal water services or private communal sewage services and private communal water services. The determination of Provincial Policy Statement, 2020 | 20 sufficient reserve sewage system capacity shall include treatment capacity for hauled sewage from private communal sewage services and individual on-site sewage services.

1.6.6.7 Planning for stormwater management shall:

a) be integrated with planning for sewage and water services and ensure that systems are optimized, feasible and financially viable over the long term;
b) minimize, or, where possible, prevent increases in contaminant loads;
c) minimize erosion and changes in water balance, and prepare for the impacts of a changing climate through the effective management of stormwater, including the use of green infrastructure; d) mitigate risks to human health, safety, property and the environment;
d) maximize the extent and function of vegetative and pervious surfaces; and
e) promote stormwater management best practices, including stormwater attenuation and re-use, water conservation and efficiency, and low impact development.

3.2 Master Plan Study for Arthur Water Supply and Sanitary Sewage System (January 2012)

Arthur is a growing urban community within the Township of Wellington North that is serviced by municipal water, sanitary and stormwater systems. In 2011, the Township initiated a technical review of the water and sanitary infrastructure within the community, which was completed by Triton on behalf of the Township, in accordance with the Class EA Master Plan process. The intention of the review was to formulate a long-term servicing strategy to maintain the existing level of municipal service for future development within Arthur. The results of the technical review were documented in a report by Triton, entitled Township of Wellington North Class Environmental Assessment Master Plan Study for Water Supply and Sanitary Sewage System (Master Plan), Community of Arthur, dated January 2012 (Revision 2) and included conclusions and recommendations (based on 2012 existing conditions and projected growth information) regarding the Arthur water system, as follows:
Conclusions:

- Source capacity sufficient to meet the estimated water demands of the 2031 growth scenario.
- Additional storage capacity is required to meet the needs of the 2031 growth scenario.
- Existing water storage facilities are aging and are limited in servicing outlying areas.
- Water distribution system pressures and fire flow capabilities sufficient to meet the needs of the 2031 growth scenario.
- Watermains are in good condition, although some mains are approaching their end of service life.
- Distribution network is well looped with few dead-ends.

Recommendations:

- Complete annual Water Supply Reserve Capacity Calculations (RCC) to monitor usage and future needs.
- Be proactive in securing future water sources, given that establishment can be a lengthy, arduous process.
- Consider construction of a new elevated tower with more storage to replace an existing tower.
- Replace watermains that are approaching end of service life as part of road reconstruction projects.
- Future developments (i.e., requiring watermain extensions) should be designed to eliminate dead ends and ensure adequate circulation.
- Review the Master Plan every five years to determine the need for a detailed formal review and/or update.

3.3 Arthur Water and Sanitary Systems Technical Study (November 2020)

Since the 2012 Master Plan, the Township has completed Water RCC on an annual basis, replaced aging watermain as part of reconstruction projects and ensured designs of new developments eliminate dead ends, as reasonably feasible, and ensure adequate circulation. In 2020, on behalf of the Township, Triton updated the computer simulation models of the municipal water and sanitary systems in Arthur, (which were created in 2011 for the Master Plan) based on current (2020) existing conditions to evaluate the adequacy of the systems to meet the needs of the existing and projected future population to calendar year 2045. The results of the technical update were documented in a report by Triton, entitled Water and Sanitary Systems Technical Study – Arthur (Technical Study) dated November 2020 (Revision 1) and included conclusions and recommendations regarding the Arthur water system, as follows:

Conclusions:

- Source capacity is sufficient to meet the estimated water demands of the 2045 growth scenario.
- Given that the firm capacity of the water system is obtained from three sources, two of which are in the same well field, a failure of any of these wells would significantly impact the ability of the water system to meet current and future maximum day demand (MDD).
- Additional water storage is required to service projected population within 5 to 15 years.
- Existing water storage facilities are aging and are limited in servicing outlying areas.
- Water distribution system pressures and fire flow capabilities sufficient to meet the needs of the 2045 growth scenario; however, potential future development areas to the north of the existing urban area will benefit from having a water tower with a higher operating range to increase system pressures and fire flows.
- Watermains are in good condition, although some mains are approaching their end of service life.

Recommendations:

- Determine the available water RCC on an annual basis and consider the possibility of failure of one of the current supply wells.
- Proactively identify and secure future water sources through a well exploration program.
- Add additional storage to the system within 5 to 15 years.
- Consider construction of a new elevated tower at a higher operating level and with more storage to replace an existing tower.
- Replace watermains that are approaching end of service life as part of road reconstruction projects.
- Extend watermain trunks to service the future expansion of the industrial area.

3.4 Existing Facilities

The Township owns, operates and maintains the Arthur drinking water system, which operates under the Safe Drinking Water Act, 2002 and its applicable regulations.

The Arthur water system is a single pressure zone watermain distribution network that is pressurized by two elevated water storage tanks. Water is supplied to the system from three deep overburden (groundwater) wells and two pumphouses. The system provides fire protection to the entire service area and currently provides service to its permanent population of approximately 3,195 and 1,229 residences and 111 Industrial/Commercial/Institutional (ICI) properties, according to Township records (2023).

Operation of the system is in accordance with its Municipal Drinking Water License (MDWL, 113-101), Drinking Water Works Permit (DWWP, 113-201) and Permit to Take Water (PTTW). The MDWL provides authorization for the operation of the system, the DWWP describes the scope of the system and authority to establish and make changes to the system, and the PTTW describes the approved rate of water taking for the system.

Operation of the system is controlled by a Supervisory Control and Data Acquisition (SCADA) system. The system is a demand/storage system. Generally, well pumps are called on and turned off based on water levels in the storage towers. These levels are set by the operators based on storage requirements, volume turnover needs and well pumping constraints. The SCADA system also provides real-time monitoring and record keeping.

The ICI water customers in Arthur are fully metered, meaning the volume of water used is measured and charges/billing include a base charge and a metered rate for the volume of water that was consumed. Residential water customers in Arthur are on a flat rate system, meaning they are charged/billed a flat rate on a monthly or annual basis, regardless of the amount of water they consume.

3.4.1 Watermain Distribution Network

The distribution network currently services all existing developed areas within Arthur's urban boundary. The network includes approximately 21 km of watermain ranging in size from 50 mm to

600 mm, with 1,340 service connections. The distribution network trunk consists of 250 mm and 300 mm diameter watermain, which runs from Wells 8A/8B along Jones Baseline, Highway 6, George Street and Smith Street, past the Freud Tower to Wells Street and along Wells Street to Well 7B.

Type of watermain used to construct the distribution network has varied over the years and includes cast iron, ductile iron and PVC. Any recent upgrades or extensions have been PVC. Figures 2 and 3 present the existing watermain distribution network by size and material, respectively.

3.4.2 Water Storage

Storage for the Arthur Drinking Water System is provided by two elevated water storage facilities, identified as the Charles Street (multi-leg) Tower and the Freud (Spheroid) Tower. The locations of these storage facilities are presented on Figure 4. Details for these tanks are summarized as follows:

Charles Street Tower:

- Located near the intersection of Charles Street East and Isabella Street, in the southeast part of the system (195 Isabella St E)
- Multi-legged steel tank
- Commissioned in 1932
- Storage volume is 227 m^3
- Operation range: 494.2 m to 499.6 m

Freud (Spheroid) Tower:

- Located on Smith Street between Preston Street and Wells Street in the northwest part of the system (460 Smith Street)
- All steel spheroid tank
- Commissioned in 1970
- Storage volume is 1,137 m^3
- Operation range: 494.0 m to 499.2 m

The existing total storage volume of the system is 1,364 m^3. Based on discussions with Township staff, the existing storage facilities have been recently inspected by Landmark Municipal Services (Calendar Year 2024 and 2025 for the spheroid and multi-leg towers, respectively). The Clean, Inspection and Report (CIR) for the July 2024 cleaning and inspection of the Spheroid Tower recommended full removal and replacement of the exterior paint when it has been deemed unacceptable from a cosmetic standpoint, and complete removal and replacement of the interior lining as the existing interior liner is expected to reach the end of its useful life within the next 2 to 4 year period.

TOWNSHIP OF WELLINGTON NORTH

ARTHUR WATER SYSTEM SUPPLY REDUNDANCY AND STORAGE CLASS EA

WATERMAIN SIZING:

- ≤100mm
- 150mm
- 200mm
- 250mm
- 300mm

FIGURE 2

EXISTING WATERMAIN DISTRIBUTION NETWORK BY SIZE

SCALE 1:10,000
T4003A

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Fergus, Ontario

TOWNSHIP OF WELLINGTON NORTH

ARTHUR WATER SYSTEM SUPPLY REDUNDANCY AND STORAGE CLASS EA

WATERMAIN MATERIAL

- PVC
- CAST IRON
- DUCTILE IRON
- THIN WALL PVC

FIGURE 3

EXISTING WATERMAIN DISTRIBUTION NETWORK BY MATERIAL

SCALE 1:10,000
T4003A

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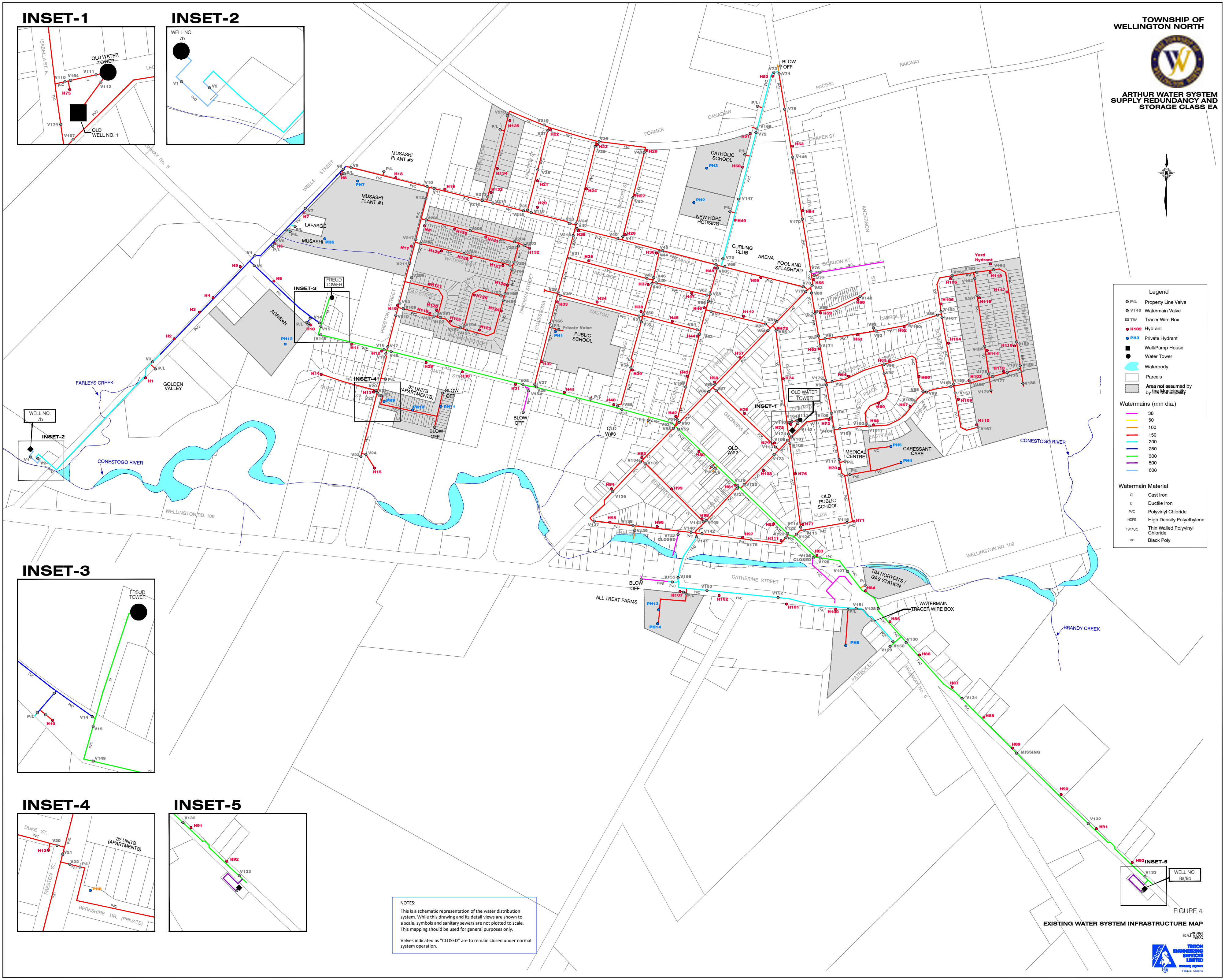

TOWNSHIP OF WELLINGTON NORTH
ARTHUR WATER SYSTEM SUPPLY REDUNDANCY AND STORAGE CLASS EA
INSET-1
INSET-2
INSET-3
INSET-4
INSET-5
OLD WATER TOWER
OLD WELL NO. 1
WELL NO. 7b
FREUD TOWER
WELL NO. 8a/8b
MUSASHI PLANT #1
MUSASHI PLANT #2
LAFARGE
AGRISAN
GOLDEN VALLEY
FARLEYS CREEK
CONESTOGO RIVER
BRANDY CREEK
CATHOLIC SCHOOL
NEW HOPE HOUSING
CURLING CLUB
ARENA
POOL AND SPLASHPAD
PUBLIC SCHOOL
OLD PUBLIC SCHOOL
OLD W#3
OLD W#2
MEDICAL CENTRE
CARESSANT CARE
TIM HORTONS / GAS STATION
ALL TREAT FARMS
32 UNITS (APARTMENTS)
WATERMAIN TRACER WIRE BOX
BLOW OFF
CLOSED
MISSING
Yard Hydrant
Private Valve
WELLINGTON RD. 109
CATHERINE STREET
CANADIAN PACIFIC RAILWAY
WELLS STREET
PRESTON STREET
SMITH STREET
DUKE ST.
BERKSHIRE DR. (PRIVATE)
CONESTOGA STREET
DRAPER ST.
GORDON ST.
ELIZA ST.
PATRICK ST.
HIGHWAY No. 6
Legend
P/L Property Line Valve
V140 Watermain Valve
TW Tracer Wire Box
H102 Hydrant
PH3 Private Hydrant
Well/Pump House
Water Tower
Waterbody
Parcels
Area not assumed by the Municipality
Watermains (mm dia.)
38
50
100
150
200
250
300
500
600
Watermain Material
CI Cast Iron
DI Ductile Iron
PVC Polyvinyl Chloride
HDPE High Density Polyethylene
TW PVC Thin Walled Polyvinyl Chloride
BP Black Poly
NOTES:
This is a schematic representation of the water distribution system. While this drawing and its detail views are shown to a scale, symbols and sanitary sewers are not plotted to scale. This mapping should be used for general purposes only.
Valves indicated as "CLOSED" are to remain closed under normal system operation.
FIGURE 4
EXISTING WATER SYSTEM INFRASTRUCTURE MAP
JAN 2025
TRITON ENGINEERING SERVICES LIMITED
Fergus, Ontario

The CIR for the June 2025 cleaning and inspection of the Multi-Leg Tower noted many areas of corrosion and de-lamination on structural members and recommended consideration of replacement given the age of the facility, signs of structural deterioration and coating failure. As noted in the inspection report, the industry recognized lifecycle for a multi-legged water storage facility is between 80 and 100 years. The CIR further indicates that the capital cost to repair/refurbish and maintain the existing facility will be more expensive than to replace with a new storage facility.. Therefore, the Charles Street (Multi-Leg) Tower has reached the end of its useful service life and should be decommissioned. The Freud/Spheroid Tower is expected to reach the end of its service life in Calendar Year 2050.

A computer simulation model of the Arthur water system was developed using WaterCAD V8i software as part of the Master Plan Study for the Arthur Water Supply and Sanitary Sewage Systems (2012) and subsequent Technical Study Updates (2020). Based on existing conditions in the computer simulation model, the normal pressure throughout the existing distribution network ranges from approximately 40 psi to 80 psi.

3.4.3 Groundwater Wells

The three overburden wells supplying water to the Arthur Drinking Water are named Well No. 7B, 8A and 8B. The locations of these wells are presented on Figure 4. Details for these wells are summarized as follows:

Well No. 7B:

- Located at 109 Wells Street West near the Conestogo River.
- Commissioned in 1998.
- 45.9 m deep drilled.
- 250 mm diameter.
- Well pump is a submersible type complete with a 30kW (40 hp) motor which discharges directly to the distribution system (via Pumphouse #7).
- Rated capacity is 22.7 L/s (1,961 m^3/day).

Well No. 8A/8B:

- Located on Part of Lots 20 and 21, Concession A, approximately 1.15 km south of County Road 109 and 235 m east of Highway 6.
- Commissioned in 2005.
- Depth of wells are 61.9 m and 62.2 m for 8A and 8B, respectively.
- Well pumps are submersible type complete with a 30 kW (40hp) motor which discharges directly to the distribution system (via Pumphouse #8).
- Rated capacities are 26.1 L/s (2,255 m^3/day) each; however, the PTTW allows for the operator to pump either Well 8A or Well 8B, but not both wells concurrently. Therefore, total production from this facility is limited to 2,255 m^3/day.
- Standby power provided by diesel generator.

3.4.4 Pump Houses

The locations of the pumphouses are presented on Figure 4. A summary of the details for each pumphouse is as follows:

Pumphouse #7

- Houses Well No. 7B.
- Disinfection using sodium hypochlorite. Contact time is provided by oversized discharge main.
- Iron sequestering treatment is provided.
- Pre-contact time (process) FCR analyzer and post-contact time (legislative) continuous FCR analyzer. The post-contact time chlorination analyzer takes water for sampling at the end of the contact main.
- Equipped with a remote notification security system.

Pumphouse #8

- Houses Wells 8A/8B.
- Disinfection using sodium hypochlorite. Contact time is provided by oversized discharge main.
- Manganese sequestering treatment is provided.
- Pre-contact time (process) FCR analyzer and post-contact time (legislative) continuous FCR analyzer. The post-contact time chlorination analyzer takes water for sampling at the end of the contact main.
- Equipped with a remote notification security system.

3.5 Existing System Capacity

3.5.1 Storage Capacity

The existing treated water storage for the Arthur municipal water system is 1,364 $m^{3,}$ considering the combined storage capacity of the spheroid and multi-leg towers. Treated water storage volume requirement is determined in accordance with MECP guidelines and considers fire, equalization and emergency water storage. Given that the Charles Street (multi-leg) Tower has reached the end of its service life, its storage volume should be excluded from the water storage calculations.. Therefore, the total system storage volume available for the Arthur municipal water system is 1,137m^3, which is equal to the storage volume of the Spheroid Tower.

3.5.2 Supply Source Capacity

The available water supply capacity of the Arthur municipal water system is 4,216 m^3/day. The system capacity represents the cumulative sum of all the wells rated capacities (1,961 m^3/day Well 7B and 2,255 m^3/day each Well 8A and Well 8B), which is based on the limiting condition (i.e., production limit) of the capacity of the well's respective PTTW, DWWP or pumping equipment.

3.5.3 Supply Firm Capacity

The firm capacity of a water system is defined as the (source) capacity of the system with the largest pump or source out of service. This ensures sufficient redundancy in the system supply and treatment in case of an equipment failure. The largest source of water in the Arthur water system is Well 8A or Well 8B, each with a rated capacity of 2,255 m^3/day; however, failure of these wells is unlikely given that it is a dual system and has standby power. Failure of Well 7 is more likely than failure of Wells 8A/8B, therefore the firm capacity of the system is 2,255 m^3/day (since Wells 8A and 8B cannot be pumped concurrently).

3.6 Arthur Water System Reserve Capacity Calculations

Consistent with the recommendations of the Master Plan and the Technical Study, RCC for the Arthur water system have been completed on an annual basis to monitor usage of the existing population and needs of the projected future population. The recommendations are consistent with the Master Plan and Technical Study in terms of the need for redundancy within the supply system and additional storage. Refer to Sections 7.3.1.4 – *Historical Reserve Capacity* and 7.3.2.1 – *Projected Requirements, Demands* of this Report.

4.0 Phase 1 – Problem/Opportunity Statement

Based on the conclusions and recommendations in the Master Plan, Technical Study and annual water RCC, and given that efforts (i.e., planning, technical, financial, etc.) associated with establishing new water sources and adding storage to a water system can be a lengthy and arduous process, the Township initiated this Schedule ‘B’ Class EA, to address the following Problem/Opportunity Statement:

> *The existing Arthur water system requires water supply redundancy and additional water storage to support expected population growth.*

5.0 Phase 2 – Alternative Solutions

Phase 2 of the Class EA process requires identification and assessment of a reasonable range of feasible alternatives to address the Problem/Opportunity Statement, which is generally categorized as an *expansion of an existing water system*. Consistent with the MEA Class EA document, “the feasibility of the alternative solutions will depend, in part, on the nature and location of the water system, the nature and location of the problem(s), the comparative cost of the alternative solutions, the pressures for growth, and on the municipality’s capacity to finance the extension of services.”

Therefore, the alternative solutions considered for this Project are as follows:

Baseline/General Alternatives:

- Alternative 1a – “Do Nothing”
- Alternative 1b – Limit Community Growth
- Alternative 1c – Reduce Water Demand/Implement Water Conservation Measures

Water Supply Alternatives:

- Alternative 2a – Increase Water Taking From Existing Municipal Wells
- Alternative 2b – Addition of New Well(s) to the Existing Municipal System

Water Storage Alternatives

- Alternative 3a – Construct a New Water Storage Facility to Supplement Existing Municipal Water Storage Facilities
- Alternative 3b – Construct a New Water Storage Facility and Decommission One of the Existing Water Storage Facilities
- Alternative 3c – Construct a New Water Storage Facility and Decommission Both of the Existing Water Storage Facilities

5.1 Alternative 1a – "Do Nothing"

The "Do Nothing" Alternative is considered for all Municipal Class EA projects. It means that no changes would be made to address the Problem/Opportunity statement; regardless of whether the existing population continued to grow. Typically, the "Do Nothing" alternative is only implemented when the costs (financial and environmental) of all other alternatives significantly outweigh the benefits. The "Do Nothing" alternative can be recommended at any time during the design process.

5.2 Alternative 1b – Limit Community Growth

Limiting community growth means that the size of the existing population would be maintained, or population growth would be limited to what the existing municipal water system could sustain (i.e., continue to provide the existing level of service to Arthur's urban population). This alternative does not include improvements or changes to increase water supply redundancy and water storage capacity.

5.3 Alternative 1c – Reduce Water Demand/Implement Water Conservation Measures

This alternative includes the reduction of water demand through conservation, efficiency and demand management and does not include improvements or changes to increase water supply redundancy and water storage capacity. By reducing water demand, the timeline that the existing water supply and water storage capacity of the Arthur water system would be insufficient to service the future population would be extended further into the future. This alternative does not ensure that Arthur water system would be able to services the projected future population of Arthur.

5.4 Alternative 2a – Increase Water Taking From Existing Municipal Wells

If possible, this alternative considers increasing the permitted water taking from the existing municipal well(s) to provide supply redundancy for the future population.

5.5 Alternative 2b – Addition of New Well(s) to the Existing Municipal System

For this alternative, a new municipal well(s) would be added to the existing system to increase supply capacity to achieve the desired long-term Firm Capacity to service the projected future population growth. In addition to satisfying the capacity requirements, the new well(s) would also need to meet water quality requirements.

5.6 Alternative 3a – Construct a New Water Storage Facility to Supplement Existing Municipal Water Storage Facilities

To meet the projected water storage needs of the existing and future population, additional water storage capacity would be supplied by the construction of a new water storage facility, to supplement the existing municipal water storage facilities.

5.7 Alternative 3b – Construct a New Water Storage Facility and Decommission the Existing Multi-Leg Tower

To meet the projected water storage needs of the existing and future population, additional water storage capacity would be supplied by the construction of a new water storage facility, to supplement the capacity of the existing Spheroid Tower. This alternative includes decommissioning of the Charles St multi-leg storage facility.

5.8 Alternative 3c – Construct a New Water Storage Facility and Decommission Both of the Existing Water Storage Facilities

This alternative considers the construction of a new water storage facility to meet the water storage capacity needs of the existing and future projected population growth, including decommissioning both existing water storage facilities. The location of the new water storage facility could be sited at a new or existing location.

6.0 Study Area

The Study Area, shown on Figure 5, includes approximately 460 ha of land, bounded by the urban area limits of Arthur, located within the Township of Wellington North, in Wellington County.

7.0 Phase 2 – Inventory of Existing Conditions of Study Area

The analysis and evaluation of the alternatives is based on impacts to environmental features of the Project Study Area. Before the alternatives can be evaluated, background/existing environmental conditions are defined to determine the magnitude of potential effects (positive or negative) to these features.

The Class EA divides the environment into five categories, with each category divided into its own components that may be impacted through implementation of the alternative solutions in consideration. These categories are as follows:

- Natural Environment
    - Natural heritage policies
    - Surface water
    - Groundwater
    - Vegetation
    - Wildlife, aquatic resources
    - Physiography and soils

- Cultural Environment
    - Archaeological features
    - Built heritage and cultural features

- Social Environment
    - Existing community

- Economic Environment
    - Existing development pattern
    - Growth projections

- Technical/Built Environment
    - Existing facilities
    - Existing System capacity
    - Projected System capacity requirements

A physical description and general inventory of the natural, technical, and social/cultural environments of the Study Area was completed to identify any environmental factors that could influence selection of the preferred alternative solution.

7.1 Natural Environment

7.1.1 Ecoregion

Based on the Natural Heritage Information Centre (NHIC) mapping (available through the NDMNRF website), the Study Area is located within ecoregion 6E (Lake Simcoe-Rideau), which is in the Mixedwood Plains ecozone. Ecoregion 6E covers 6.4% of Ontario, extending from Lake Huron to the Ottawa River and is the second most densely populated ecoregion in Ontario. The climate within Ecoregion 6E is mild and moist, with mean annual precipitation in the range of 759 mm to 1,087 mm (https://www.ontario.ca/page/ecosystems-ontario-part-1-ecozones-and-ecoregions).

TOWNSHIP OF WELLINGTON NORTH

ARTHUR WATER SYSTEM SUPPLY REDUNDANCY AND STORAGE CLASS EA

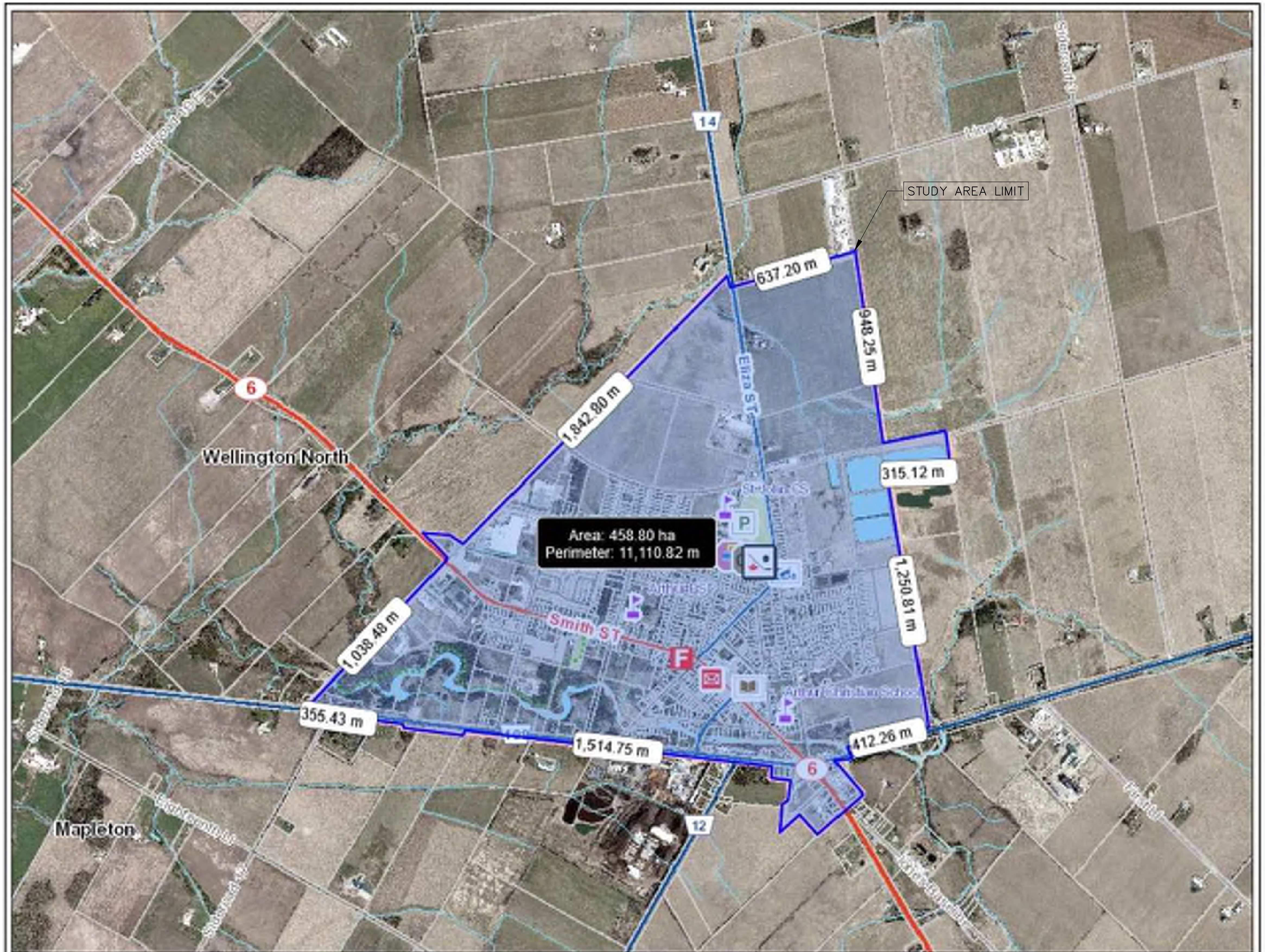

FIGURE 5

PROJECT STUDY AREA MAP

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Fergus, Ontario

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With regard to geology and substrates, the underlying bedrock is Paleozoic dolomite and limestone overlain by ice-laid materials. Majority (57%) of the landcover in Ecoregion 6E is cropland, 30% is forest cover and 4% is water. Located within the Great Lakes Watershed, ecoregion 6E is well drained, with significant volumes of groundwater located within three major overburden aquifers (Kitchener, Alliston, and Oak Ridges) and three large bedrock aquifers (Detroit River, Guelph-Amabel, and Nepean).

Vegetation within the ecoregion is moderately diverse. Within hardwood forests, sugar maple, American beech, white ash and easter hemlock are the dominant species. Within the lowlands, rich floodplain forests are comprised mostly of green ash, silver maple, red maple easter white sider, yellow birch, balsam fir and black ash trees. Occurring along the northern edge and eastern portion of the ecoregion, peatlands are dominated with black spruce and tamarack.

Characteristic fauna are as follows: mammal species including white-tailed deer, northern raccoon, striped skunk and woodchuck; bird species including wood duck, great blue heron, wilson’s snipe, field sparrow, grasshopper sparrow, eastern meadowlark, hairy woodpecker, wood thrush, scarlet tanager and rose-breasted grosbeak; reptile and amphibian species including American bullfrog, northern leopard frog, spring peeper, red-spotted newt, snapping turtle, eastern gartersnake and common watersnake; and fish species including white sucker, smallmouth bass, walleye, northern pike, yellow perch, rainbow darter, emerald shiner and pearl dace.

7.1.2 Regulated and Wooded Areas

The Study Area is located within the Grand River Watershed under the jurisdiction of the Grand River Conservation Authority (GRCA). The GRCA mapping database was consulted as part of the desktop investigation to collect background information on the significant environmental features within the Study Area. Majority of the Study Area is comprised of a “built-up” landscape. Other landscape features include regulated areas and wooded areas. Regulated areas within the Study Area include floodplain, slope erosion, slope valley and regulated watercourse. Wooded areas, identified by the Ontario Ministry of Natural Development, Mines, Natural Resources and Forestry (NDMNRF) are also present within the Study Area. Based on GRCA mapping, there is no Area of Natural and Scientific Interest (ANSI) identified within the Study Area. The regulated areas, wooded areas, and “built-up” landscape within the Study Area are presented on Figure 6.

GRCA’s policies are regulated under *Ontario Regulation (O.Reg.) 150/06: Grand River Conservation Authority: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses,* under the *Conservation Authorities Act, R.S.O. 1990, C.27*. Any work proposed within the GRCA regulated limits requires approval from GRCA prior to implementation.

7.1.3 Species at Risk

NHIC mapping was used to identify the presence of any Species at Risk in Ontario (SARO) within the Study Area. Four provincial SAR under the ESA and two other species considered rare in the province were identified within or proximate to (within 1km) the Study Area.

NDMNRF and NHIC both use range maps to protect the exact location of an identified species. Therefore, the SAR identified through the desktop investigation can only be considered as potentially present within the Study Area. Field observations have not been completed to determine whether any of the identified species are present within the Study Area.

A summary of the NHIC data is provided in Table 1.

Table 1 – Summary of At-Risk Species Potentially Within the Study Area

Species Scientific name	Common Name	Species Type	SARO Status
Spatula discors	Blue-winged Teal	Bird	Not Listed
Dolichonyx oryzivorus	Bobolink	Bird	Threated
Sturnella magna	Eastern Meadowlark	Bird	Threatened
Contopus virens	Eastern Wood-pewee	Bird	Special Concern
Chrysemys picta marginata	Midland Painted Turtle	Reptile	Special Concern
Bartramia longicauda	Upland Sandpiper	Bird	Not Listed

7.1.4 Breeding Bird Habitat

The online Atlas of Breeding Birds of Ontario was consulted to identify the potential presence of breeding birds within the Study Area. The Study Area is encompassed within geographic survey and area entitled Square 17TNJ35 (Region 47). A total of 80 bird species were identified as having breeding evidence. With respect to breeding status, 25 species were confirmed, 32 species were categorized as possible, and 23 species were categorized as probable. Of the confirmed species, one species (northern pintail) is considered provincially rare, and three (killdeer, cliff swallow, bobolink) are considered species of interest. Field observations have not been completed to determine whether breeding birds and/or breeding bird habitat are present within the Study Area.

7.1.5 Physiography and Soils

GRCA online mapping was consulted to obtain surficial and Paleozoic geology information for the Study Area. The GRCA mapping tool uses NDMNRF data to define physiography and soils characteristics of the Site. The entire Study Area is situated within the Salina Formation, which is thin-bedded, argillaceous dolostone and shale, with beds and nodules of gypsum and thick salt beds in the deep subsurface. Surface soils in most of the Study Area consist of clayey silt to silt till, which is primarily diamicton material that was deposited during the Wisconsian age. This material has low permeability. Generally, within the regulated area of the Conestoga River, the surface soil

TOWNSHIP OF WELLINGTON NORTH

ARTHUR WATER SYSTEM SUPPLY REDUNDANCY AND STORAGE CLASS EA

Map Centre (X,Y): 536914.56, 4853980.97 | Map Link

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Grand River Conservation Authority

Date: Apr 10, 2024

Regulated and Wooded Areas within the Study Area

Legend

- Regulation Limit (GRCA)
- Floodplain (GRCA)
  - Engineered
  - Estimated
  - Approximate
- Floodplain - Special Policy Area (GRCA)
- Slope Erosion (GRCA)
  - Steep
  - Oversteep
  - Toe
- Slope Valley (GRCA)
  - Steep
  - Oversteep
- Regulated Watercourse (GRCA)
- Regulated Waterbody (GRCA)
- Wetland (GRCA)
- Lake Erie Flood (GRCA)
- Lake Erie Shoreline Reach (GRCA)
- Lake Erie Dynamic Beach (GRCA)
- Lake Erie Erosion (GRCA)
- ANSI (ON)
- Wooded Area (MNRF)

Disclaimer: This map is for illustrative purposes only. Information contained herein is not a substitute for professional review or a site survey and is subject to change without notice. The Grand River Conservation Authority takes no responsibility for, nor guarantees, the accuracy of the information contained on this map. Any interpretations or conclusions drawn from this map are the sole responsibility of the user.
The source for each data layer is shown in parentheses in the map legend. See Sources and Citations for details.

Scale 1:18,353

NAD83 UTM zone 17 (EPSG:26917)

FIGURE 6

REGULATED AND WOODED AREAS WITHIN THE STUDY AREA

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is described as silt, sand and gravel, which is primarily sand material that was deposited during the Hudson age. This material has variable permeability.

The physiography of the Study Area is described as Till Plains (Drumlinized), encompassed mainly within the Stratford Till Plain Region and the rest within the Dundalk till Plain Region.

7.1.6 Hydrogeology

Within the Study Area, the hydrogeology is Paleozoic aged carbonate and shale bedrock (100 to 120 m) overlain by approximately 50 to 75 m of glacial derived overburden (Lower Sediments). The Lower Sediments that are directly above the bedrock are the source for the existing high capacity wells; however, high iron (Well 7B) and manganese (Wells 8A and 8B) concentrations are also typical, due to the mineral compositions of the sediments. The layer of lower sediments tends to thin out in the north and east of the Study Area.

The deep bedrock within the Study area is characterized by low hydraulic conductivity due to the massive unfractured carbonate bedrock; however, south of the Study Area, the deep bedrock is characterized by a higher hydraulic conductivity due to the presence of reef bedrock structures and interconnected fractures that result in micro karst bedrock groundwater flow paths.

The rural residences on the properties surrounding the Arthur serviced area obtain their water supplies from private domestic wells. The majority of the existing individual domestic wells in the area surrounding the study area obtain their water supplies from the lower sediments or bedrock.

7.1.7 Source Water Protection

Source water protection implementation requirements are a combination of Source Protection Plan policies and the *Clean Water Act* and its associated regulations. A review of the MECP Source Protection Information Atlas identified that the Study Area is located within the Grand River Source Protection Area of the Lake Erie Source Protection Region and is therefore subject to the approved Grand River Source Protection Plan, Chapter 7 - County of Wellington Source Protection Plan, dated February 9, 2022.

Municipal wells are required to have wellhead protection areas. This requirement is pursuant to the *Safe Drinking Water Act* and *Clean Water Act.* Four WHPAs are specified, with one being a proximity zone and the others are time related capture zones, as follows:

Zone A = 100 m radius from wellhead

Zone B = 2-year time of travel (TOT) capture zone

Zone C = 5-year TOT capture zone

Zone D = 25-year time of travel capture zone.

Other WHPAs may apply if a well is designated as groundwater under the direct influence of surface water. Hydrogeological modelling is required to delineate the WHPAs and vulnerability scoring, which indicates how sensitive the water source is to contamination. Vulnerability is numerically scored between 2 and 10, with 10 being the most vulnerable.

In addition to WHPAs, there are three other vulnerable areas around municipal wells and surface water intakes that are defined in source protection plans, under the Clean Water Act, including the Intake Protection Zone (IPZ), Significant Groundwater Recharge Area (SGRA) and Highly Vulnerable Aquifer (HVA).

IPZ is the area surrounding a surface water (river and stream) intake and are specified in three zones, based on a proximity zone and vulnerability score, and are determined by wind, water pumping rates. SGRA contribute to the maintenance of capacity in water supply aquifers and are areas with porous soils with higher than average infiltration rates and are hydraulically connected to groundwater supply wells. HVA are aquifers with thin or permeable overlying soil layers and can be easily contaminated.

The Grand River Source Protection Plan, Chapter 7 - County of Wellington Source Protection Plan, dated February 9, 2022 identifies location and nature of threats (including potential threats) to the Arthur water system groundwater sources and provides a delineation of vulnerable areas and an overview of water quality and quantity.

Consistent with the MECP Source Protection Information Atlas, and as illustrated on Figure 7, portions of the Study Area are located within Zones A, B, C and D of the existing GRCA Wellhead Protection Area for the existing municipal wells (7B, 8A/8B).

7.1.7.1 Groundwater

Arthur relies on groundwater for its water supply. The municipal water system and majority of private residential wells within (abandoned) and surrounding Arthur obtain water from the groundwater supply.

Groundwater usage within Arthur includes municipal drinking water and industrial and commercial water taking. Most of the water takers require a Permit to Take Water (PTTW) from MECP due to the volume of water taken per day.

7.1.7.2 Surface Water

The Conestoga River generally flows east to west along the south boundary of the Study Area. An unnamed stream, which is a tributary of Farleys Creek also flows east to west within the Study Area from west of Conestogo St N to beyond Wells St, where it bends and flows south into Farleys Creek, which ultimately discharges to the Conestoga River in the southeast corner of the Study Area.

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ARTHUR WATER SYSTEM SUPPLY REDUNDANCY AND STORAGE CLASS EA

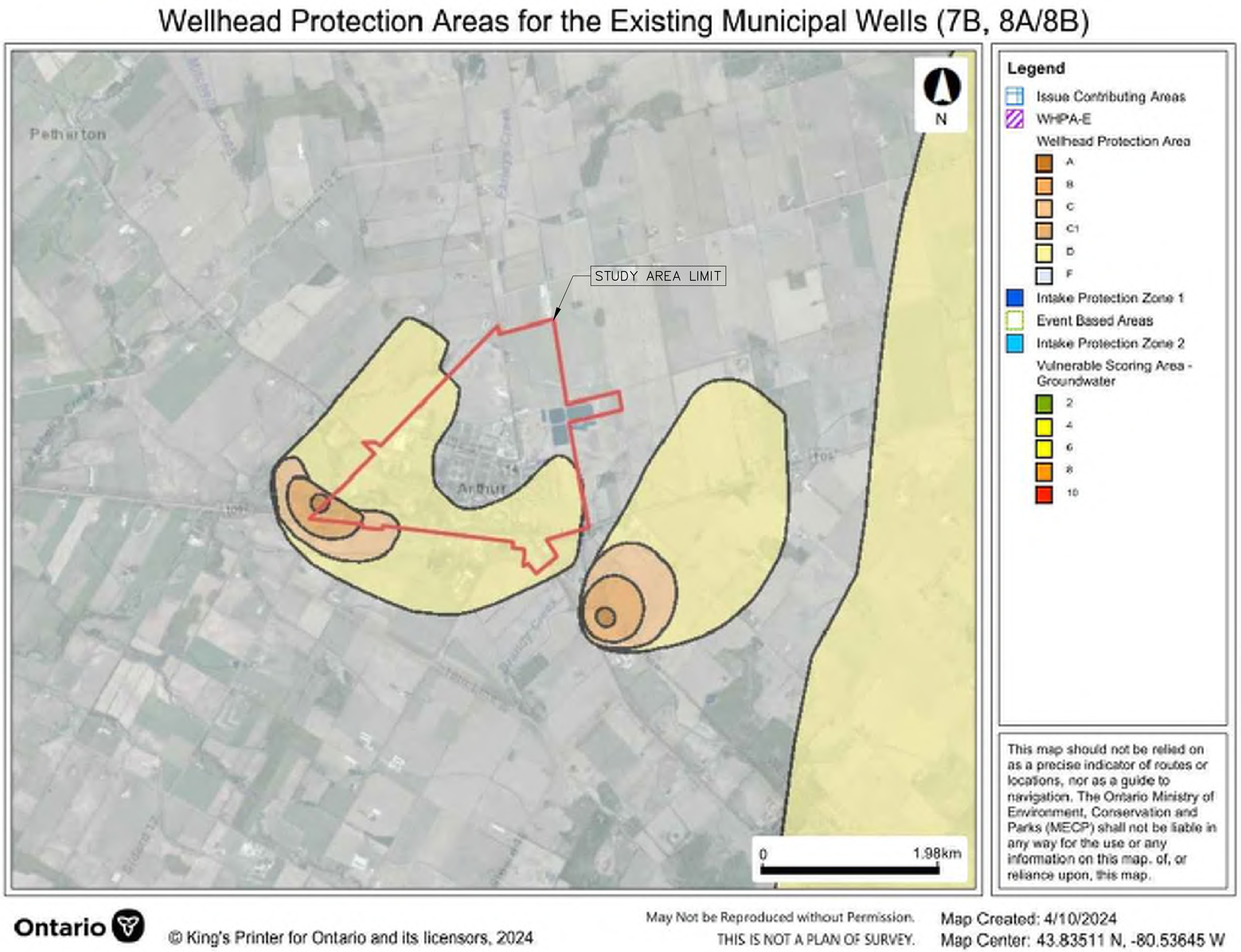

FIGURE 7

EXISTING WHPAS FOR THE EXISTING ARTHUR MUNICIPAL WATER SYSTEM

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7.1 Economic Environment

7.1.1 Existing Development Pattern

Arthur has a predominantly rural character; with older established neighbourhoods and new residential developments. The existing predominant housing type is single detached homes; however, townhouses, semi-detached houses, low rise apartment buildings and mobile homes also exist within the urban area. Recent residential development has included a combination of low to high density, including four-story apartment buildings, main street rental units, townhouse blocks, stacked townhouses, condominiums, semi-detached and single detached homes. The majority of existing residential development is off the main street (Smith St/George St/Highway 6), within the central region of the urban area.

Existing commercial development is located along the main street (George St/Smith St/Highway 6), with the central business district mainly being along George St. Industrial development is located primarily along the western urban limits and represent a significant component of the local economy.

Over the last three years, the community of Arthur has experienced a strong average annual rate of growth (i.e., households) of 10 percent, which is more than was anticipated for the community based on growth projections in the County Municipal Comprehensive Review.

7.1.2 Growth Projections

7.1.2.1 Growth Plan, February 2018

GSP and Curtis Planning completed the Township of Wellington North Growth Plan, dated February 2018, (also referred to as a Growth Plan) to “provide direction for policy development and decision-making regarding land development and growth-related investments and initiatives, to contribute to planning for positive growth and change in Wellington North.” The Growth Plan provides details on the expected growth between 2016 and 2041 and focuses on the urban areas of the communities of Arthur and Mount Forest; however, rural settlements within the Township are also considered. A copy of the Growth Plan is included in Appendix A.

With respect to infrastructure, the Growth Plan indicates that “majority of growth and development [is to] be located where it can be serviced by existing or planned municipal water and wastewater systems.” additionally, “…development that optimizes the efficient use of this infrastructure should be prioritized and balanced with the construction of new infrastructure. Future infrastructure planning is required to be undertaken on a watershed- and asset management basis, through servicing master plans and environmental assessments….”

Per the Growth Plan, “the 2036 and 2041 population, housing and employment growth forecasts for the Township of Wellington North, as established in the County Official Plan (current edition at that time), should continue to be used for planning purposes to determine urban land requirements.” And “The growth forecasts for Wellington North and the distribution of the population and housing forecasts within the Township should be revised and updated through future reviews of the County Official Plan, to align the forecasts with local growth patterns and infrastructure plans." The population growth forecast in the Growth Plan for Arthur reflects the increase in available capacity resulting from the Phase 2 expansion of the Arthur Wastewater Treatment Facility and is focused within the existing built-boundary that was delineated by the Province as part of the 2006 Growth Plan for the Greater Golden Horseshoe.

As required by the Provincial Policy Statement and Provincial Growth Plan, the County conducted a comprehensive review of its Official Plan. The municipal comprehensive review (MCR) provides population and employment projections to calendar year 2051, which is an additional ten years beyond the planning period presented in the current County Official Plan. The growth projections form the basis of the Official Plan review, during which a hierarchy of settlement areas are developed, and growth allocated accordingly. A copy of the Municipal Comprehensive Review is provided in Appendix B.

Consistent with the County Official Plan (last updated July 2024), residential intensification should occur at a rate of at least 20 percent annually, within the existing built-up area; designated greenfield areas should be developed to achieve a minimum density of at least 40 residents and jobs per hectare; and at least 25 percent of new housing within Wellington County should be *affordable to low and moderate income households*. "The target is intended to focus growth and development within the existing built-up area of the urban centres, and to ensure outward growth in greenfields is compact", which can be achieved through infilling and development of existing vacant land in the built-up area, building expansions or conversion, or redevelopment.

Per the Phase 1 MCR Report: Urban Structure and Growth Allocations, County of Wellington, Final Report (MCR Report, dated June 16, 2021 and as amended January 31, 2022) by Watson & Associates Economists Ltd., Wellington North is anticipated to accommodate 12% of the County's population growth over the forecast period, with an annual population growth rate of 1.5%, which is significantly higher that the observed growth rate of 0.3% annually over the last 20-year census period. These growth projections are to be used in planning for growth and growth related facilities. A summary of the population and household growth anticipated for Arthur over the forecast period, consistent with the Phase 1 MCR Report is presented in Table 2.

Table 2 – Summary of Population and Household Growth Anticipated for Arthur, per Phase 1 MCR Report

Year	Population	Households				Persons Per Unit
		Low Density	Medium Density	High Density	Total	
2021	2,700	750	120	170	1,040	2.50
2026	3,500	940	140	240	1,320	2.58
2031	3,900	1,060	170	260	1,490	2.55
2036	4,200	1,110	200	280	1,590	2.58
2041	4,400	1,140	200	310	1,650	2.55
2046	4,700	1,200	240	330	1,770	2.54
2051	4,800	1,240	250	340	1,830	2.57

7.1.2.2 Growth Management Action Plan, August 2024

Watson & Associates Economists Ltd. and WSP prepared the Township of Wellington North Growth Management Action Plan, dated August 16, 2024 (Growth Management Action Plan) on behalf of the Township to guide the Township through long-term growth management in the delivery of municipal services, infrastructure requirements, urban land needs and land use planning policy, economic development and financial stability. As opposed to the Growth Plan (February 2018), which was used to inform the County of Wellington on the Township's growth priorities as the County completed the MCR and draft Official Plan Amendments, the purpose of the Growth Management Action Plan is to develop a vision for growth and provide direction for implementation of the preferred growth scenario presented in the Growth Plan (2018), which informed the County's MCR (2022).

It is noted that The Growth Management Action Plan provides a summary of the population, housing and employment forecasts from the County's MCR (2022), for which the projected population for Arthur is the same as was presented in the Phase 1 MCR Report (refer to Table 2 of this Report); however, the total household value and population density changed/updated, as summarized in Table 3. A copy of the Growth Management Action Plan is provided in Appendix C.

Table 3 - Summary of Population and Household Growth Anticipated for Arthur, per the Growth Management Action Plan

Year	Population	Households					Persons Per Unit
		Low Density	Medium Density	High Density	Other	Total	
2026	3,500	940	140	240	10	1,330	2.63
2031	3,900	1,060	170	260	10	1,500	2.60
2036	4,200	1,110	200	280	10	1,600	2.63
2041	4,400	1,140	200	310	10	1,660	2.65
2046	4,700	1,200	240	330	10	1,780	2.64
2051	4,800	1,240	250	340	10	1,840	2.61

7.1.3 Township Operation

The cost to operate and maintain the Township's water and wastewater systems are recovered from operating (non-rate) revenues (i.e., administrative fees, etc.) and through direct billing to customers (rate revenues). Currently, only non-residential water customers are metered in terms of water usage. Residential customers are billed based on a (flat) base charge calculated based on the full costs associated with managing the Township's water and wastewater systems over a ten year period and considers various cost components including operation and maintenance, customer growth, water consumption volume, asset management, capital expenditures (necessary for growth and asset renewal), capital inflation, inflation and market competition and pricing.

DFA Infrastructure International Inc. prepared the 2020 Water and Wastewater Rate Study and O.Reg. 453/07 Financial Plan (Rate Study) for the Township of Wellington North, dated

November 13, 2020 to conduct a comprehensive review of its water and wastewater services rate structure review. The Rate Study determined the full cost to service water and wastewater over a ten year period between Calendar Years 2021 through 2030 and calculated corresponding rates to adequately fund the cost of the Township's municipal water and wastewater systems, through fair and equitable treatment of its ratepayers.

7.2 Technical Environment

7.2.1 Existing Requirements

7.2.1.1 Storage

Storage requirements for the municipal water systems in Ontario are based on MECP Water System Design Guidelines (2008) and require municipal storage facilities to be designed to allow maintenance of adequate flows and pressures in the distribution network during peak hour demand and to meet the Maximum Day Demand (MDD) during fire and emergency events. The calculation for the storage requirement of a water system is as follows:

Total Treated Water Storage Requirement = A + B +C

Where: A = Fire Storage (MECP suggested flow/duration based on population)

B = Equalization Storage (25%) of MDD

C = Emergency Storage (25% of A+B)

Fire storage allows the system to achieve flow rates and volume necessary to effectively fight fires and is based on population specific fire flow rate and duration, as indicated in Table 8-1 of the MECP's Drinking Water Systems Design Guidelines (2008). Equalization storage provides water to the system during peak demand periods. Emergency storage is intended to provide a safety factor for the water storage.

The existing total system storage volume is 1,137m^3, equal to the storage volume of the Spheroid Tower. As previously noted, the Charles Street Tower has reached the end of its service life and has been excluded from the total storage capacity.

7.2.1.2 Distribution Network and System Pressures

The horizontal infrastructure (i.e., watermains) and the associated capacity of the distribution network is a factor of the water storage operating ranges and demands within the water system. The Arthur water system operates based on a hydraulic grade line (HGL), a critical concept for understanding water pressure and distribution. The HGL is a theoretical line representing the height to which water would rise in a column due to the pressure at any given point in the system. It reflects the potential energy within the system, indicating the water pressure available at various locations.

Consistent with MECP Design Guidelines (2008), the normal pressure in water distribution networks should fall within the range of 40 psi to 100 psi during normal demand periods, and typical operating pressures within the range of 50 psi to 70 psi. Additionally, available fire flows within the network should maintain a minimum residual pressure of 20 psi under MDD conditions, with the municipal wells running at the rated capacity, which represents the maximum water taking capability of the system, consistent with the normal accepted industry standard for firefighting (MECP, 2008).

As watermain approaches the end of its service life, with the occurrence of corrosion and scale build-up or breaks, there are impacts to the hydraulic performance of the distribution network, including reduced flows and pressures.

Pressure within the existing water distribution network is maintained within an optimal range of 40 to 100 psi, as per MECP guidelines. This range ensures that the water supply remains sufficient for domestic use and fire protection without causing damage to the infrastructure. Pressures below MECP's recommended range can result in insufficient water supply, while pressures above MECP's recommended range can cause infrastructure damage.

Topography significantly impacts pressure distribution in the existing distribution network. Higher elevations experience lower water pressure whereas lower elevations generally have higher pressures as the difference between the HGL elevation and the ground elevation is greater (i.e.,, the HGL is at a higher elevation than the ground elevation).

The municipal infrastructure (i.e., water towers), as discussed earlier, is designed to manage and balance pressure across the community. Ensuring a consistent pressure level is necessary to maintain adequate service and meet fire flow requirements. Fire flow capability is a critical part of the system's operation, ensuring sufficient water pressure and flow rate for firefighting purposes.

The existing Arthur water system distribution network by watermain size and expected fire flow capabilities is presented on Figure 8 and the existing watermain material and typical system pressure is presented on Figure 9.

7.2.1.3 Historical Demands

The total annual volume of raw water pumped from the Arthur municipal wells between calendar years 2019 through 2023 is summarized in Table 4. Maximum Day Demand is expected to vary yearly as it is attributed to many factors. Water demands often increase during dry weather as a result of consumers using water to water gardens, lawns, etc., during seasonal operations (i.e., municipal recreation services such as splash pad) or during extreme cold weather events where tap water is run (trickle flow) continuously to prevent water services from freezing, or during system maintenance events (i.e., watermain flushing and reservoir cleaning), emergency events (i.e., fire protection) or system failures (i.e., watermain breaks). Water demands typically decrease in the event of a loss of significant users (i.e., industrial) or when water conservation measures are implemented.

TOWNSHIP OF WELLINGTON NORTH

ARTHUR WATER SYSTEM SUPPLY REDUNDANCY AND STORAGE CLASS EA

JUNCTION FIRE FLOW RANGE

- 70 - 80 L/s
- 80 - 103 L/s
- 103 - 200 L/s
- 200 - 350 L/s

FIGURE 8

EXISTING EXPECTED FIRE FLOW CAPABILITIES OF THE EXISTING ARTHUR MUNICIPAL WATERMAIN DISTRIBUTION NETWORK

SCALE 1:10,000
T4003A

TRITON ENGINEERING SERVICES LIMITED
Consulting Engineers
Fergus, Ontario

TOWNSHIP OF WELLINGTON NORTH

ARTHUR WATER SYSTEM SUPPLY REDUNDANCY AND STORAGE CLASS EA

FIGURE 9

EXISTING TYPICAL SYSTEM PRESSURE WITHIN THE EXISTING ARTHUR MUNICIPAL WATERMAIN DISTRIBUTION NETWORK

SCALE 1:10,000
T4003A

TRITON ENGINEERING SERVICES LIMITED
Consulting Engineers
Fergus, Ontario

Table 4 – Summary of the Total Annual Volume of Raw Water Pumped from the Arthur Municipal Wells

	Treated Volume Pumped				
	2019	**2020**	**2021**	**2022**	**2023**
Total Volume Pumped (m^3)	394,313.79	371,882.63	365,993.37	361,192.61	375,188.61
Change (m^3)	+14,943.27	-22,431.16	-5,889.26	-4,800.76	+13,996
Total Rainfall (mm)[1]	651.00	648.40	798.20	520.70	711.30

[1]When ambient temperature is >0ºC as reported at the Mount Forest Environment and Climate Change Canada - Meteorological Service of Canada, Climate ID6145504

The following Table 5 summarizes the average day demand (ADD) for each month of the last 5 years.

Table 5 – Summary of the Average Day Demand Over the Most Recent 5 Years for the Arthur Water System

Month	Historical Average Day Demand (m^3/day)				
	2019	**2020**	**2021**	**2022**	**2023**
January	1,006.3	1,028.9	879.1	899.1	925.5
February	1,018.6	1,010.9	918.5	905.4	958.4
March	1,052.0	1,007.5	962.3	869.6	972.7
April	1,029.5	890.8	935.8	870.3	998.5
May	1,077.2	1,021.1	1,084.2	962.7	1,092.9
June	1,153.9	1,156.1	1,187.0	1,109.6	1,219.6
July	1,237.1	1,228.1	1,065.2	1,138.9	1,151.3
August	1,117.9	1,104.1	1,107.2	1,052.3	1,093.0
September	1,109.9	1,048.7	1,032.2	1,069.2	1,116.9
October	1,083.7	1,012.0	984.5	1,024.7	1,060.1
November	1,056.0	958.7	958.3	1,001.4	949.1
December	1,016.5	832.6	913.5	966.4	922.5
Average	**1,079.9**	**1,025.0**	**1,002.3**	**989.1**	**1,038.4**
Maximum	**1,237.1**	**1,228.1**	**1,187.0**	**1,138.9**	**1,219.6**

The following Table 6 summarizes the max day demand (MDD) for each month of the last 5 years.

Table 6 – Summary of the Maximum Day Demand Over the Most Recent 5 Years for the Arthur Water System

Month	Historical Maximum Day Demand (m^3/day)				
	2019	**2020**	**2021**	**2022**	**2023**
January	1,108.4	1,138.8	1,040.9	1,056.2	1,074.5
February	1,123.1	1,120.5	1,065.6	1,065.0	1,079.1
March	1,173.0	1,494.8	1,116.9	1,020.4	1,118.1
April	1,153.7	1,086.6	1,130.2	1,143.1	1,225.3
May	1,209.2	1,503.2	1,423.0	1,226.1	1,491.6
June	1,359.3	1,472.0	1,541.7	1,558.0	1,535.0
July	1,477.9	1,572.0	1,376.8	1,447.0	1,436.1
August	1,421.4	1,309.9	1,405.8	1,257.3	1,431.7
September	1,240.3	1,212.2	1,187.1	1,225.5	1,402.3
October	1,228.4	1,172.7	1,257.2	1,293.9	1,278.2
November	1,219.7	1,203.8	1,167.5	1,169.5	1,153.8
December	1,162.1	1,020.9	1,197.4	1,196.0	1,089.6
Average	**1,239.7**	**1,275.6**	**1,242.5**	**1,221.5**	**1,276.3**
Maximum	**1,477.9**	**1,572.0**	**1,541.7**	**1,558.0**	**1,535.0**

7.2.1.4 Historical Reserve Capacity

The hydraulic reserve capacity for a water system is based on the system's Firm Capacity. Using Firm Capacity to determine the hydraulic reserve capacity ensures sufficient redundancy in the system for water supply and treatment in case of an equipment/facility failure. Reserve Capacity Calculations (RCC) are completed in accordance with the requirements outlined in the MECP Procedure D-5-1 Calculating and Reporting Uncommitted Reserve Capacity at Sewage and Water Treatment Plants, dated March 1995. The MECP Design Guidelines for Drinking Water Systems (2008) recommends that the Source Capacity of a water supply system should be greater than the MDD so that daily demand can be met if storage is offline.

A summary of the RCC (firm capacity) and source reserve capacity for Arthur's water system over the last 4 years is presented in Table 7. The RCC is typically calculated such that the residential and ICI demands are separated, to establish a more accurate per person expected demand. However, for the purposes of this report, the residential and ICI demands will not be separated, as the detailed expected ICI growth for the urban area of Arthur is not known at this time. Taking this approach will leave the historic ICI demands embedded and included in the existing and future demand projections.

Table 7 – Summary of the Reserve Capacity Calculations for Arthur's Water System Over the Last 5 Years

Data Year	**2020**	**2021**	**2022**	**2023**
RCC Year	**2021**	**2022**	**2023**	**2024**
Firm Capacity (m^3/day)	2,255	2,255	2,255	2,255
3-Year Average MDD (m^3/day)	1,521	1,531	1,557	1,545
(Firm) Reserve Capacity (m^3/day)	**734**	**724**	**698**	**710**
Occupied & Serviced Households (Each)	918	968	1,093	1,229
Persons Per Existing Residential Unit (Capita)	2.40	2.40	2.60	2.60
Population Served (Capita)	2,203	2,323	2,842	3,195
MDD Per Capita[1] (m^3/day/capita)	**0.690**	**0.659**	**0.548**	**0.483**

[1] MDD per capita includes demand from employment lands.

Per Table 7, the 3-Year Average MDD has been relatively consistent for the recent (4-years) RCC, even though the serviced population has increased over the same period. This is likely due to large ICI users or other uses (watermain flushing, fire flows, etc.) with consistent demands that exceed residential water demands.

Per MECP design guidelines, the typical domestic use water demand should be in the range of 0.225 to 0.450 m3/day/capita. Given that the MDD in Arthur is significantly influenced by its ICI users, the per capita MDD is assumed to be an overestimated representation of equivalent residential usage. It is noted that the per capita MDD has consistently decreased based on the recent (4-years) RCC, which is likely due to the increase in population and residential service connections, which are expected to have much lower demands based on efficiencies in water usage for new developments. The current MDD per capita (0.483 m3/day/capita) is approaching the high end of the typical domestic use water demand (0.450 m3/day/capita) and can be used as a conservative approach for estimate future water demands.

7.2.2 Projected Requirements

7.2.2.1 Demands

A summary of the forecasted water demands is presented in Table 8. The projected demands assume population growth in Arthur will be in accordance with the projections presented in the MCR (Watson & Associates Economists Ltd, January 31, 2022) and assumes the per capita water demands remain consistent with existing conditions (i.e., 2023, MDD per capita of 0.483 m3/day/capita). It is noted the projected persons per residential unit presented in the Growth Management Action Plan differed from the MCR; however, the total population remained the same, therefore, there were no impacts to the calculated theoretical total system MDD.

Table 8 – Summary of the Projected Water Demands of the Existing and Future Population of Arthur

	Projected Demands and Reserve Capacity						
	2023 (Existing)	**2026**	**2031**	**2036**	**2041**	**2046**	**2051**
Firm Supply Capacity (m^3/day)	**2,255**						
Population Served (Capita)	3,195	3,500	3,900	4,200	4,400	4,700	4,800
Persons Per Residential Unit (Each)	2.6	2.63	2.60	2.63	2.65	2.64	2.61
Per Capita MDD (m^3/day/capita)	0.483						
Total System MDD (m^3/day)	1,545	1,692	1,886	2,031	2,127	2,272	2,321
Utilization (%)	69%	75%	84%	90%	94%	101%	103%
Firm Reserve Capacity (m^3/day)	**710**	**563**	**369**	**224**	**128**	**-17**	**-66**

The MECP Design Guidelines for Drinking Water Systems (2008) recommends that the Source Capacity of a water supply system should be greater than the MDD so that daily demand can be met if storage is offline. Further, exceedance of the system's Firm Capacity indicates that there is insufficient redundancy in the system for water supply and treatment in case of an equipment/facility failure. Based on the forecasted water demands presented in Table 8, the Arthur water supply system will be exceeding 75% utilization by 2026, nearing capacity by 2036, with a deficit predicted by 2046. The 75% threshold is typically a milestone to initiate the implementation of the necessary infrastructure to continue meeting the MDD of the system.

7.2.2.2 Storage

Per Section 7.3.3.1 of this Report, MECP Design Guidelines for Drinking Water Systems (2008) require municipal water storage facilities to be designed to allow maintenance of adequate flows and pressures (component B, equalization storage) in the watermain distribution network during peak hour water demand and to meet critical demands during fire (component A, fire storage) and emergency events (component C, emergency storage).

The calculated storage requirements for the existing and future population in Arthur, assuming population growth is in accordance with the projections presented in the MCR (Watson & Associates Economists Ltd, January 31, 2022), is presented in Table 9.

Table 9 – Summary of Projected Water Storage Requirements of the Existing and Future Population of Arthur

	Projections						
Calendar Year	**2023 Existing**	**2026**	**2031**	**2036**	**2041**	**2046**	**2051**
Projected Serviced Population (Capita)	3,195	3,500	3,900	4,200	4,400	4,700	4,800
MDD (m^3/day)	1,545	1,692	1,886	2,031	2,127	2,272	2,321
Duration (hours)	2	2	2	2	2	2	2
Fire Flow (L/s)	111	117	123	128	131	136	137
A - Fire Storage (m^3)	799	842	886	922	943	979	986
B – Equalization Storage (m^3)	386	423	472	508	532	568	580
C – Emergency Storage (m^3)	296	316	339	357	369	387	392
Total Storage Required (m^3)	1,482	1,582	1,696	1,787	1,844	1,934	1,958
Existing Storage (m^3)	1,364	1,137[1]					
Storage Remaining (m^3)	-118	-445	-559	-650	-707	-797	-821

[1]The existing storage for the 2023 considers the 227m^3 capacity of the Charles Street multi-leg tower; however, as this has reached the end of its service life, it is not considered in the total system storage capacity for the projected future storage capacity needs.

As per Table 9, the storage volume requirements to support the future growth indicate that the existing available storage is insufficient to meet the projected needs of the future population to 2051. Further, it is calculated that the existing storage capacity of the Arthur water system is deficient in meeting the required storage for the existing population; however, given that there is currently surplus Firm Reserve Capacity, the system maintains a sufficient water supply capacity to service the existing population. A storage volume of at least 900 m^3 is needed to ensure there is enough water storage capacity within the Arthur water system to service the projected future population to at least calendar year 2051.

7.2.2.3 System Pressures

Future development areas as contemplated within the 2018 Growth Plan,2020 Water and Sanitary Systems Technical Study – Arthur (Technical Study) and Growth Management Action Plan (2024) generally surround the existing built-up area of Arthur and these future development areas are located at higher topographic elevations than the existing community.

Watermain extensions will be required to service future developments. The design of the extensions will provide interconnection and looping for the existing water distribution network and will be determined at the preliminary stage of future developments. Although Arthur has a relatively consistent topography, the future development areas to the north and northeast of the existing built-up area are at higher elevations than the rest of the community. Consistent with the Technical Study (refer to Appendix D), the projected pressures within the watermain distribution network were reviewed for various development scenarios. It was determined that the available pressure within the watermain distribution network would ultimately be reduced to the lower end and below the optimal minimum pressure (40 psi) of the normal operating range for development of lands sited on lands at higher elevations, which may result in end user complaints relating to sufficient flows and pressures. A summary of the expected pressures within the anticipated watermain distribution network is provided in Table 10.

A summary of the expected pressures within the anticipated watermain distribution network within future development areas based on the water level within the existing spheroid water tower is provided in Table 10.

Table 10 – Summary of Expected Pressures within the Watermain Distribution Network for Future Development Areas

Pressure (PSI)		**Ground Elevation**											
		469.0	**468.5**	**468.0**	**467.5**	**467.0**	**466.5**	**466.0**	**465.5**	**465.0**	**464.5**	**464.0**	**463.5**
Tower Water Level	494.0	35.6	36.3	37.0	37.7	38.4	39.1	39.8	40.5	41.2	42.0	42.7	43.4
	494.5	36.3	37.0	37.7	38.4	39.1	39.8	40.5	41.2	42.0	42.7	43.4	44.1
	495.0	37.0	37.7	38.4	39.1	39.8	40.5	41.2	42.0	42.7	43.4	44.1	44.8
	495.5	37.7	38.4	39.1	39.8	40.5	41.2	42.0	42.7	43.4	44.1	44.8	45.5
	496.0	38.4	39.1	39.8	40.5	41.2	42.0	42.7	43.4	44.1	44.8	45.5	46.2
	496.5	**39.1**	**39.8**	**40.5**	**41.2**	**42.0**	**42.7**	**43.4**	**44.1**	**44.8**	**45.5**	**46.2**	**46.9**
	497.0	39.8	40.5	41.2	42.0	42.7	43.4	44.1	44.8	45.5	46.2	46.9	47.6
	497.5	40.5	41.2	42.0	42.7	43.4	44.1	44.8	45.5	46.2	46.9	47.6	48.4
	498.0	41.2	42.0	42.7	43.4	44.1	44.8	45.5	46.2	46.9	47.6	48.4	49.1
	498.5	42.0	42.7	43.4	44.1	44.8	45.5	46.2	46.9	47.6	48.4	49.1	49.8
	499.0	42.7	43.4	44.1	44.8	45.5	46.2	46.9	47.6	48.4	49.1	49.8	50.5
	499.5	43.4	44.1	44.8	45.5	46.2	46.9	47.6	48.4	49.1	49.8	50.5	51.2

Per Table 10, if the water level within the existing tower is half full (i.e., elevation of 496.5 m above mean sea level [amsl]), the theoretical pressure at any ground elevation above 468 m amsl will be less than 40 psi. Operating pressures improves as the water level in the storage facility increases; however, it is still at the lower end of the optimal operating range. It is noted that the future development lands to the north and east of the existing built-up area are at elevations of 461 m to 470 m amsl. Therefore, an increase to the HGL and operating range of the storage facility should be considered to improve pressures within the watermain distribution network to adequately service future development areas.

To further assess this, the Township and Triton Engineering completed a System Pressure Testing assessment in the summer of 2024 to assess the existing system's operating levels and consider potential improvements to service existing and future development lands. A copy of the System Pressure Testing Report is included in Appendix E. The assessment determined that the HGL in the water system should be increased by 3.0m to a high-water level (HWL) of 501.73m in the future, to ensure that future development areas have adequate pressure. It was further determined that existing areas, such as those near Schmidt Drive and Eliza Street, exhibit pressures close to the minimum acceptable threshold of 40 PSI, indicating an opportunity for improvement. A 3.0m increase in the HGL would improve pressures within the existing system and is not expected to result in pressures exceeding the 100 PSI (689.5kPa) threshold within the existing or future distribution system. Therefore, it would be reasonable to design the future water system to have a low-water level (LWL) equal to the existing LWL (493.303m) and future HWL to be 3 metres above the existing HWL (498.703m) for a future HWL of 501.703m and a future operational range of 8.4m to manage and balance pressure across the community (including future development lands).

7.3 Social Environment

The Township of Wellington North is the most northerly Township in Wellington County, and the community of Arthur is the most southerly urban centre in the Township. Arhtur is designated as "Canada's Most Patriotic Village" by the Toronto Star newspaper in its November 2, 1942 edition and through formal confirmation of its patriotism in 2002 by David Tilson, MPP for Dufferin-Peel-Wellington-Grey, as he stated in the Ontario Legislature.

Per the Township's 2024 Strategic Plan (Do/Able Consulting, October 2023), residents in the Township "enjoy the benefits of a small-town atmosphere, a wealth of conservation land and natural areas, and highly rated community services." Community services include emergency, environmental, arts and culture, recreation, transportation related services and support for small and large businesses.

Per the Township's 2024 Strategic Plan, prepared by Do/Able Consulting and dated October 23, 2023, Township residents are satisfied with the quality of life within and the services provided by the Township. Members of the community that participated in the planning process for the Township's strategic plan supported the goal of "building a safe, sustainable and welcoming community," which the Township intends to achieve through three strategic priorities, as follows:

- shape and support sustainable growth
- deliver quality, efficient community services aligned with the Township's mandate and capacity
- enhance information sharing and participation in decision-making.

7.4 Cultural Heritage Environment

Cultural heritage resources include archaeological resources, built heritage resources and cultural heritage landscapes.

7.4.1 Built Heritage Resources and Cultural Heritage Landscapes

Cultural Heritage Landscapes and Built Cultural Heritage Resources are geographical areas and built resources which may or may not have been modified by human activity and are identified as having cultural heritage value or interest by a community. Areas can include features such as structures, buildings, archaeological sites, natural elements, groups of elements and properties (i.e., neighbourhoods, main streets, gardens, etc.) with cultural value or interest under the Ontario Heritage Act, or have been included or protected by registers, official plans, zoning by-laws or other land use planning mechanisms.

Within Arthur, the lands and premises at the property of 181 Tucker Street is designated as being of architectural and historical value or interest under the Ontario Heritage Act. Additionally, the Arthur River Trails, which opened in 2013 are used year-round by residents and visitors for recreational use, and is an important cultural feature within the Study Area. The Grand River is a designated Canadian Heritage River System, with cultural heritage features. There is a historical structure located at MacPherson Park (corner of George Street and Francis Street) honoring the history of Arthur, entitled “Founding of Arthur”, which was erected by the Archaeological and Historical Sites Board, Department of Public Records and Archives in Ontario. Another feature includes Arthur’s Cenotaph, located at the corner of George Street and Frederick St, which was unveiled in 1923, to honor soldiers who fought in World War I, and later World War II and peace keeping missions. The Charles St multi-leg water tower may have historical and cultural significance as a landmark within the Study Area.

Per the Township’s Municipal Cultural Plan Update (MDB Insight, November 2021), the Township *is home to several natural heritage and cultural heritage assets. Cultural heritage assets such as plaques and monuments, public art, and cemeteries commemorate the history and stories of Wellington North’s residents. Murals such as* [Arthur’s] *Jones Baseline offer an approach to the history of relationships between Indigenous groups and the communities they have interacted with. Other significant murals include the Patriotic Mural in Arthur, Canada’s Most Patriotic Village,* Pioneer Mural and Freedom Isn’t Free Mural. *Local stories are the “DNA of culture” and are intangible cultural resources that contribute to Wellington North’s arts and culture. Key intangible assets include Arthur “Canada’s Most Patriotic Village,” Wellington North as a Fashion Destination, The Roxy Theatre and The History of Hotels.*

The *Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes, A Checklist for the Non-Specialist* was completed for the Study Area, consistent with the Ministry of Citizenship and Multiculturalism (MCM) requirements. Although the Study Area is located within a Heritage River Watershed (Grand River Watershed) and contains buildings or structures that are 40 or more years old, it is interpreted that if there is not any work planned to occur adjacent to the Grand River or buildings and/or structures that are more than 40 years old, then these particular criterion are not met and the response to these boxes on the checklist can be marked as ‘no’. A copy of the checklist is provided in Appendix F.

7.4.2 Archaeological Resources

The potential for archaeological resources exist within the Study Area since agricultural areas and historic transportation routes are very commonly high potential areas for archaeological resources to be present. The *Criteria for Evaluating Archaeological Potential, A Checklist for the Non-*

Specialist was completed for Study Area, consistent with MCM requirements. The results of the checklist indicate that an archaeological assessment (Stage 1) is required. A copy of the checklist is provided in Appendix G.

8.0 Phase 2 – Shortlist Evaluation of Alternative Solutions

As part of Phase 2 of the planning process, the reasonable alternative solutions are evaluated, with consideration of the effects of the alternatives on the environment (natural, economic, technical , social, and cultural), leading to identification of the preliminary recommended solution.

The shortlist evaluation of alternative solutions is based on the ability of the alterative solution to address the issues identified in the Problem/Opportunity Statement and is summarized in Table 11, as follows:

Table 11 – Shortlist Evaluation of Alternative Solutions

Alternative Solutions		Problem Statement Components: Increase Water Supply Redundancy to Support Expected Population Growth	Problem Statement Components: Increase Water Storage to Support Expected Population Growth	Problem Statement Addressed? (Alternatives 2 and 3 need to satisfy corresponding component)
Baseline/General Alternatives	1a – "Do Nothing"	No	No	No
	1b – Limit Community Growth	No	No	No
	1c – Reduce Water Demand/Implement Conservation Measures	No	No	No
Water Supply Alternatives	2a – Increase Water Taking from Existing Municipal Wells	Yes	Not Applicable	Yes
	2b – Addition of New Well(s) to the Existing Municipal System	Yes	Not Applicable	Yes
Water Storage Alternatives	3a – Construct a New Water Storage Facility to Supplement the Existing Municipal Water Storage Facilities	Not Applicable	Yes	Yes
	3b – Construct a New Water Storage Facility and Decommission the Existing Multi-Leg Storage Facility	Not Applicable	Yes	Yes
	3c – Construct a New Water Storage Facility and Decommission Both Existing Water Storage Facilities	Not Applicable	Yes	Yes

Note: If Problem Statement is satisfied (i.e., "Yes") = Alternative is shortlisted for further evaluation.

Consistent with Table 11, Alternatives 2a and 2b are carried forward for further evaluation with respect to addressing the water supply component of the Problem/Opportunity Statement and Alternatives 3a, 3b and 3c are carried forward for further evaluation with respect to addressing the water storage capacity component of the Problem/Opportunity Statement. It should be noted that further evaluation of the shortlisted alternative solutions will identify a preliminary preferred water supply alternative and water storage alternative that will together best address the Problem/Opportunity Statement. It should be noted that Baseline/General Alternative 1c should be considered as a key component of the identified preliminary preferred alternative solutions, since its implementation is expected to extend the service life of the existing and future increased water supply and storage capacities.

9.0 Evaluation of Water Supply Alternatives

R.J. Burnside & Associates Limited (Burnside) was retained by the Township in 2021 to complete an assessment and initial exploration for a new water source, per the recommendations of the Arthur Water and Sanitary Systems Technical Study (November 2020) and Reserve Capacity Calculations for Arthur's Water System, to support the eventual associated Class EA project. Burnside's well exploration study included a desktop evaluation of background information, including local overburden and bedrock geology; alternatives for additional water, well exploration; and a summary of conclusions and recommendations. The results of the study are documented in the report by Burnside entitled Arthur Preliminary Well Exploration Assessment (May 6, 2021) (Well Exploration Assessment), summarized in the following section. A copy of the Well Exploration Assessment is provided in Appendix H.

9.1 Alternative 2a - Increase Water Taking From Existing Wells

Per the Well Exploration Assessment, Well 7B currently uses less than half of the available drawdown of the well. It is expected that Well 7B could produce more than 35 L/s. Wells 8A and 8B are also expected to be capable of producing significantly more water that is currently permitted. It is ideal that these wells are drilled into separate aquifers because should one aquifer become contaminated, the other source would not be impacted. The issue with increasing water taking from these existing wells is the existing concentrations of iron and manganese.

Water sourced from Well 7B has an elevated concentration of iron and water sourced from the Well 8A/8B site has elevated concentrations of manganese, both being metals that affect the aesthetic water quality. Health Canada proposed Guidelines for Canadian Drinking Water Quality for Iron, with the consultation period ending November 28, 2023. Health Canada also proposed Guidelines for Canadian Drinking Water Quality for Manganese, dated May 10, 2019, which remains a guideline. Should the guideline for manganese be adopted as a standard, water sourced from Well 8A/8B would require a new treatment process, which would involve the construction of a larger pumphouse and discharge of wastewater from the treatment process for treatment.

The existing wells (7B, 8A and 8B) are located in relatively remote areas outside of the existing developed area of Arthur.) There are no sanitary sewers in the proximity of the existing municipal wells, therefore, there is nowhere to discharge wastewater from water treatment processes, if required. Watermain connecting the existing wells to the distribution system are potential sources of failure as there is only one transmission line (no looping) leading from the water sources and the length of the transmission line/watermain increases failure opportunities and maintenance costs for this asset.

Increasing the capacity of the permitted water taking at Well 7B would also require the construction of a new Well 7C, to provide mechanical duplication of 7B. Increasing the capacity at the Wells 8A/8B site could be achieved through operating the wells together, which could be obtained through a Category 3 PTTW amendment following testing completed under a MECP EASR registration. Alternatively, a new, deeper test well could be drilled at the Wells 8A/8B site to determine if the deep bedrock in this area can produce sufficient capacity of water whose manganese concentrations would likely be lower than at the existing Wells 8A/8B. If so, water from a deep bedrock well could be used to replace existing Wells 8A/8B or blended. Either of these options to increase water taking at either or both well sites would require additional testing.

Per Burnside's Well Exploration Assessment, the following conclusions and recommendations were made regarding increasing water taking from existing wells.

Conclusions:

- The deep overburden contact aquifer, located between 40 and 70 m below grade, where the existing Wells 7B and 8A/8B draw water has high capacity with the potential for significant expansion (on existing or additional sites).
- Increasing the permitted capacity from the Well 7B site would require testing to increase the PTTW rate, and a second well to duplicate the water source in case the existing Well 7B were to fail and would be expensive given the requirement to expand the existing pump house and construction of a treatment system to remove iron.
- Increasing the permitted capacity from Wells 8A/8B would require testing and treatment system to remove manganese.

Recommendations:

- The cost to treat water sourced from Wells 8A/8B for the removal of manganese should be investigated, including the disposal of water from the treatment process.
- The cost to treat water sourced from Well 7B for the removal of iron should be investigated, including the disposal of water from the treatment process.
- A second well should be constructed at the Well 7B site to provide mechanical duplication.

Wellington Source Water Protection, Risk Management division, also provided comment on Source Water Protection in relation to increasing water taking from existing wells, as follows:

- Well 7B is currently pumping at less than half its available drawdown. Pumping more capacity at this well would likely increase the size of the WHPA, but would not change the orientation of the WHPA, or increase the vulnerability. The WHPA-A would not change, and due to the low to moderate vulnerability scoring it would likely only result in a small number of properties that may potentially have DNAPL threats. However, with the increased capacity, whether due to increasing pumping from 7B, a new well (7C) would have to be drilled as back up. This well would likely increase the area of the WHPA-A but would be unlikely to impact any new properties.

- Wells 8A/B could be pump concurrently to increase capacity. Pumping more capacity at this well would likely increase the size of the WHPA, but would not change the orientation of the WHPA, or increase the vulnerability. The WHPA-A would not change, and due to the low to moderate vulnerability scoring, it would likely only result in a small number of properties that may potentially have DNAPL threats. However, due to increased levels of manganese in the water at this location, expensive treatment may be required. Should the Township choose to drill these wells deeper to avoid the manganese, the size and orientation of the WHPA could change drastically, affecting many properties both within the urban boundary and in the rural areas surrounding Arthur.

9.2 Alternative 2b - Addition of New Well(s)

Based on the growth projections and RCC for Arthur's water system, the criteria for siting a new well included the following:

- Water production of at least 10 L/s.
- Water quality that meets or exceeds the current and future Ontario Drinking Water Standards, for the following parameters: sulphate, iron and manganese.

It was determined that exploration for a new well should occur at the north end of the Study Area, on Township property (corner of the unopened Wells St road allowance and Macauley St) based on Burnside's detailed review of the exiting background information, including studies completed by adjacent municipalities, history of municipal wells (Wells 1 to 6, currently abandoned), and review of the MECP water well record database for wells within the Study Area and within the surrounding 5 km of the Study Area. A summary of the background conditions in the north end of the Study Area, as it relates to water production is as follows, consistent with the Burnside Well Exploration Assessment:

- The overburden gravel aquifer (Lower Sediments) is not reported.
- Top of bedrock is located at approximately 50 m below grade.
- The bottom of the carbonate aquifer is approximated at 180 m below grade.

The area at the existing Wells 8A/8B site was also identified as a potential area for well exploration given that it is Township property and is equipped with existing water source infrastructure. If a bedrock test well drilled at this site does not have the capacity to produce a water capacity of at least 10 L/s, then an additional exploration site on Township property at the extreme south end of the Jones Baseline road allowance would be explored, given that it is Township property in an area with the potential to produce a high-capacity water supply.

Per Burnside's Well Exploration Assessment, the following conclusions and recommendations were made regarding the exploration for the addition of new well(s).

Conclusions:

- Exploration for a bedrock water source is preferred over increasing capacity within the deep overburden as it is anticipated that a bedrock water source would contain less iron and manganese and therefore not require construction of a treatment system.
- Exploration for a bedrock water source (in the deep carbonate bedrock aquifer) outside of the Arthur core area is preferred, given that it is anticipated to provide better water quality and source capacity as compared to existing and/or abandoned municipal wells.

Recommendations, in order of implementation:

- A test well should be drilled in the north end of the Study Area on Township property (intersection of unopened roads Wells St and Macauley St).
- A test well should be drilled at the Well 8A/8B site, following exploration in the north end of the Study Area.
- If drill at the Well 8A/8B site does not provide favourable results, drilling at the south end of the Jones Baseline road allowance should be considered.

9.3 Well Exploration and Short-Term Pumping Test

Consistent with the conclusions and recommendations in Burnside's Well Exploration Assessment, exploration for a new water source, in the north end of the Study Area, outside of the urban core, was the next step in evaluating the water supply alternatives. Therefore, Well Initiatives Limited (Well Initiatives) was retained by the Township as the licensed well contractor to support the well exploration process.

9.3.1 Test Well TW1-21 Construction and Preliminary Testing

Burnside and Well Initiatives initiated drilling on Township property at the southeast corner of the Macauley St and Wells St intersection in November 2021. Sampling of the overburden identified a relatively thick permeable layer of sand and gravel in the lower sediments that was recommended for testing with a test well. A 150 mm diameter test well, identified as TW1-21, was constructed to a depth of 42.4 m below grade, with a 150 mm diameter stainless-steel water well screen installed between 42.7 m and 47.5 m below grade, in the most permeable and productive part of the thick sand and gravel aquifer. Following installation of TW1-21, it was pumped with compressed air for two days to develop the stainless-steel well screen before initiating the short-term pump test.

The location of TW1-21 is shown on Figure 10. The TW1-21 site is bounded by cultivated fields; however, lands to the east are within the Arthur urban boundary and are zoned industrial, lands to the north (within the urban boundary) are zoned as future development, and lands to the west of Wells St are outside of the Arthur urban boundary and are zoned as agricultural.

A short-term pump test was completed at TW1-21 on November 21, 2021, which included pumping rates of up to 25 L/s and the collection of water samples to test the quality. Water quality results indicated concentrations of iron, manganese and nitrate at less than half the allowable limits in the Ontario Drinking Water Standards and less than half of the concentrations currently present at water produced from the existing municipal wells. Based on Burnside's review of the water well database, there are no other wells drilled into the same aquifer, within a 2 km radius of TW1-21.

Given that the short-term pump test at TW1-21 met the criteria of water production of at least 10 L/s, and promising initial water quality sample results, long-term pump testing was recommended by Burnside as the next step in evaluation of TW1-21 to confirm water production capability and water quality at this site. It was proposed long-term pump testing include continuous pumping for an approximate duration of one week, combined with water level monitoring of existing municipal wells and private wells in the area immediately surrounding the TW1-21 area, as well as detailed water sampling for quality analysis.

Details of the initial well exploration are provided in Burnside's Technical Memorandum – Arthur Well Exploration Update 1, TW1-21 Construction and Preliminary Testing (Technical Memo), dated January 4, 2022, which is provided in Appendix I. This Technical Memo was received by Township Council at their January 10, 2022 meeting.

9.3.2 TW1-21 Long-Term Pumping Test

In accordance with their recommendations in the Technical Memorandum, Burnside proceeded with the long-term pumping test at TW1-21 in 2022. Details of the long-term pumping test are documented in the report by Burnside entitled *Hydrogeological Report in Support of Arthur Water Supply Environmental Assessment* (Rev 1. November 2022) (Hydrogeological Report), which is attached to this report in Appendix J. A summary of the long-term pumping test is provided in the following sections:

9.3.2.1 TW1-21 Testing

Variable rate testing was completed at TW1-21 on November 29, 2021 during the short-term pumping test to determine the production capacity of the test well and inform the parameters for the long-term pumping test. Burnside prepared a pumping test design report to meet the requirements of and register the test in the Environmental Activity Sector Registry (EASR) on May 16, 2022. Per the design report and registry (Reg. No. R-011-9152754560), the maximum rate of taking permitted was 42 L/s for seven days; however, the actual long-term pumping test consisted of pumping at a rate of 23 L/s for 6 days (144 hours, starting at 9:10 AM on June 18, 2022 and ending at 9:15 AM on June 24, 2022), including pre- and post- test monitoring. Water pumped from TW1-212 during the test was discharged to Farley Creek, downstream of the monitoring locations. The pumping test occurred during a period of below average precipitation that experienced 70 percent of the historical normal for precipitation.

9.3.2.2 Well Monitoring

Burnside reviewed the MECP well records database to identify wells within 2.5 km of TW1-21. They then completed a door-to-door well survey for those identified within 2.5 km of TW1-21 to review additional details of the wells (i.e., permission to access, depth, location, accessibility, etc.). Burnside obtained permission to monitor 14 private wells, including four shallow monitoring wells, to support the long-term pumping test at TW1-21. They also notified all residences within 1 km of TW1-21 of the long-term pumping test, with emergency contact information to report any impacts.

Monitoring of the private wells and TW1-21 included a combination of manual water level measurements, automatic water level recorders and sonic water level meters. A 50 mm diameter monitoring well, drilled to the same depth as TW1-21, identified as MW1-21, was installed 7 m south of TW1-21 for monitoring by manual and automatic methods during the long-term pumping test. The existing municipal wells (7B, 8A and 8B) and their associated monitoring wells were also monitored as part of the long-term testing and was completed using the SCADA system and automatic water level recorders, in accordance with the Township's PTTW monitoring program.

The response of the wells being monitored, including at TW1-21 and MW1-21, as part of the test were measured before, during and after the pumping test and were recorded relative to ground surface, well depth and approximate pump depth to approximate drawdown caused by the pumping test, with consideration of seasonal water level declines. The response observed at TW1-21 and MW1-21 were similar, with the static water level at MW1-21 being 0.03 m lower than at TW1-21 prior to the test and 1.54 m less during the test, with similar recovery trends. The static water level in TW1-21 was 8.63 mbgs prior to testing (i.e., total drawdown of 14.56 m), 23.19 mbgs during testing and 8.56 mbgs 36-hours post-testing.

Both TW1-21 and MW1-21 are completed in relatively thick and permeable portion of an overburden aquifer and the response observed at both locations was typical of a leaky confined aquifer with a limiting boundary. Based on Burnside's interpretation of the distance drawdown analysis, the results are representative of a regional discontinuous contact aquifer, with slightly more drawdown observed at wells upgradient of TW1-21. Reduced recovery is interpreted to be due to seasonal water level decline in the regional aquifer.

The response observed at private wells followed similar response trends as TW1-21 and a delayed recovery that is interpreted to be influenced by seasonal water level declines and increased water taking during an extended period drought in 2022.

One report of interference, at 8580 County Road 14, was noted during the test, where sand production was observed. Production of sand is common at this location under heavy pumping scenarios, as the well pump at this location is equipped with a flow restrictor and was installed higher than typical above the bottom of the well. Another report of interference (loss of pressure) was reported at 8580 County Road 14; however, it was determined the well had been running for an extended period.

TOWNSHIP OF WELLINGTON NORTH

ARTHUR WATER SYSTEM SUPPLY REDUNDANCY AND STORAGE CLASS EA

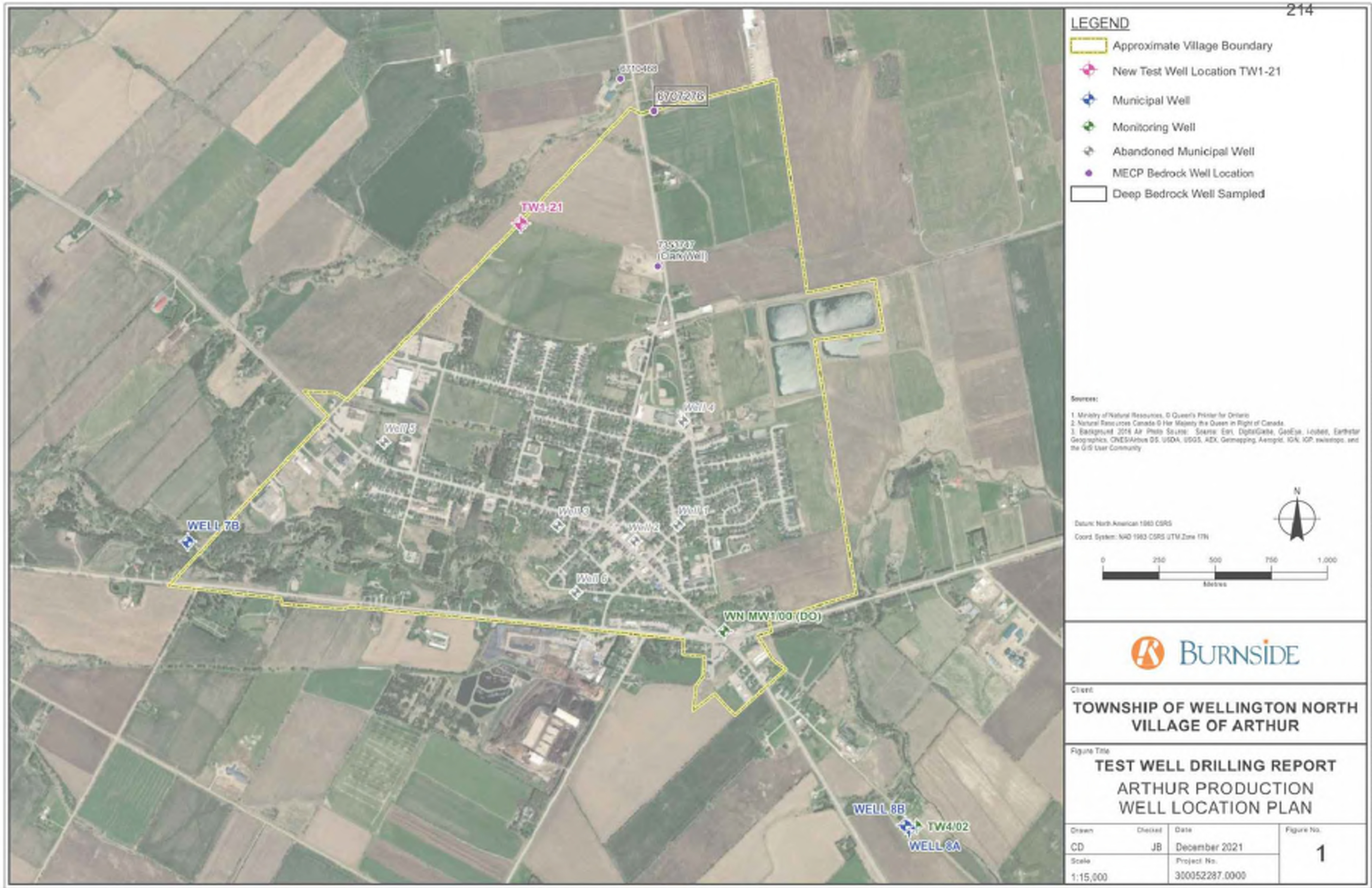

FIGURE 10

TW1-21 LOCATION

NOT TO SCALE
T4003A

TRITON ENGINEERING SERVICES LIMITED
Consulting Engineers
Fergus, Ontario

There was no observable response at the monitoring wells completed in the shallow overburden (between 4 m and 11 m below grade). At municipal Well 7B, a total drawdown of 1.2 m was observed during the pumping test; however, production from Well 7B also increased at the same time. Therefore, there is no interpreted response to the pumping test at Well 7B. Wells 8A and 8B showed a decline in static water levels during the pumping test; however, the decline is interpreted to be because of increased water consumption during a period of drought. Therefore, there is no interpreted response to the pumping test at Wells 8A and 8B.

Projected impacts (drawdown) on the closest surrounding bedrock wells of pumping at TW1-21 to meet the demands of the future population (in 2045 based on continued pumping at the average day demand) was estimated by Burnside to be between 4 m and 8 m, which is within the available drawdown limits of these wells, except for the well located at 8580 County Road 14. Upgrades to or replacement of the well noted to experience interference during the pumping test (at 8580 County Road 14) are expected to be required prior to the start of pumping from a permanent production well at the TW1-21 site.

Monitoring of private (domestic and commercial), municipal wells and associated monitoring wells also included water quality monitoring for analysis of general chemistry pre-test and post-test. Water quality monitoring at TW1-21 included the following, completed at various frequencies throughout the long-term pumping test:

- Continuous ultraviolet light transmission (UVT) and turbidity
- General chemistry, e. coli, and total coliforms
- *Cryptosporidium* spp., *Giardia* spp., pigment-bearing algae and diatoms (PBADs)
- Ontario Drinking Water Quality Standards (ODWS)

Water quality monitoring at TW1-21 during the test including daily samples for analysis of general chemistry, including major ions and metals. Analytical results were stable, with only slight changes in quality around day 3 of pumping. Concentrations of arsenic were more than half (61 to 74 percent) of the OWDS Maximum Acceptable Concentration (0.01 mg/L) but within range of health-related guideline limits. It is expected that water produced from TW1-21, and immediate area will continue to produce water with similar arsenic concentrations. The arsenic concentrations observed would require quarterly sampling/monitoring and treatment if TW1-21 was developed into a municipal well site.

Like water quality in water produced at Wells 7B, 8A and 8B, sodium in the water produced at TW1-21 during the pumping test was above the health guideline limit of 20 mg/L at an average concentration of 24.2 mg/L. Hardness as calcium carbonate ($CaCO_3$) was measured to be an average of 148.8 mg/L, which is above the ODWS operational guideline of 80-100 mg/L; however, less than the typical concentrations observed at Well 7B (309 mg/L) and Wells 8A/8B (187 mg/L).

There were no detections of e. coli, PBADs, *Cryptosporidium* spp. or *Giardia* spp. from TW1-21. Total coliform was detected in the sample collected from TW1-21 at the end of the pumping test at low concentration (2 cfu/100 mL). Therefore, based on interpretation of these results by Burnside, there is separation of the surface water and deep overburden aquifer, indicating a secure source of groundwater.

Turbidity monitoring results (average of 0.4 NTU) were below the ODWS MAC (1 NTU). UVT monitoring results fluctuated between 92 and 95 percent.

Water quality analysis of surrounding private wells does not show direct links to quality observed at TW1-21.

9.3.2.3 Surface Water Monitoring

Burnside installed a staff gauge (SG1) and piezometer (PZ1, 0.9 m deep) in Farley Creek, located approximately 150 m west of TW1-21, to monitor creek flow and shallow groundwater levels beneath the creek during the long-term pumping test at TW1-21. Farley Creek flows northeast to southwest and is a tributary of the Conestoga River.

During the pumping test, the water level in Farley Creek measured at SG1 declined, likely due to seasonally dry conditions. No response to the pumping test was also observed at PZ1, given that groundwater level trends were maintained prior to, during and after the test.

Monitoring of Farley Creek also included water samples for quality analysis (general chemistry) from PZ1 and SG1 before and at the end of pumping and compared to water quality at TW1-21. Analytical results for samples collected at PZ1 indicated no impact on the water quality of the shallow groundwater table. Further, the results are indicative that agricultural land use has not impacted the shallow groundwater table, based on the relatively low nitrate and sulphate concentrations. Analytical results for samples collected at SG1 were consistent between the sampling events are typical of surface water, indicative of impacts for surrounding land use. Given the differences in quality composition between the surface water quality and quality at TW1-21, there does not appear to be a link.

9.3.3 Conclusions and Recommendations

Per Burnside's Hydrogeological Report, the following conclusions and recommendations were made regarding the long-term pumping test completed at TW1-21.

Conclusions:

- Long-term pumping of TW1-21 at a rate of 23 L/s for 6 days resulted in a drawdown of 14.56 m.
- Interpretation of the pumping test data indicate the deep overburden aquifer at TW1-21 is leaky, confined, and is extremely permeable in the local area and thins and permeability decreases away from the TW1-21 site.
- A drawdown of up to 3.3 m was observed at nearby water supply wells monitored before, during and after the pumping test.
- Water quality results indicate the deep aquifer in the lower sediments is a secure source of groundwater (not directly influenced by surface water).

- Water quality results at TW1-21 indicate that hardness, iron and manganese concentrations are lower than water produced at existing municipal wells.
- Arsenic concentrations are less than the ODWS standard (10 ug/L); however, are more than half of the MAC, which therefore would require quarterly sampling and additional effort in terms of operation, monitoring, and maintenance.
- If TW1-21 becomes a permanent water supply source, it is recommended that the permanent pumping station be sized and designed to remove or reduce arsenic from the water to prevent or mitigate exceedance of the ODWS for arsenic, in the event that treatment is required in the future if the ODWS standard is reduced to 5 ug/L.

Recommendations:

- TW1-21 should be considered as a potential municipal water source.
- Development of the TW1-21 site would require the following:
    - Construction of two 250 mm diameter production overburden wells.
    - Short-term step testing and 6-hour tests to confirm production capacity of at least 30 L/s.
    - Monitor and define arsenic concentrations from the production wells while being pumped at the design flow rate.
    - Pumphouse design to consider appropriate treatment for secure groundwater (Category 1) and arsenic removal.
    - Amend the existing PTTW for the Arthur water supply system to include the two new wells at a continuous rate of 27 L/s, with the Hydrogeological Report and well construction report for the new production wells as supporting documentation.
    - Install automatic water level recorders in MW1-21 and 8590 Wellington Road 14 well to monitor water levels and confirm the aquifer response for one year prior to municipal pumping at the TW1-21 site.
    - Drill a new private well at 8580 Wellington Road 14 to ensure their well supply is not interrupted once municipal pumping begins and water levels decline.
    - Perform an additional well survey of all wells within 1.5 km of the TW1-21 site to document baseline conditions and identify well interference issues, if any, to support the PTTW application.

9.4 Identification of the Water Supply Preferred Solution

Evaluation of Alternatives 2a and 2b was completed on a comparative basis, based on specific considerations for the categories of the environment, including natural, economic, technical, and socio-cultural, as follows:

Natural Environment

- Water quality/quantity
- Water resources
- Natural heritage features

Technical Environment

- Ease of implementation
- Servicing/operation

Socio-Cultural Environment

- Aesthetics
- Land Use
- Property Acquisition
- Cultural and Archaeological resources

Economic Environment

- Capital and Life Cycle Costs

A summary of the comparative analysis is provided in Table 12.

Table 12: Evaluation of Water Supply Alternatives, Comparative Analysis

Environment Category	Alternative 2a – Increase Water Taking from Existing Well(s)	Alternative 2b – Addition of a New Well
Natural	• Potential impacts to vegetation, wildlife and their habitat are rated as minor. Natural heritage assets will continue to existing with or without the installation of proposed infrastructure. • Impacts to surface/groundwater quality and quantity are not anticipated as Wells 7B, 8A/8B are existing. • Increasing pumping and adding a back-up well at Well 7B or increasing pumping at Wells 8A/8B is likely to increase the size of the existing WHPA and area of WHPA-A and affect several new properties that may have DNAPL threats. • Further study is required to delineate vulnerable areas and amend the respective Source Protection Plan.	• Potential impacts to vegetation, wildlife and their habitat are rated as minor. Natural heritage assets will continue to existing with or without the installation of proposed infrastructure. • Impacts to surface/groundwater quality and quantity are not anticipated as Wells 7B, 8A/8B are existing. • The new well would change the size and orientation of the WHPA and could affect many (future) properties within and outside the urban boundary. Properties within a 100 m radius may be subject to requirements including septic inspections, manure application prohibitions and risk management plans for agricultural activities. • Further study is required to delineate vulnerable areas and amend the respective Source Protection Plan.
Social	• Will provide increased supply redundancy, which is a requirement for continued growth to meet the requirements of the Provincial Policy Statement.	• Will provide increased supply redundancy, which is a requirement for continued growth to meet the requirements of the Provincial Policy Statement.

Environment Category	Alternative 2a – Increase Water Taking from Existing Well(s)	Alternative 2b – Addition of a New Well
Cultural	• The heritage attributes of the cultural heritage assets will continue to existing with or without the installation of proposed infrastructure. Mitigation measures to continue to conserve cultural heritage value or interest will limit potential impacts.	• The heritage attributes of the cultural heritage assets will continue to existing with or without the installation of proposed infrastructure. Mitigation measures to continue to conserve cultural heritage value or interest will limit potential impacts.
Technical	• Existing wells have elevated iron (Well 7B) and manganese (Wells 8A/8B), which affect aesthetic water quality. • Water may require treatment if the proposed guidelines for iron and manganese are adopted as a standard and will include wellhouse expansion and treatment systems. • Mechanical duplication would be required at Well 7B, to improve system redundancy. • Given the methodology of calculating Firm Capacity, increasing capacity at existing wells without the addition of a new well supply will likely not increase Firm Capacity, even with mechanical duplication at the Well 7B site. • Volume of additional capacity is unknown and requires investigation.	• The site is in a future development area that will eventually require water system infrastructure regardless of siting a municipal well at the proposed location and is not considered to be in a relatively remote location like existing Wells 7B, 8A/8B. • Construction of a new wellhouse and treatment system for arsenic will be required. • Can likely achieve a rated capacity of 2332 m3/day, which will satisfy project demands beyond calendar year 2051.
Economic	• Will require the expansion of well houses, treatment facilities, sanitary sewers for discharge • of wastewater from treatment process, drilling and development of a new well. • It is uncertain if expansion of existing facilities would provide sufficient firm capacity for future development and therefore, additional water supply capacity at a new source may also be required, at additional cost. • It is expected that costs will be comparable to those anticipated for Alternative 2b.	• Will require development of two production wells at TW1-21 site, construction of a well house and associated appurtenances including treatment facilities, watermain extensions and sanitary sewer extensions for discharge of wastewater from treatment process. • Estimated Capital Cost: $3.3M - $4M, including treatment system, wellhouse, infrastructure extensions.

Consistent with Table 12, anticipated impacts to the cultural, natural, social, technical and economic environments are similar between Alternatives 2a and 2b and can be minimized via mitigation measures; however, Alternative 2b is the most prepared to meet the requirements of the future growth scenario. Therefore, Alternative 2b – Addition of a New Well is the preferred solution to address the water supply and redundancy component of the Problem/Opportunity Statement (*The existing Arthur water system requires water supply redundancy and additional water storage to support expected population growth).* Well exploration and the associated drilling of TW1-21, testing and monitoring, was assessed based on the following criteria:

- Water production of at least 10 L/s.
- Water quality that meets or exceeds the current and future Ontario Drinking Water Standards, for the following parameters: sulphate, iron and manganese.
- Exploration for a bedrock water source is preferred over increasing capacity within the deep overburden as it is anticipated that a bedrock water source would contain less iron and manganese and therefore not require construction of a treatment system.
- Exploration for a bedrock water source (in the deep carbonate bedrock aquifer) outside of the Arthur core area is preferred, given that it is anticipated to provide better water quality and source capacity as compared to existing and/or abandoned municipal wells.

The following criteria indicate that TW1-21 should be considered as a new source of municipal water:

- Located outside of the Arthur urban core.
- The ability to produce water at a rate of 27 L/s during the long-term pumping test.
- An interpreted secure source of groundwater having water quality that meets the current and future ODWS for sulphate, iron, and manganese.

It should be noted that the bedrock was not explored due to the positive results at TW1-21 in the deep overburden, in terms of capacity and water quality for sulphate, iron and manganese.

Consistent with the recommendations in Burnside's Hydrogeological Report, additional exploration and well development is recommended near the TW1-21 site, as TW1-21 is considered a potential source of municipal water. Given the location of TW1-21 is within the future road allowance, a new well should be located outside the right-of-way on adjacent private property, which will require legal permission from the property owner(s) to enter and conduct all necessary fieldwork activities.

It should be noted that *Alternative 1c – Reduce Water Demand/Implement Conservation Measures* should be considered as a key component in the implementation of the preferred alternative, since a reduction in water demands via conservation measures is expected to extend the service life of the existing and future increased water supply and storage capacities of the Arthur water supply system.

An evaluation of potential impacts resulting from the implementation of Water Supply *Alternative 2b – Addition of New Well(s) to the Existing Municipal System* is provided in Section 13.

10.0 Evaluation of Water Storage Alternatives

Additional water storage is required to support the existing community and expected population growth in Arthur. Section 7.3.2.2 and 7.3.2.3 of this Report summarizes the preliminary estimate of water storage volume required for the projected population growth in Arthur and considerations for pressures within the water distribution network, respectively.

Adequate water storage facilities are required in a municipal water system to ensure sufficient flows and pressures during peak hour demands, critical demands during fires, infrastructure failure events such as watermain breaks and power outages and to provide redundancy during maintenance operations. Storage facilities are designed to have distinctive storage layers, each serving a particular purpose. The equalization storage layer is located at the top of the storage facility and is usually cycled on a daily basis to meet peak demands, ensuring adequate pressure throughout the distribution network. Emergency storage is defined as the water level in the storage facility above which 20 psi can be maintained within the distribution network and is typically used only during fire and emergency events. To meet current and future water demands, water storage facilities are typically designed for extended planning horizons as they are difficult to expand, and economies of scale are significant.

It should be noted that an increase in the HGL of approximately 10 meters, to a maximum operating level of 510 meters, would provide an overall pressure increase of 14 psi within the existing water distribution network and achieve a normal pressure within the range of 40 psi to 100 psi within the future development areas of Arthur. This would also improve the fire flow capability throughout the system whilst also keeping maximum system pressure under the acceptable limit of 100 psi within the entire distribution network.

The type of storage facility selected is influenced by several factors, including but not limited to function, elevation/topography, life cycle costs and the volume of storage required.

Siting the system storage requires evaluation of various factors, including but not limited to:

- Land availability and ownership.
- Proximity to the existing water distribution system.
- Site elevation.
- Potential impacts on adjacent properties.
- Potential impacts on natural and heritage features.
- Type of facility being considered.

The three main types of water storage facilities that are commonly used in Ontario are elevated tank/water tower, ground level or partially buried reservoir with booster pumping provisions and standpipe with booster pumping provisions. Each type has their own advantages and disadvantages that should be weighed out in evaluating and selecting a storage facility to design and implement.

Elevated Storage/Water Tower

Elevated storage/water towers provide water storage in a tank that is mounted on a support system. In recent years, the support or pedestal is usually constructed of reinforced concrete. In the past, many elevated tanks were supported by steel structures. The most prominent advantage of an elevated tank is the ability to store all the contents at a height where it is available to feed the distribution system by gravity and provide adequate and uniform pressure to the distribution system. Filling of such a facility is typically provided by high lift pumps at well sites, or booster pumps within the distribution system, which increase system pressures.

In addition to providing storage for the water system, elevated tanks minimize the need for continuous and emergency high lift pumping, thereby making the system more energy efficient. Often, elevated tanks are used to control the operation of the supply pumps at each of the well sites such that the elevated tank can supply water to the system during peak electricity rate periods, allowing the supply pumps to fill the tank during off peak times, resulting in cost savings and less stress on the electrical grid.

An elevated tank typically has lower operating and maintenance costs when compared to alternatives that require booster pumping due to:

- Reduced pumping during peak electrical periods resulting in lower energy costs.
- Less and simplified mechanical and control equipment reducing operating staff time for process set-up, checks and maintenance, and reduced capital cost for equipment replacement.

There are different types of elevated storage/water towers, including spheroid, multi-column, composite and composite glass-lined. Spheroid elevated towers are a spherical water storage tank that is elevated and supported by a single cylindrical pedestal with a flared conical based (i.e., Freud Spheroid Tower). Multi-column towers (traditional design) provide a steel elevated tank that is supported by columns and cross-braces (i.e., Charles Street Multi-Leg tower). Composite water towers are considered modern, having a steel elevated storage tank supported by a large diameter steel-reinforced concrete tower base on a concrete foundation. Composite glass-lined towers are the newest type of water storage facility that has a glass-lined elevated steel tank (glass fused to steel coating) supported by a large diameter steel-reinforced concrete tower base on a concrete foundation.

In terms of new construction, composite towers are the most common given that its design provides an economical solution with reduced maintenance costs (i.e., only the steel tank requires painting at a frequency of every 20 years as opposed to the entire structure of a spheroid or multi-column tower), interior access to the elevated tank (as opposed to the Spheroid Tower and Multi-Leg tower, which only have exterior access) and valuable structural properties. Composite glass-lined towers have reduced maintenance requirements than the composite tower; however, the life expectancy has not been confirmed given that it is a relatively new design. Additionally, it is susceptible to damage from seismic activity, wind and ice and does not provide interior access. Therefore, the composite tower is considered the preferred elevated storage design.

As mentioned, the steel portion of the elevated tank of a composite tower does require periodic maintenance to ensure that the coating continues to adequately protect the steel. This requires the tank to be taken off line for interior cleaning, inspection and re-coating. Under ideal design conditions, elevated tanks are normally located at a high elevation in the system to minimize the required height of the support pedestal thereby reducing capital costs. The initial capital cost for an elevated tank is typically higher than for a ground level reservoir or standpipe complete with booster pumping.

From an aesthetic perspective, these facilities are often utilized as a community focal point and community identification/ “way finding” or “way marking” if they are located in a visible area near main entrance roads to the community. However, they also create shadows which can be a negative impact for nearby property owners. An elevated water tower may also provide the municipality with the possibility of revenue generation through renting space for the installation of communications antennae.

Ground Level or Partially Buried Reservoir and Booster Pumping Station

Reservoirs typically require a larger site footprint compared to an elevated tank as their height is less than or equal to their diameter. Most reservoirs require booster pumps to maintain system pressures. When there is no elevated storage on the system, booster pumps must operate continuously. As a result, this storage alternative does not improve upon the energy efficiency of the existing system. Further, this type of storage facility has more mechanical parts than other types of storage facilities due to the requirement for pumping. As a result, there are greater operating and maintenance costs. Depending on the configuration of the reservoir, it could be built in phases with additional volume added to meet system storage requirements. Revenue generation is limited with this type of facility as the height is typically not sufficient for the installation of antennae.

Standpipe and Booster Pumping Station

Standpipes are typically taller than their diameter. They are usually constructed of steel and contain water in the entire height of the structure. They are designed such that only the top few metres of the facility volume is available by gravity to maintain system operation/pressures. Booster pumps are often installed at standpipes to utilize the majority of the storage volume during emergency and fire flow conditions. Depending on the cost of the required pumping system, a standpipe may cost less than an elevated tank while providing some energy savings compared to a ground level reservoir.

Standpipes are not as energy efficient as elevated towers due to the small storage volumes available for system pressure maintenance. The requirement for pumps also results in higher operating and maintenance costs compared to an elevated tank. However, standpipes have two of the same disadvantages as elevated tanks in that they are difficult to expand and they can shade adjacent properties. Similar to Elevated tanks, there is some potential for revenue generation with a standpipe.

Preferred Type of Water Storage Facility

Based on the description of the main types of water storage facilities (provided in Section 10.0), the composite elevated water storage facility is a better option compared to other alternatives (ground level or partially buried reservoir and booster pumping station or standpipe and booster pumping station) due to the combination of gravity-fed pressure, energy efficiency, cost savings, lower maintenance requirements, and additional community benefits.

10.1 Alternative 3a – Construct a New Water Storage Facility to Supplement Existing Storage Facilities

In this scenario, the existing Spheroid and Multi-Leg towers would remain in operation and a new water storage tower would be constructed to provide additional storage capacity for the water system. As previously indicated and supported by the CIR for the June 2025 cleaning and inspection by Landmark Municipal Services the existing Multi-Leg tower has reached the end of its service life and it is recommended to be removed from service. Therefore, this alternative is not considered for further evaluation given that the existing Multi-Leg tower needs to be decommissioned.

10.2 Alternative 3b – Construct a New Water Storage Facility and Decommission the Existing Multi-Leg Tower

In this scenario, the existing Spheroid tower would remain in operation, and a new water storage tower would be constructed to provide additional storage capacity for the water system. In addition to providing additional water storage capacity, a new elevated storage facility would provide an opportunity to improve pressures within the water distribution network in the future and allow for servicing of future development in the lands to the north and east of the existing built-up areas of Arthur, if constructed in a location at a higher elevation than the existing spheroid water tower.

The difficulty of implementing this strategy is that the towers in a given pressure zone typically need to be operating at the same HGL, similar to existing conditions. Therefore, in maintaining the existing Spheroid Tower, and operating a new tower at a higher HGL would require a separate pressure zone be established. Creating multiple pressure zones in a system increases the operating complexity and infrastructure requirements.

Although the CIR for the 2024 cleaning and inspection of the Spheroid Tower did not note any significant issues; the Spheroid Tower is aging (was constructed in 1969 and commissioned in 1970) and it is expected that the cost to maintain this asset will eventually outweigh the cost to replace it. Assuming an 80-year service life, the Spheroid Tower will have reached its theoretical service life by 2050. Therefore, consideration of constructing a new tower at a higher elevation (which is expected to provide sufficient pressures to future development lands to the north and east of the exiting built up area) should be considered.

As presented in the System Pressure Testing Report (refer to Appendix E), it would be reasonable to design the future water system to have the LWL equal to the existing LWL (493.303m) and future HWL (FHWL) to be 3 metres above the existing HWL (498.703m) to provide a FHWL of 501.703m and a future operational range of 8.4m. Therefore, allowing the new system to operate at the existing HWL of 498.703m until the Spheroid tower is due for decommissioning and maintaining one pressure zone while both are operating together.

Operating the system with two towers presents several benefits including redundancy and reliability, allowing the pressure within the system to be sustained in the event of one of the towers being offline due to maintenance or a failure. This type of system also improves pressure management and fire flow capacity as the pressure and volume source is available from multiple locations within the system. Additionally, it improves the energy efficiency as the pumped water does not need to travel as far to reach one of the storage facilities.

10.3 Alternative 3c – Construct a New Water Storage Facility and Decommission Both of the Existing Water Storage Facilities

In this scenario, both the existing Multi-Leg and Spheroid towers would be decommissioned and replaced with a single new elevated tower located at a higher HGL than the existing Spheroid and Multi-Leg towers. This new tower would be designed to provide sufficient storage capacity to address the immediate and future water storage requirements of the existing and future population to at least Calendar Year 2051 and would provide sufficient pressures within the watermain distribution network for the future development areas to the north and east of the existing built-up area, within the urban boundary.

It is anticipated that the new water tower can be constructed at a higher elevation than the existing water storage towers, resulting in an overall pressure increase throughout the watermain distribution network. This increase will ensure that all current and future development areas, as outlined in the 2018 Growth Plan and the 2020 Water and Sanitary Systems Technical Study, receive adequate water pressure and fire flows.

The future development areas, particularly those in the most northern and eastern extent of the urban area, are situated at higher topographic elevations than the existing community. Without an increased HGL, these areas would experience lower water pressures, ranging from 24 to 30 psi, which are below acceptable standards for residential developments. The new elevated tower, with an HGL of 510 meters, is expected to provide sufficient pressure to all future development areas.

10.4 Identification of the Water Storage Preferred Solution

Evaluation of Alternatives 3b and 3c was completed on a comparative basis, based on specific considerations for the categories of the environment, including natural, economic, technical, and socio-cultural, as follows:

Natural Environment
- Natural heritage features

Technical Environment
- Ease of implementation
- Servicing/operation

Socio-Cultural Environment
- Aesthetics
- Land Use
- Property Acquisition
- Cultural and Archaeological resources

Economic Environment
- Capital and Life Cycle Costs

A summary of the comparative analysis is provided in Table 13.

Table 13: Evaluation of Water Storage Alternatives, Comparative Analysis

Environment Category	Alternative 3b – Construct a New Water Storage Facility and Decommission the Existing Multi-Leg Tower	Alternative 3c – Construct a New Water Storage Facility and Decommission Both of the Existing Water Storage Facilities
Natural	• Potential impacts to vegetation, wildlife and their habitat are rated as minor. Natural heritage assets will continue to existing with or without the installation of proposed infrastructure.	• Potential impacts to vegetation, wildlife and their habitat are rated as minor. Natural heritage assets will continue to existing with or without the installation of proposed infrastructure.
Social	• Will provide increased water storage capacity, which is a requirement for continued growth to meet the requirements of the Provincial Policy Statement.	• Will provide increased water storage capacity, which is a requirement for continued growth to meet the requirements of the Provincial Policy Statement.
Cultural	• The heritage attributes of the cultural heritage assets will continue to existing with or without the installation of proposed infrastructure, noting that the Multi-Leg tower is an antiquated asset that requires decommissioning and removal to avoid the risks and expenses in preserving the structure as a landmark. • Mitigation measures to continue to conserve cultural heritage value or interest will limit potential impacts.	• The heritage attributes of the cultural heritage assets will continue to existing with or without the installation of proposed infrastructure, noting that the Multi-Leg tower is an antiquated asset that requires decommissioning and removal to avoid the risks and expenses in preserving the structure as a landmark. • Mitigation measures to continue to conserve cultural heritage value or interest will limit potential impacts.
Technical	• Retaining the spheroid tower allows the operational advantage of a two-tower system to be retained once the Multi-Leg tower is decommissioned and the remaining service life of the spheroid tower can be realized.	• A single tower system reduces storage redundancy and will sacrifice the remainder of the service life of the existing spheroid tower.
Economic	• Estimated New Tower (1,000 m^3 capacity) capital cost is between $5M and $6.5M. • Estimated Spheroid Refurbishment Capital Cost is between $2M and $2.5M. • Operational Cost: No change anticipated for the existing system as there would be no additional facilities to operate.	• Estimated New Tower (2,000 m^3 capacity) capital cost is between $7M and $8.5M. • Estimated existing spheroid demolition costs: $1M. • Operational Cost: Marginal operation cost reduction from the existing system.

Consistent with Table 13, anticipated impacts to the cultural, natural and social environments are similar between Alternatives 3b and 3c. Alternative 3b – *Construct a New Water Storage Facility and Decommission the Existing Multi-Leg Tower* is identified as the preferred solution to address the water storage component of the Problem/Opportunity Statement as it is the alternative that is most prepared to meet the requirements of the future growth scenario and offers an operational advantage over a single tower system. Retaining the Spheroid Tower while constructing and implementing a new tower provides a strategic advantage in terms of cost efficiency and operational continuity. By keeping the Spheroid Tower operational until it reaches the end of its service life, the community can defer some of the capital costs associated with constructing and maintaining additional new infrastructure. It is noted that maintenance of the existing Spheroid Tower is required, as noted in the CIR for the 2024 cleaning and inspection, including increased security at the site (site security fencing and locks), various accessories and improvement to the bell landing floor, full removal and replacement of the tank exterior system (25-30 year solution) when deemed cosmetically required, and full removal and replacement of the tank interior within the next 2 to 4 years (25-30 year solution). This allows for a phased implementation approach, which will address the increased pressure demands of future development lands at higher elevations whilst also improving overall system reliability. Further to this, the new tower can be designed such that it is operated at a lower elevation (until the existing Spheroid tower is decommissioned), reducing energy losses within the distribution network.

Additionally, operating the new elevated tower alongside the existing Spheroid Tower provides a reliable water storage system. Placing the tower strategically near future development areas, at a higher elevation, would further allow these areas to operate at a higher HGL in the future and the existing Spheroid Tower would continue to support current demands, maintaining adequate pressure and fire flow capabilities across the existing urban boundary. This dual-tower operation not only enhances the system's redundancy and reliability but also ensures a smoother transition and integration of new infrastructure, mitigating risks of supply disruptions during the development phases. Ultimately, this approach aligns with the community's long-term growth plans, balancing immediate infrastructure needs with future scalability and resilience.

It should be noted that Alternative *1c – Reduce Water Demand/Implement Conservation Measures* should also be considered as a key component of the identified preferred alternative solution, since its implementation is expected to extend the service life of the existing and future increased water supply and storage capacities.

10.4.1 Siting of Storage Facility

Per MECP design guidelines, consideration in choosing a site for a water storage facility includes:

- Pressures within the water distribution network (including topography) and water demands throughout the distribution network
- Pumping and transmission costs
- Safety considerations
- Aesthetic concerns
- Future expansion, and
- Site access.

MECP recommends that a water tower is placed in the area of the highest water demand and/or low pressure and ideally with the tower at the topographically highest elevation of the serviced area; however, should also consider whether the placement will be located in the centre or on the extremity of the service area and impacts to pressures as well as pumping and transmission costs. Safety considerations include proximity (i.e., at least 15 m) to potential sources of contamination (i.e., sewers, drains, septic tanks, tile fields, standing water, etc).

Typically, a minimum 0.5 ha site is required for an elevated water storage tank, and a Geotechnical Investigation is required to confirm the subsurface conditions to support an elevated water storage tank and construction requirements.

Based on MECP recommendations for storage facility siting, it is recommended that an Elevated Storage Facility be installed within the future development area adjacent to the unopened Macauley Street right-of-way or near/within the same site as the new well at TW1-21 site, so that the new well can be used to fill the tower increasing energy efficiency.

Prior to confirming final sizing of the storage facility, the Township should consider the life expectancy of the Spheroid Tower and potential development beyond 2051, since the economies of scale are significant with these facilities, and they are not expandable.

11.0 CONSULTATION PROGRAM

11.1 General

Consultation with affected parties is a key component of the environmental assessment process. Public involvement at the onset of a project allows early identification of concerns/information, improves project understanding, and focuses planning and decision making.

Proponents undertaking a Schedule “B” Class EA are required to engage in a screening process that includes a mandatory minimum of two points of contact with stakeholders (i.e., agencies, interest groups, Indigenous Communities and the public). The proponent has the freedom to tailor the consultation program, including the methods of contact, to suit the project and stakeholder needs; however, the minimum requirements must be met and must ensure that stakeholders are aware of the project and have ample opportunity to provide input related to project.

The first mandatory point of contact is during Phase 2 of the Class EA process, after the project problem/opportunity statement has been identified, an inventory of existing environmental resources and local sensitivities that may be impacted by alternative solutions have been identified. The purpose of the first point of contact is to review potential issues, and invite public input to assist in selection of a preferred solution. Although the Class EA Schedule is typically selected by the proponent before the first point of contact is made, the input from the first point of contact will confirm or change the Schedule and determine how the project proceeds. The mandatory first point of contact is the same for Schedule B and C projects and Schedule A projects do not require formal contact with the public.

The second mandatory point of contact is made at the completion of the planning process in the form of a Notice of Completion. The purpose of the Notice of Completion is to formally advise the public and agencies of the 30-calendar day (minimum) review period before the proponent will proceed to design and construction of the recommended preferred alternative solution. Prior to implementation of a project, the proponent is obligated to consider and address any concerns that are presented from the stakeholders. Ultimately, the Minister makes the final decision on all comments/concerns/input, if any, as to whether the project requires a higher level of assessment (i.e., Part II Order granted, but only if it applies to potential adverse impacts to constitutionally protected Aboriginal and treaty rights), if it should be approved with conditions, or if it can proceed without conditions.

The Aboriginal and Treaty Rights Information System (ATRIS) was consulted to search for Indigenous Communities within a 50 km radius of the Study Area and the Metis Nation of Ontario, Mississaugas of the New Credit First Nation, Six Nations of the Grand River Territory, Haudenosaunee Development Institute and Saugeen Ojibway Nation were included in the stakeholder contact list. The stakeholder contact list was updated to include the Chippewas of Nawash First Nation and Saugeen First Nation, following receipt of MECP acknowledgement of the Notice of Commencement.

11.2 Notice of Commencement

A Notice of Study Commencement (Notice) was posted in the July 13th and 20th, 2023 issue of the Wellington Advertiser, which is a free press weekly newspaper that is distributed throughout Wellington County. The Notice was also posted on the Township's website on July 13th, 2023 and distributed in a letter (via mail and/or email) to approval agencies, Indigenous Communities (via registered mail), utility suppliers, municipalities, and potentially interested stakeholders. The purpose of the Notice was to create awareness of the project and act as an invitation to participate in the EA screening process. A copy of the Notice and stakeholder contact list that the notice was distributed to is provided in Appendix K.

Comments were received from MECP, MNRF, MCM, DFO, GRCA Indigenous Affairs, Métis Nation of Ontario, Six Nations of the Grand River Territory and private stakeholders in response to the Notice of Commencement. In general, the comments included acknowledgement of receipt of the notice and provided background information and guidance on requirements for the project or requested to be added to the Project Contact List. A summary of the comments received following distribution and advertisement of the project Notice of Commencement is provided in Appendix K.

11.3 Public Information Centre

Consistent with the requirements of the Class EA process for Schedule 'B' projects, formal (mandatory) contact with project stakeholders took place in the form of a Public Information Centre (PIC). The PIC was held on November 26, 2024 between the hours of 5:00 pm and 7:00 pm, at the Arthur Area Curling Club (160 Domville St, Arthur). Notice and invitation to the PIC were included in the November 14 and 21, 2024 issues of the Wellington Advertiser newspaper and was distributed to the stakeholder contact list via various methods of delivery (e.g., email, hard copy letter, or registered mail).The Notice of PIC was also posted to the Township's website and its social media pages. A copy of the Notice of PIC and the stakeholder contact list that it was distributed to is included in Appendix L.

The purpose of the PIC was to present the background/existing inventory of the environment, including results of any studies that were conducted to assist in the evaluation, the alternative solutions to address the problem statement, anticipated impacts (positive and negative) to the environment, mitigation measures to reduce or eliminate negative impacts, and the preliminary preferred alternative solution based on the comparative evaluation matrix and information collected as of the PIC date. A copy of the information boards that were on display at the PIC are provided in Appendix L. A copy of the attendance sheet for the PIC is also included in Appendix L. A summary of questions, comments and/or concerns received in response to the PIC and how these items were addressed by the Proponent are provided in Appendix L. Although comment sheets were available at the meeting, none were submitted at or following the meeting. None of the feedback received concerned potential adverse impacts to constitutionally protected Aboriginal and treaty rights.

As noted in Appendix J, the Township will consult with residents/owners of private property impacted by the project, as required, during the next phase of the project to finalize the details for the design and implementation of the preferred alternative.

11.4 Notice of Completion

The second point of mandatory contact is the Notice of Completion, which was published in the December 4, 2025 issue of the Wellington Advertiser newspaper and was also distributed to review agencies (via registered mail and email), Indigenous Communities (via registered mail and email) and public stakeholders (via regular mail and/or email) on December 4, 2025.

A copy of the Notice of Completion, template for notifications, and the distribution list is provided in Appendix M. This Project File Report was filed for public review, through the Township website and hardcopy at the Township office, starting on December 4, 2025.

Consistent with MECP's recommendations, each of the Indigenous Community contacts on the distribution list for the Notice of Completion were contacted via email and phone call as a follow-up on the letters/notices that were circulated for the Class EA.

12.0 RECOMMENDED PREFERRED ALTERNATIVES

Alternative 2b – *Addition of New Well(s)* and Alternative 3b – *Construct a New Water Storage Facility and Decommission the Existing Multi-Leg Tower* have been identified as the recommended preferred alternatives to address the Problem/Opportunity Statement, *The existing Arthur water system requires water supply redundancy and additional water storage to support expected population growth.*

12.1 Project Implementation

As determined by this Class EA and documented in this Report, water supply redundancy and additional water storage is required for the Arthur water system to support expected population growth. Sections 7.3.2.1 and 7.3.2.2 provide a preliminary estimate of the water supply capacity and storage volume, respectively, required for each of the planning horizons. The sizing of the water storage facility will be completed during detailed design.

13.0 POTENTIAL IMPACTS

13.1 Natural Environment

Potential impacts to vegetation, wildlife and their habitats are rated as minor for implementation of the preferred alternatives. Mitigation measures can be used to avoid any adverse impacts to wildlife and habitat.

Further study is required following completion of this Class EA to delineate vulnerable areas and amend the Grand River Source Protection Plan.

13.2 Economic Environment

Implementation of the preferred Alternative supports the intent of the Growth Plan, consistent with the projections in the MCR.

13.2.1 Capital Costs

Implementation of Alternatives 2b and 3b requires the construction of a new municipal well and water storage facility, as well as associated infrastructure (well house, contact chamber, etc.), connection to the associated existing water distribution network and associated permitting and the repair and maintenance costs as estimated by Landmark Municipal Services. The total preliminary estimated capital cost of the infrastructure as described above is estimated to be between $19,730,000 and $21,951,000. A breakdown of the estimated costs is provided in Appendix N. These costs are subject to change based on the detailed design considerations of the infrastructure. Additionally, the distribution network connection length may be increased, or decreased, depending on the layout of the adjoining development areas.

13.3 Technical Environment

In addition to implementation of the preferred Alternatives, it is recommended that the Township explore opportunities to reduce water demands/implement water conservation measures to extend the service life of the supply and storage capacity of the Arthur water system.

13.3.1 Supply

Evaluation of Alternative 2b to meet the demands of the existing and future population to Calendar Year 2051 is summarized in Table 14.

Table 14 – Evaluation of Alternative 2b to Meet the Demands of the Existing and Future Population

Projected Serviced Population	**2023 (Existing)**	**2026**	**2031**	**2036**	**2041**	**2046**	**2051**
Projected Supply Requirements (m^3/day)	1,545	1,692	1,886	2,031	2,127	2,272	2,321
Arthur Well 7 Capacity (m^3/day)	1,961						
Arthur Well 8A/8B Capacity (m^3/day)	2,255						
Existing Source Capacity (m^3/day)	4,216						
Existing Firm Capacity (m^3/day)	2,255						
Existing Firm Reserve Capacity (m^3/day)	710	563	369	224	128	-17	-66
Existing % Firm Reserve Capacity Utilization	69	75	84	90	94	101	103
TW1-21 Capacity (m^3/day)	2,333						
New Source Capacity (m^3/day)	6,549						
New Firm Capacity (m^3/day)	4,216						
New Firm Reserve Capacity (m^3/day)	2,671	2,524	2,330	2,185	2,089	1,944	1,895
% Firm Reserve Capacity Utilization	37	40	45	48	50	54	55

13.3.2 Storage

Based on Table 9, it has been determined that at least 900 m^3 of storage capacity is required to meet the storage requirements of the projected future population to Calendar Year 2051, while the capacity of the Spheroid Tower remains in service. It is recommended that the storage requirements continue to be updated on an annual basis to monitor the water storage needs of the existing and future population as the Spheroid Tower approaches the end of its service life to determine the capacity requirements for the Spheroid Tower replacement storage facility.

13.3.3 Distribution Network

In order to connect the new well and storage facility to the existing municipal system, approximately 1,670 m of 300 mm diameter watermain and associated appurtenances including treatment facilities/reservoir, pressure controls and wellhouse will need to be constructed. Associated utilities and road/easement/servicing corridor restorations would also be required as part of the connection.

13.4 Social Environment

13.4.1 Community

Implementation of the Alternatives 2b and 3b will permit the extension of water services to new developments, which is a requirement for continued growth to meet the requirements of the PPS and Growth Plan. Construction of the preferred alternatives may result in visual disturbance to adjacent properties and will be reviewed during detailed design.

13.5 Cultural Heritage Environment

13.5.1 Built Heritage Resources and Cultural Heritage Landscapes

Although the Study Area is located within a Heritage River Watershed (Grand River Watershed), the TW1-21 site and immediate surrounding area is not adjacent to the Grand River and/or buildings or structures that are 40 or more years in age. Therefore, it is interpreted that it does not meet the criterion requiring any further Cultural Heritage work.

The Charles St Multi-Leg tower could be considered to have historical and cultural significance as a landmark within the Study Area; however, preservation of the structure following decommissioning is not recommended given the associated risks and expenses, consistent with Landmark's CIR dated September 2025. Therefore, it is recommended the Township explore alternative ways to honour its legacy.

13.5.2 Archaeological Resources

A Stage 1 Archaeological Assessment will be completed for the future well exploration site(s) once a site location is determined and permission to enter has been received from the property owner and prior to proceeding with exploration work. Stage 1 Archaeological Assessments include a background study of historical data and property inspection of the subject site to determine the archaeological potential of the property that may be disturbed as a result of project implementation.

13.6 Source Water Protection

Wellington Source Water Protection, Risk Management, provided a Memorandum, entitled Preliminary Assessment of Source Protection Implementation Requirements for a Potential New Well Site, dated June 25, 2024. The purpose of the Memorandum was to evaluate the potential source protection implementation requirements for TW1-21.A copy of the Memorandum is provided in Appendix O.

As stated in the Memorandum, any changes to a municipal drinking water system (i.e., new well expansion of an existing well, etc.) requires the delineation of wellhead protection areas, updates to vulnerability scoring, and other reference layers, in accordance with the Clean Water Act and Safe Drinking Water Act. Additionally, the corresponding Source Protection Plan must be updated to include the changes prior to the distribution of water to the public. Updates to the Grand River Source Protection Plan to incorporate the new WHPAs must be completed through a public process.

A summary of expected results from adding TW1-21 to the Arthur municipal drinking water system is as follows:

- The WHPAs for TW1-21 is assumed to run generally to the northeast and short distance to the southeast of the well location, consistent with the current orientation of the existing WHPAs for existing wells 7B and 8A/8B.

- Properties expected to be impacted by the new WHPAs include agricultural and rural residential; however, may overlap existing WHPA Zone D of existing Well 7B, which impacts an existing industrial area of Arthur.
- It is likely that the vulnerability scores outside of the WHPA Zone A for TW1-21 would remain low (i.e. WHPA Zones B, C and D having vulnerability scores of 6, 4, and 2, respectively).
- Properties within a 100 m radius of the new well (TW1-21 location) may be subject to a number of requirements, including septic inspections, manure application prohibitions, risk management plans for agricultural activities and for chemical handling/storage and education requirements. Conditions/restrictions (i.e., no private servicing) will be applicable to developments created within 100 m of the new well.
- If a backup generator is to be incorporated into the design of the new well, spill containment and risk management measures would be required.

The wellhead protection area for TW1-21 should be delineated using the original model used to develop the WHPAs for Arthur Wells 7B and 8A/8B.

13.7 Climate Change

The MECP Guide entitled Considering Climate Change in the Environmental Assessment Process guide, dated October 2017 was consulted as part of the planning for this Class EA project to consider the impacts of this project on climate change, the impacts of climate change on this project, and associated mitigation and adaptation measures.

13.7.1 Project's Impact on Climate Change

The project will generate limited greenhouse gas emissions during construction and occasionally during operation, by carbon dioxide emissions from heavy vehicles and backup generator during power outages/emergency situations. It is expected that all construction equipment and backup generator will be in good working/efficient condition, minimizing greenhouse gas emissions.

Vegetation removal during construction will be limited, including tree removals. The anticipated well and storage facility site, is adjacent to the municipal right-of-way, on undisturbed private property with tall grasses. The watermain construction required to connect the new well and storage facility to the existing distribution network will occur either within an existing or unopened road right-of-way. There is an opportunity for the design of the new well and storage facility site to incorporate landscaping to compensate for any vegetation removal and provide carbon sinks.

Additionally, the associated pump house building does not need to be heated or cooled to typical human comfort levels as it is not occupied. In the summer, the water circulating in the pumphouse and the water tower will act as a heat sink to keep the buildings cool in the summer. In the winter, the buildings only need to be heated between 10°C and 15°C to keep the building from freezing.

Given the anticipated impacts on climate change, it is understood that this project is sufficiently minor in scale.

13.7.2 Impact of Climate Change on Project

Extreme weather events (i.e., extreme temperatures, winds, precipitation) may occur and impact the operation, structural integrity, and utilities of the new well and storage facility. Impacts to operation include reliability, continuity, maintenance, and to utilities including communications, drainage/wastewater, and fire and safety. Temporary loss of service or function due to climate related extremes may occur; therefore, a backup generator will be included in the design of the new well and pumphouse, so that impacts are mitigated. Other adaptations to mitigate impacts from climate change will include consideration of temperature extremes, building materials, building floor elevation to mitigate impacts from flooding, etc.

Climate change may affect the local water supply over time. Operation of the proposed municipal well and associated municipal water system will be in accordance with the applicable Permit to Take Water and drinking water permits. Annual reporting of water takings is required by the PTTW and is used to determine changes in capacity over time, which may be attributed to climate change, given changes in weather conditions (i.e., less snowfall, timing of snow melt, increase in drought, reduced soil moisture, etc.).

13.8 Excess Soil Management

Implementation of the project will require some excavating for construction of the wellhouse, well site and foundation/footing of the storage facility and for watermain installation. Excess soils management investigations will be completed during detailed design of the project, as required by and in accordance with the Ontario Regulation (O. Reg.) 406/19: On-Site and Excess Soil Management.

14.0 MITIGATING MEASURES

During well exploration and development of the proposed well site and construction of the new water storage facility, the following mitigating measures will be implemented to minimize impacts on the environmental features on adjacent lands:

- Provide notification of construction activities and construction schedule to surrounding properties.
- Minimize vibrations, dust and odours during construction.
- Install and maintain sediment and erosion control measures to minimize impacts on surrounding properties, streams and wetlands.
- Ensure construction activities will be undertaken during the hours specified in the Township's Noise By-Law.
- Employ a wildlife ecologist to undertake an active nest survey to establish nest protection zones if tree removal or trimming should be required during the generalized nesting period of April 1 to August 31.
- Implement a monitoring program, as part of an eventual Permit To Take Water for the proposed well to examine the potential for longer term impacts to environmental features and to assess

the potential for impact during dry annual conditions, as well as to assess long-term effects on the bedrock system (and potential private well interference).

- Inform Contractor to stop work and report to MCM, any potential archaeological resources if any, found during construction and consult with Indigenous Communities.
- Restrict idling of construction equipment, as practicably possible, during construction to reduce greenhouse gas emissions.
- Operate equipment that is energy efficient, so as to conserve energy and reduce greenhouse gas emissions.
- Incorporate landscaping into the restoration of the well and storage facility site to compensate for vegetation removal during construction and create carbon sinks for greenhouse gas emitted during operation.
- Design and restore the well and storage facility site so that it is compatible with and minimizes aesthetic disturbances to adjacent properties.
- Construct the new facilities to provide clearance from the 100-year floodline.
- Complete required geotechnical investigations during detailed design and incorporate the recommendations into the design of structural components of the project.
- Minimize the volume of excess soil to be generated during construction of the project and reuse excess material, on site, as reasonably practicable. This will also reduce associated hauling efforts required.
- Manage excess soil in accordance with O. Reg. 406/19.
- Dispose of waste generated during construction in accordance with MECP requirements.
- Provide emergency backup power via a standby diesel generator with on-site fuel storage, weatherproof and noise enclosure, designed to applicable regulations including MECP air and noise regulations.
- Incorporate stormwater management into the design to mitigate potential impacts from flooding and extreme weather conditions.
- Implement a spills management and response plan for during construction and operation, as well as an operation and maintenance manual for the facilities.
- As part of planning for the decommissioning of the Multi-Leg Tower, it is recommended the Township explore alternative ways to honour its legacy.

15.0 Anticipated Approvals

Approvals, permits and requirements for implementation of this Project during design and/or construction are expected to include the following:

- Permission to enter private property for the purpose of well exploration and associated studies.
- Permit to Take Water.
- Environmental Activity and Sector Registry.
- Site Plan Approval.
- Rezoning applications for proposed use.

- Building Permit.
- Approvals from applicable agencies for associated work (i.e., TSSA, Electrical Safety Authority).
- Utilities (i.e., gas, hydro, communications, etc.).
- Updated Source Water Protection Plan with new WHPAs.
- Drinking Water Works Permit Amendment.
- Municipal Drinking Water License Amendment.
- MECP Form 1 for new watermain.

16.0 Additional Studies Required

It is anticipated that the following studies will be required during the next phase of the Project:

- Stage 1 Archaeological Assessment of the well exploration site once determined.
- Well Exploration and associated pumping tests to support application for production well PTTW approval.
- Geotechnical investigation.
- Water Conservation Opportunities.

17.0 Next Steps

It is anticipated that the next phase of the Project will include but not be limited to the following tasks:

- Consult with the Township to prepare an implementation strategy for required water system infrastructure upgrades, including phasing and scheduling. This strategy will depend primarily on development timing and funding sources.
- Township should proceed with well exploration adjacent to the TW1-21 site, outside of the municipal right-of-way and continue with development, assuming anticipated favorable well exploration results. Development of the new well is expected to include the following:
    - Construction of two 250 mm diameter production overburden wells
    - Short-term step testing and 6-hour tests to ensure production capacity of at least 30 L/s.
    - Monitor and define arsenic concentrations from the production wells while being pumped at the design flow rate.
    - Pumphouse design to consider appropriate treatment for secure groundwater (Category 1) and arsenic.
    - Amend the existing PTTW for the Arthur water supply system to include the two new wells at a continuous rate of 27 L/s, with the Hydrogeological Report and well construction report for the new production wells as supporting documentation.
    - Install automatic water level recorders in MW1-21 and 8590 Wellington Road 14 well to monitor water levels and confirm the aquifer response for one year prior to municipal pumping at the new well site.

  - Drill a new well at 8580 Wellington Road 14 to ensure that their well supply is not interrupted once municipal pumping begins.
  - Perform an additional well survey of all wells within 1.5 km of the new well site to document baseline conditions and identify well interference issues, if any, to support the PTTW application.
- Complete the next steps/recommendations provided in the Memorandum from Wellington Source Water Protection (refer to Appendix O), including:
  - WHPA delineation and vulnerability assessment
  - Enumeration of the treat activities on the properties within the new WHPAs
  - Meeting between Grand River Source Protection Region and Grand River Source Protection Authority to discuss the Project and ensure the updated Assessment Report, including WHPA delineation and vulnerability assessment meets the requirements pursuant to the *Safe Drinking Water Act* and *Cean Water Act*.
  - Section 34 amendment to the corresponding Assessment Report and Source Protection Plan, including public consultation and Provincial approval.
- Applications for PTTW approval for the new well.
- Preliminary and detailed design of required infrastructure including well pumping/treatment facilities, transition watermains, storage facilities and booster pumping/pressure control facilities.
- Acquisition of land for development of the municipal well, storage facility and associated provisions.