THE CORPORATION OF THE TOWNSHIP OF WELLINGTON NORTH
AGENDA OF SPECIAL COUNCIL MEETING – JUNE 2, 2021 AT 2:00 P.M.
VIA WEB CONFERENCING

HOW TO JOIN

Join from a PC, Mac, iPad, iPhone or Android device:

Please click this URL to join. https://us02web.zoom.us/j/87977132257

Or join by phone: 855 703 8985 (Toll Free) +1 647 558 0588 (long distance charges may apply)

Webinar ID: 879 7713 2257

PAGE NUMBER

CALLING TO ORDER

ADOPTION OF THE AGENDA

Recommendation:
THAT the Agenda for the June 2, 2021 Special Meeting of Council be accepted and passed.

DISCLOSURE OF PECUNIARY INTEREST

OPENING REMARKS FROM THE MAYOR AND CAO

PRESENTATIONS

1. Water and Sanitary Master Plan Technical Update – Mount Forest 001
   - Frank Vanderloo, P.Eng., B.M. Ross and Associates Limited

   Report OPS 2021-020 being a report on the Mount Forest water and wastewater technical update 009
   - Matthew Aston, Director of Operations
   - Corey Schmidt, Environmental Services Manager

Recommendation:
THAT the Council of the Corporation of the Township of Wellington North receive Report OPS 2021-020 being a report on the Mount Forest water and wastewater technical update;

AND FURTHER THAT Council receive for information the presentation by Frank Vanderloo, P.Eng., of B.M. Ross and Associates Limited;

AND FURTHER THAT Council direct staff to proceed with the "second supplemental elevated storage tank in the Industrial Park" detailed as "Alternative No. 2" in the B.M. Ross and Associates Limited report entitled "Mount Forest Sanitary and Water Servicing – Technical Update" dated January 6, 2021;

AND FURTHER THAT Council direct staff to proceed with the 2021 capital budget project for the Mount Forest Stand-Pipe Rehabilitation ($950,000); and

AND FURTHER THAT Council direct staff to defer the 2020 capital budget project for the design of the Mount Forest Water Tower ($75,000) and place these funds into an appropriate reserve fund until the project comes forward at a future capital budget.

2. Water and Sanitary Master Plan Technical Update - Arthur 012
   - Dustin Lyttle, P.Eng., and Ray Kirtz, P.Eng., Triton Engineering Services Limited

3. Water Supply Study - Arthur 022
   - Jim Baxter, P.Eng., RJ Burnside & Associates Limited

Report OPS 2021-021 being a report on the Arthur water and wastewater technical update 033
- Matthew Aston, Director of Operations
- Corey Schmidt, Environmental Services Manager

Recommendation:
THAT the Council of the Corporation of the Township of Wellington North receive Report OPS 2021-021 being a report on the Arthur water and wastewater technical update;

AND FURTHER THAT Council receive for information the presentation by Ray Kirtz, P.Eng., of Triton Engineering Services Limited;

AND FURTHER THAT Council receive for information the presentation by Jim Baxter, P.Eng., of RJ Burnside and Associates Limited;

AND FURTHER THAT Council direct staff to proceed with the "single new tower" detailed in Section 3.4.2.2 in the Triton Engineering Services Limited report entitled "Water and Sanitary Systems Technical Study - Arthur" dated September 2020;

AND FURTHER THAT Council direct staff to proceed with the 2021 capital budget project for Arthur Water Supply Investigation ($100,000).

Report OPS 2021-012 being a report to prioritize major Wellington North water and wastewater projects 036
- Matthew Aston, Director of Operations
- Corey Schmidt, Environmental Services Manager

Recommendation:
THAT the Council of the Corporation of the Township of Wellington North receive Report OPS 2021-012 being a report to prioritize major Wellington North water and wastewater capital projects;

AND FURTHER THAT Council, as the system Owner prioritized upcoming major water and wastewater projects for consideration/information of staff when bringing forward future capital budgets and recommendations as follows:

1. Arthur Wastewater Plant Project – Phase 2

2A. Mount Forest Water Tower

2B. Arthur Water Tower

3. Arthur Water Supply

4. Mount Forest Wastewater Plant Capacity

5. Arthur Water Treatment

AND FURTHER THAT Council direct staff to give due consideration to this priority listing when bringing forward future capital budget recommendations, development charge studies, water and wastewater rate studies, etc.

ITEMS FOR CONSIDERATION

1. OPERATIONS

    a. Report OPS 2021-005 being a report on the water and wastewater technical update(s) 120
        - For information purposes only - received at the February 8, 2021 Regular Council Meeting

CONFIRMING BY-LAW 125

Recommendation:
THAT By-law Number 067-21 being a By-law to Confirm the Proceedings of the Council of the Corporation of the Township of Wellington North at its Special Meeting held on June 2, 2021 be read a First, Second and Third time and enacted.

ADJOURNMENT

Recommendation:
THAT the Special Council meeting of June 2, 2021 be adjourned at __:__ p.m.

The following accessibility services can be made available to residents upon request with two weeks' notice:
Sign Language Services – Canadian Hearing Society – 1-877-347-3427
- Kitchener location – 1-855-656-3748

TTY: 1-877-843-0368 Documents in alternate forms CNIB – 1-800-563-2642

TOWNSHIP OF WELLINGTON NORTH

MOUNT FOREST
SANITARY AND WATER SERVICING TECHNICAL UPDATE
PRESENTATION TO COUNCIL

MARCH 3, 2021

BMROSS
engineering better communities

Agenda

- Study Scope
- General Study Conclusions
- Water Storage
- WWTP/NWS-SPS
- Questions

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Technical Update Scope

- Reliance on Third Party information
- Update GIS database (sanitary sewer & watermain)
- Water distribution system model update
- Well supply capacity evaluation
- Water storage capacity expansion alternative evaluation (preliminary)
- Sewage Pumping Station (SPS) capacity evaluations
- Select capital costs
- Exclusions: Class EA; WWTP evaluation

General Study Conclusions

- Well supply firm operational supply reserve capacity >50 years
- Water quality acceptable and no known trends
- Water storage expansion within the next 5-10 years.
- Water distribution system upgrades to service growth
- Water booster pumping station SE corner of town
- Sanitary sewer extensions to service growth
- Some growth areas will require a SPS (by Developers)
- Cork Street and Durham Street SPS reserve capacities anticipated to be >20 years
- WWTP & NWS-SPS capacity expansion within 10 years

Water Storage Alternatives

- Evaluation outcome: Two possible alternatives,
  - A single new E.T. at the existing site (Alternative #1); $5.6M
  - Existing Standpipe (35 years old) & BPS (13 years old) + a 2nd new E.T. north end of town (Alternative #2); $5.0M, including recoating existing standpipe and large diameter watermain loops to connect 2nd E.T. to Industrial Drive and Main Street
- Lifecycle analysis (50± years) – Alternative #2
- Pros/Cons

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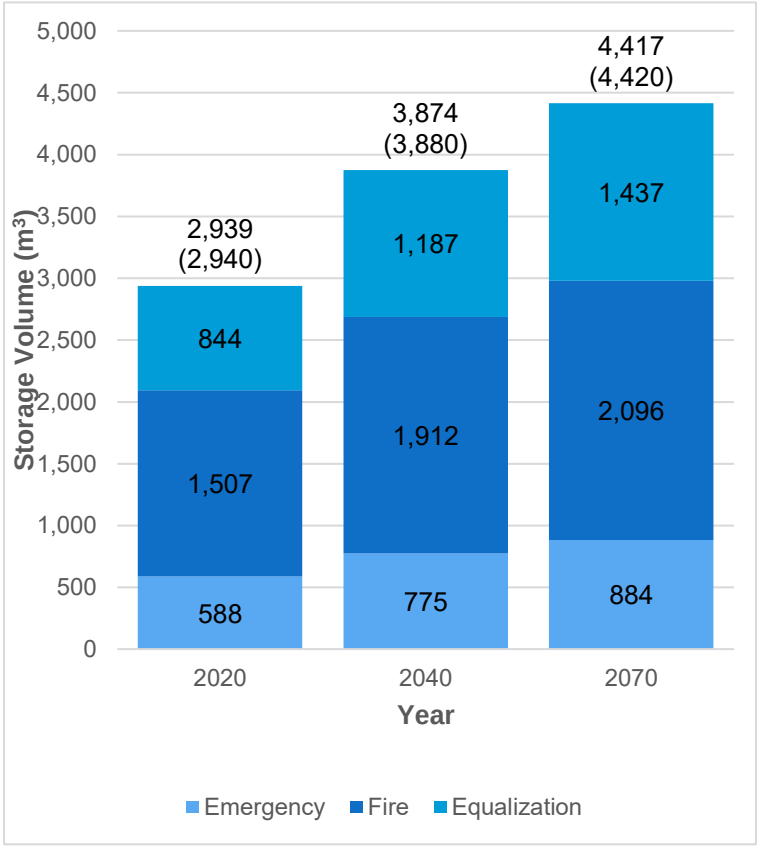
Water Storage Timeline

- Existing standpipe 2,000m^3
- Guidelines: 2,940m^3 now
- Guidelines: 4,420m^3 in 50 years
- Well supply surplus
  - Equalization storage met to Yr. 2031
  - Fire storage Yr. 2031 = 1,826m^3
  - 174m^3 left for Emergency storage
    vs. 719m^3 per guidelines
- Expand storage before Yr. 2031?



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WWTP & NWS-SPS

- WWTP 2,818m^3/d current approved capacity
- WWTP & NWS-SPS capacity expansion by Yr. 2031
- Co-treatment of leachate may advance that by a year or two
- Complete the Receiver Impact Assessment in support of 3,500m^3/d WWTP capacity, and then reassess expansion timelines

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engineering better communities

Thank you.

Questions?

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WELLINGTON NORTH
SEMPER PORRO

Staff Report

To:	Mayor and Members of Council Special Meeting of June 2, 2021
From:	Matthew Aston, Director of Operations Corey Schmidt, Environmental Services Manager
Subject:	OPS 2021-020 being a report on the Mount Forest water and wastewater technical update

RECOMMENDATION

THAT Council of the Township of Wellington North receive Report OPS 2021-020 being a report on the Mount Forest water and wastewater technical update;

AND FURTHER THAT Council receive for information the presentation by Frank Vanderloo, P.Eng., of B.M. Ross and Associates Limited;

AND FURTHER THAT Council direct staff to proceed with the "second supplemental elevated storage tank in the Industrial Park" detailed as "Alternative No. 2" in the B.M. Ross and Associates Limited report entitled "Mount Forest Sanitary and Water Servicing – Technical Update" dated January 6, 2021;

AND FURTHER THAT Council direct staff to proceed with the 2021 capital budget project for the Mount Forest Stand-Pipe Rehabilitation ($950,000); and

AND FURTHER THAT Council direct staff to defer the 2020 capital budget project for the design of the Mount Forest Water Tower ($75,000) and place these funds into an appropriate reserve fund until the project comes forward at a future capital budget.

PREVIOUS PERTINENT REPORTS/BY-LAWS/RESOLUTIONS

Report OPS 2021-005 being a report on the water and wastewater technical update(s) included in this agenda package.

BACKGROUND

As a part of the 2020 capital budget, technical updates to the existing Master Plans for drinking water and wastewater, in Arthur and Mount Forest, was approved. The resulting reports were presented at the February 8, 2021, meeting of Council and these reports have since been added to the Township website as directed:

Water and Sanitary Systems Technical Study-Arthur September 2020 Triton Engineering Services Limited:

https://wellington-north.com/content/government/departments/public-works/water-sewer/water-and-wastewater-technical-update-arthur.pdf

Mount Forest Sanitary and Water Servicing Technical Update January 2021 B.M. Ross and Associates Limited:

https://wellington-north.com/content/government/departments/public-works/water-sewer/water-and-wastewater-technical-update-mount-forest.pdf

Also, at the February 9, 2021, meeting of Council staff were directed to bring these reports to a Special Meeting of Council to provide opportunity for further discussion and Council project prioritization.

With respect to the Mount Forest drinking water and sanitary system, water storage and wastewater treatment are the two large-scale forecasted projects.

For the Mount Forest Wastewater Treatment Plant (WWTP) as shown in our 2021 reserve capacity calculations we have 1,164 equivalent residential units of sewage treatment capacity. For that reason, as shown within Report OPS 2021-012 this project is recommended for priority four and will not be discussed significantly within this report. Township staff continue to work with our Ecology Consultant and the Ministry of Environment and Climate Change to better understand what will be required to re-rate this facility.

The Mount Forest water storage situation is more of a pressing need (recommended as priority 2A within Report OPS 2021-012) and a decision will need to be made on how to proceed such that this infrastructure can be replaced within the next three to seven years. Within the BM Ross report there were three options presented for water storage replacement:

Alternative #1 – Construct New Single Tower at Grant Street Location (Existing Pool Location)
Alternative #2 – Maintain Existing Stand-Pipe and Construct New Secondary Tower at North-end of Mount Forest
Alternative #3 – Construct New Single Tower at North-end of Mount Forest

The following chart was pulled from the BM Ross report:

Table 4.7
Alternative Storage Cost Comparison

Item	Alternative No. 1	Alternative No. 2	Alternative No. 3
Size	4,420 m3	2,420 m3	4,420 m3
Location	Grant St site	Greenfield Site (north industrial park)	Greenfield Site (north industrial park)
New CET	$5,500,000	$3,400,000	$4,500,000
Recoat existing Standpipe	N.A.	$825,000	N.A.
External watermain	$102,000	$793,000	$374,000
Total capital cost (base Yr. 2020)	$5,602,000	$5,018,000	$4,874,000
Life cycle cost (Yr. 2084 – just prior to assumed Standpipe replacement)	$7,248,562	$6,979,646	$6,390,075
100-year life cycle cost (Yr. 2120)	$8,129,725	$8,914,570	$7,215,429

Above life cycle costs are high level opinions established only for alternative comparison purposes

BM Ross report details the benefits and disadvantage of each alternative. I will provide a summary here of the advantages recommended alternative (No. 2):

- Second lowest total capital costs;
- Township staff prefer this option as it will see two water storage locations in Mount Forest which provides ease of operation;
- Construction of secondary tower at the north-end of Mount Forest would be less disruptive to the system during construction;
- Proceeding with the recoating of the existing stand-pipe in late 2021 or 2022 will provide more timing flexibility for the construction of the secondary tower;
- Township recently (~2007) invested significant capital dollars for a booster pump system at existing stand-pipe location;

FINANCIAL CONSIDERATIONS

$75,000 in 2020 Capital Budget for Mount Forest Water Tower Design
$950,000 in 2021 Capital Budget for Mount Forest Stand-Pipe Rehabilitation

Project	Estimated Cost*
Mount Forest Water Tower	$5.0 Million (2021)
Mount Forest Wastewater Plant Capacity	Unknown

*- Estimate costs are approximate and parenthesis' indicate year of engineered or preliminary estimate.

ATTACHMENTS

NA

STRATEGIC PLAN 2019 – 2022

Do the report's recommendations align with our Strategic Areas of Focus?

☒ Yes ☐ No ☐ N/A

Which priority does this report support?

☐ Modernization and Efficiency
☒ Municipal Infrastructure
☐ Partnerships
☐ Alignment and Integration

Prepared By:	Matthew Aston, Director of Operations Corey Schmidt, Environmental Services Manager
Recommended By:	Michael Givens, Chief Administrative Officer *Michael Givens*

ARTHUR WATER AND SANITARY SYSTEMS

Technical Study

TRITON ENGINEERING SERVICES LIMITED
Consulting Engineers

GROWTH PROJECTIONS

Vertical Infrastructure

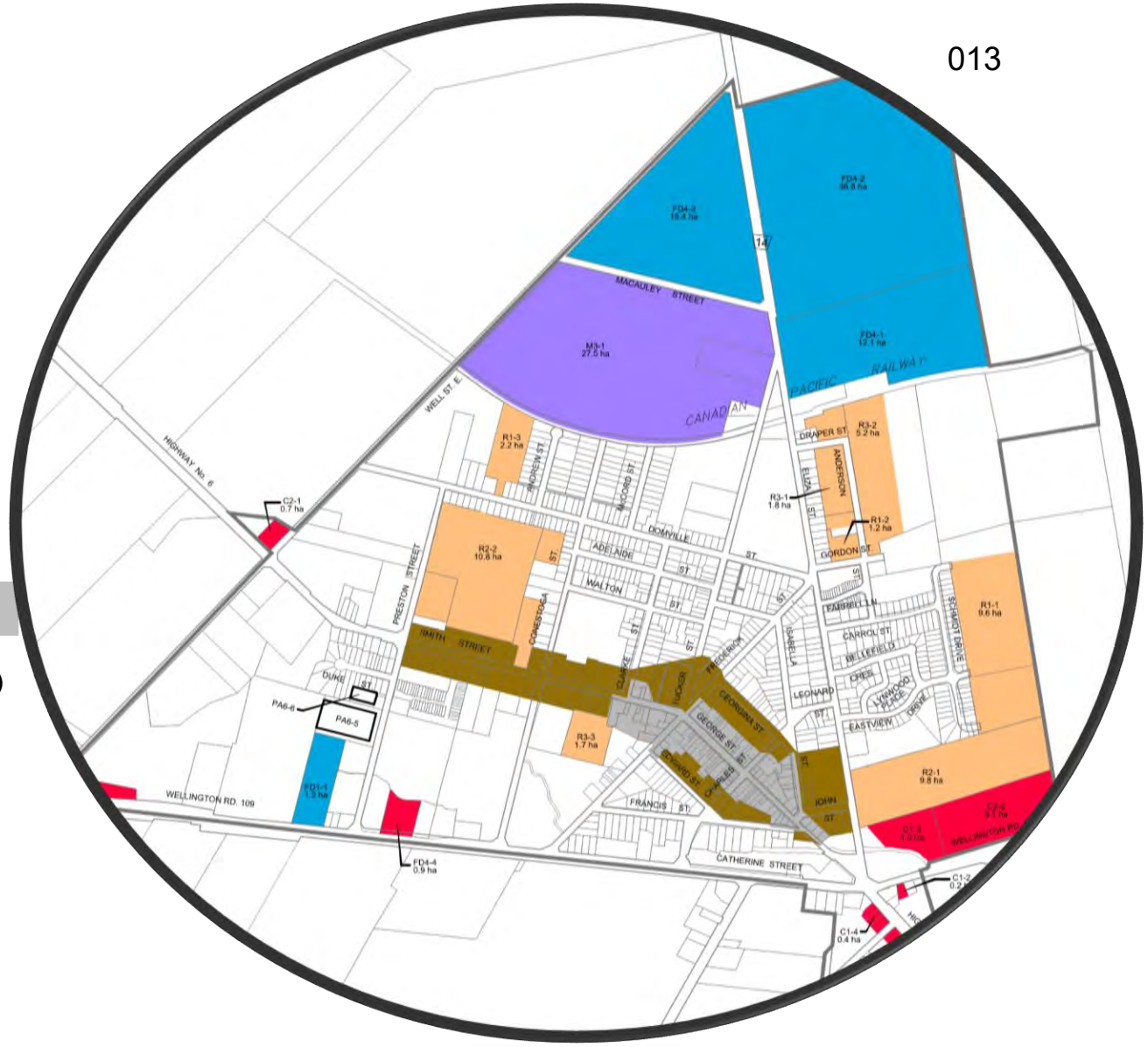
- Based on Growth Projections

Linear Infrastructure

- Based on Development Land Availability

Table 2.2 - Arthur Growth (Interpolated)

Arthur Growth (Interpolated)				
Year	Population (Capita)	Households (ERUs)	Capita per ERU	Growth (Capita/Year)
2020	2,410	970	2.5	-
2025	3,351	1,242	2.7	69.5
2030	3,698	1,370	2.7	69.5
2035	4,046	1,499	2.7	69.5
2040	4,391	1,639	2.7	69.0
2045	4,736	1,768	2.7	69.0



WATER SYSTEM

Technical Review of the Arthur Water System

TRITON ENGINEERING SERVICES LIMITED
Consulting Engineers

THE TOWNSHIP OF WELLINGTON NORTH

WATER SUPPLY & TREATMENT

Annual Water Reserve Capacity Calculations

- Schedule: Annually

Well Exploration Program (On-going)

- Schedule: 2020 – 2021

Evaluation of Existing Municipal Wells

- Schedule: 2021 - 2022
- Estimated Cost: $10,000

Commission Additional Source:

- As dictated by the annual reserve capacity calculations, current estimate 2040.
- Estimated Cost: $3 - $5 Million

Table 3.2 – Summary of Water Usage Projections and Reserve Capacity

Year	Population (Capita)	Households (ERU)	MDD (m^3/day)	Source Reserve Capacity (m^3/day)	Firm Reserve Capacity (m^3/day)
2020	2,410	949	1,572	2,644	683
2025	3,351	1,242	1,675	2,541	580
2030	3,698	1,370	1,849	2,367	406
2035	4,046	1,499	2,023	2,193	232
2040	4,391	1,639	2,195	2,021	60
2045	4,736	1,768	2,368	1,848	-113

WATER STORAGE

Single New Tower (Preferred Alternative)

Decommission the existing towers and construct a new 2,000m^3 tower at a higher operating level.

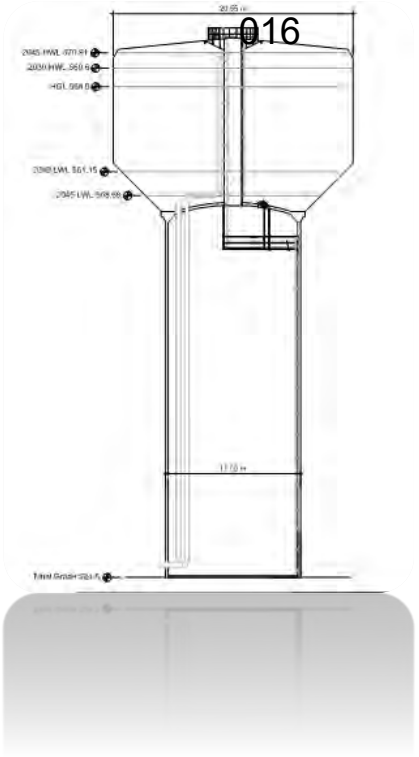
- Schedule:

  Annually: Continue to monitor demands and growth projections and complete annual storage assessment.

  2025: Initiate Class EA to confirm preferred alternative and establish design details. Timing based on annual assessment.

  2030: Construct new tower

Estimated Cost: $3,675,438.00



Existing Storage: 1,364m^3

Table 3.3 - Water Storage Requirement Summary

Year	MDD (m^3/day)	Recommended Fire Flow (L/s)	Storage Required (m^3)
Current (2020)	1,572	100	1,391
2025	1,675	110	1,514
2030	1,849	120	1,658
2035	2,023	120	1,712
2040	2,195	130	1,856
2045	2,368	130	1,910

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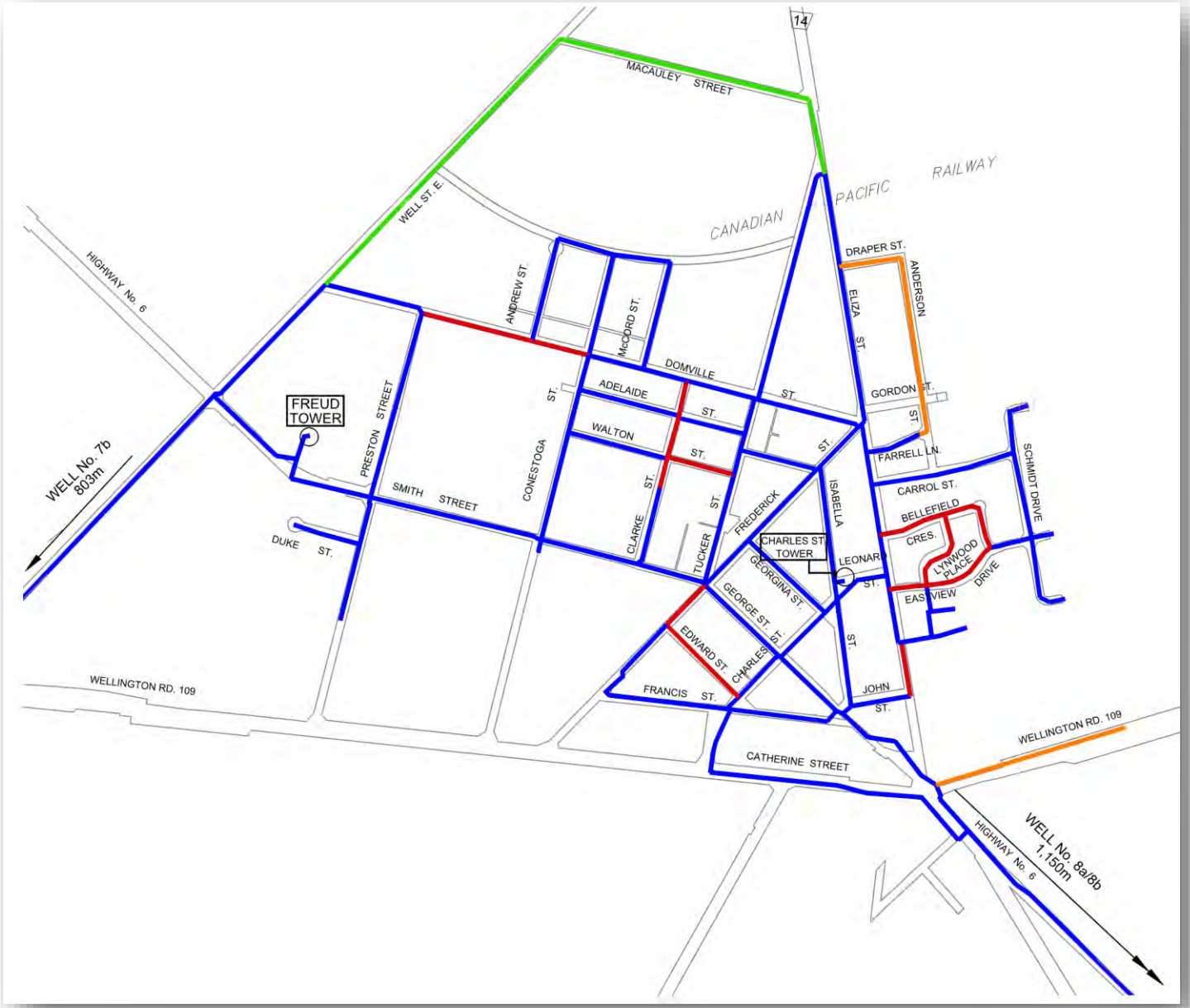
WATERMAIN UPGRADES & EXTENSIONS



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SANITARY SYSTEM

Technical Review of the Arthur Sanitary System

TRITON ENGINEERING SERVICES LIMITED
Consulting Engineers

WASTEWATER TREATMENT CAPACITY & PUMPING STATIONS

Phase 1 Plant Upgrades

- Capacity 1,860m^3/day
- Completed 2020.

Phase 2 Plant Upgrades

- Capacity 2,300m^3/day
- Required by 2025.
- Additional capacity required beyond 2045.

Existing Plant Capacity: 1,465m^3/day

Table 5.1.6 – Future Sanitary Reserve Capacity

Year	Population (Capita)	Households (ERU)	ADF (m^3/day)	Phase 1 Reserve Capacity		Phase 2 Reserve Capacity	
				m^3	ERU	m^3	ERU
Rated Capacity				1,860m^3		2,300m^3	
2020	2,410	949	1400	460	402		
2025	3,351	1,242	1777	83	69		
2030	3,698	1,370	1915	-55		385	317
2035	4,046	1,499	2055	-195		245	202
2040	4,391	1,639	2193	-333		107	89
2045	4,736	1,768	2331	-471		-31	-25

Recommendations

- Ensure adequate oversight during linear infrastructure construction.
- Monitor annual Wastewater Reserve Capacity against Growth projections

Sewage Pumping Stations

- Wells Street SPS
- Fredrick Street SPS

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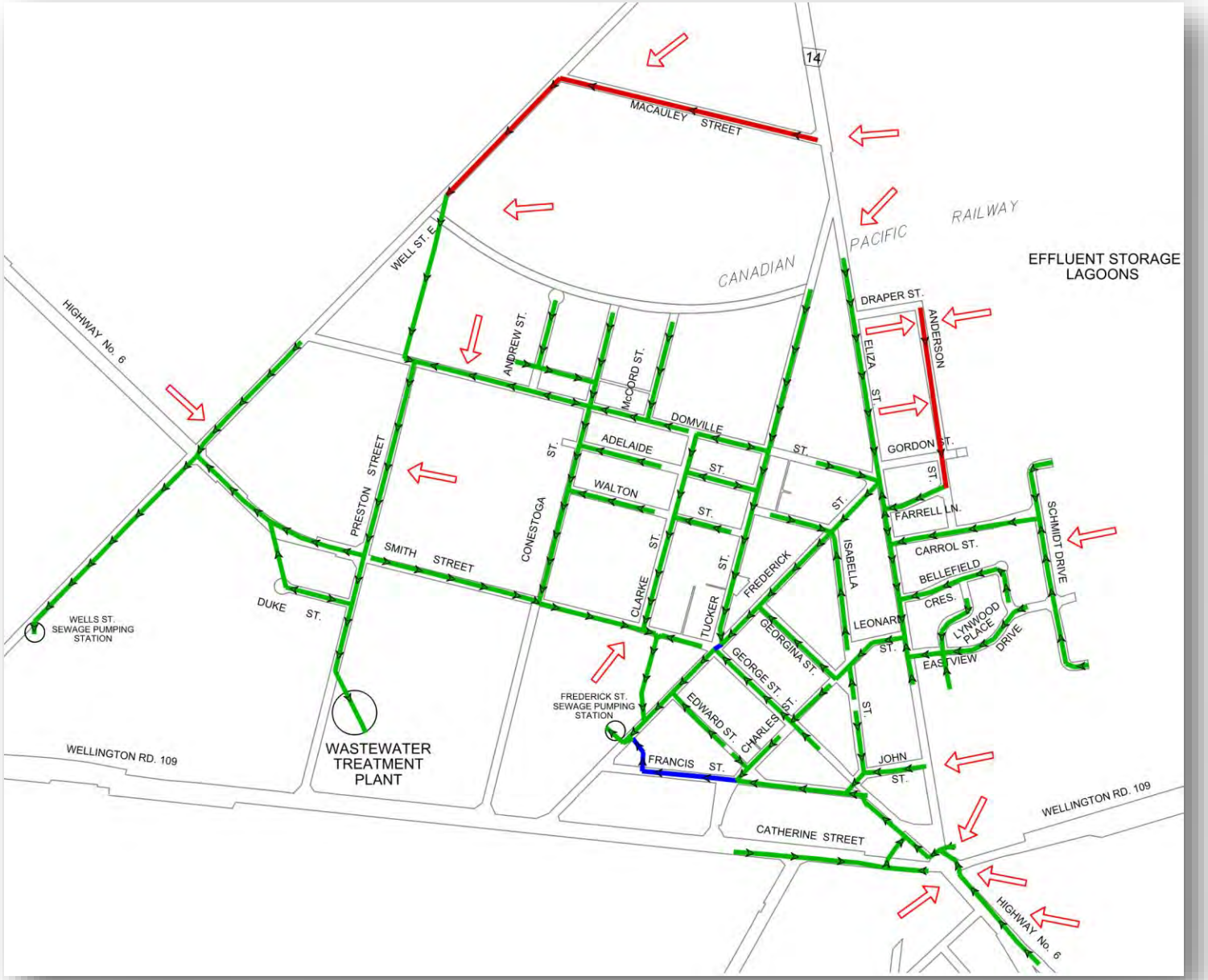
SANITARY UPGRADES & EXTENSIONS



LEGEND

- EXISTING SEWER TO REMAIN
- UPGRADES
- EXTENSIONS
- FUTURE DEVELOPMENT CONTRIBUTION

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Consulting Engineers

THANK YOU

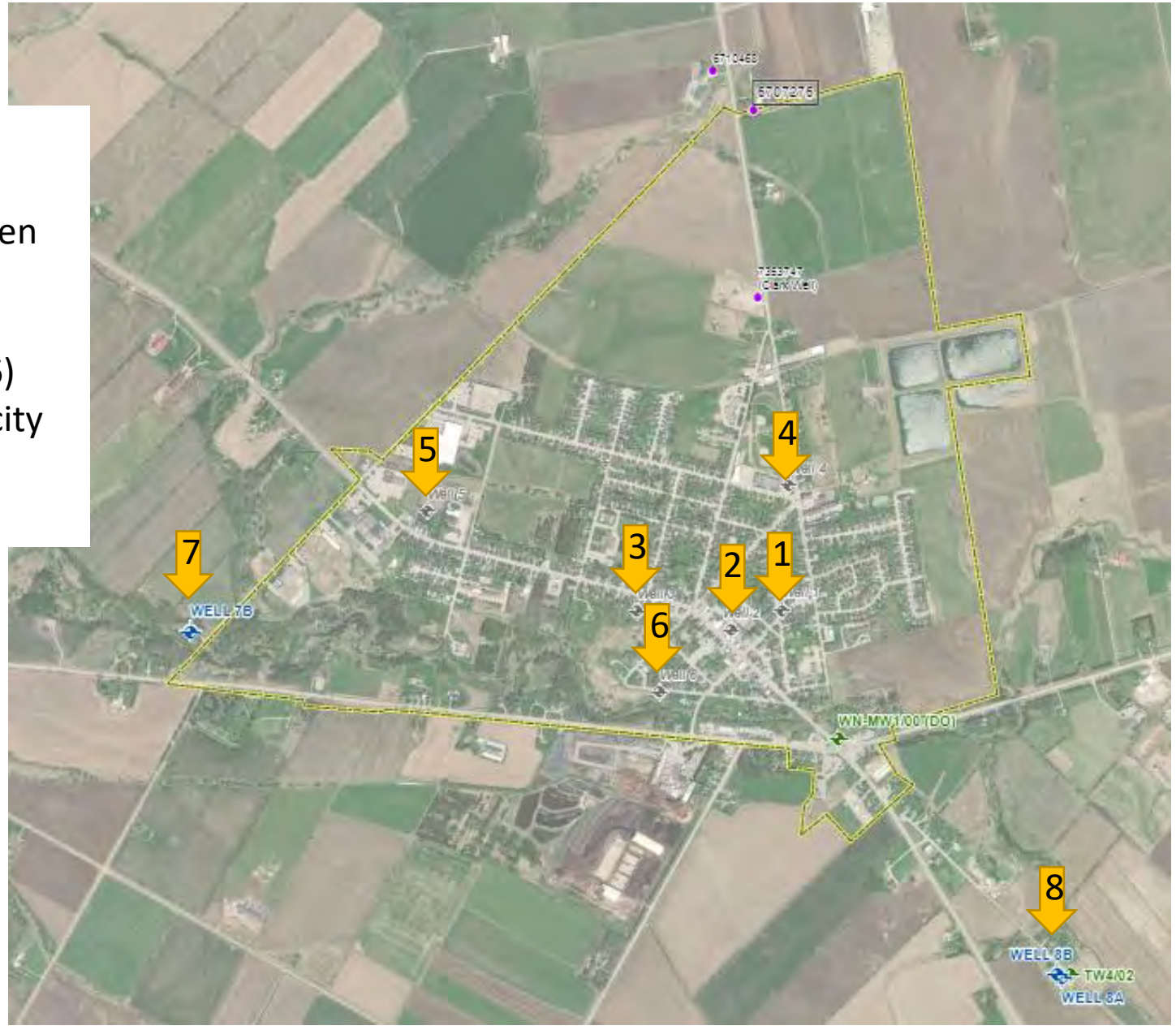
TRITON ENGINEERING SERVICES LIMITED
Consulting Engineers

ARTHUR WATER WELL EXPLORATION

Preliminary Assessment

History – Bedrock Wells 1,2,3,4,5 and 6 (Core Area)

- Drilled between 1930 and 1977
- Bedrock Wells
- Obtained water from bedrock between 50 and 183 m (164 -600')
- Capacity less than 7 L/s
- Quality Poor in deeper wells (1 and 6)
- Abandoned in 2005 when high capacity Wells 7B,8A and 8B became primary water sources



BURNSIDE

Existing Water Sources – Well 7B

- Drilled in 1998
- Gravel Aquifer above Bedrock
- 22.7 L/s (1965 m^3/day)
- Aquifer can produce more
- High Iron
- Single Well so source is unavailable if 7B fails which reduce firm capacity to 2,261 m^3/d
- Second Well required to provide a back-up source

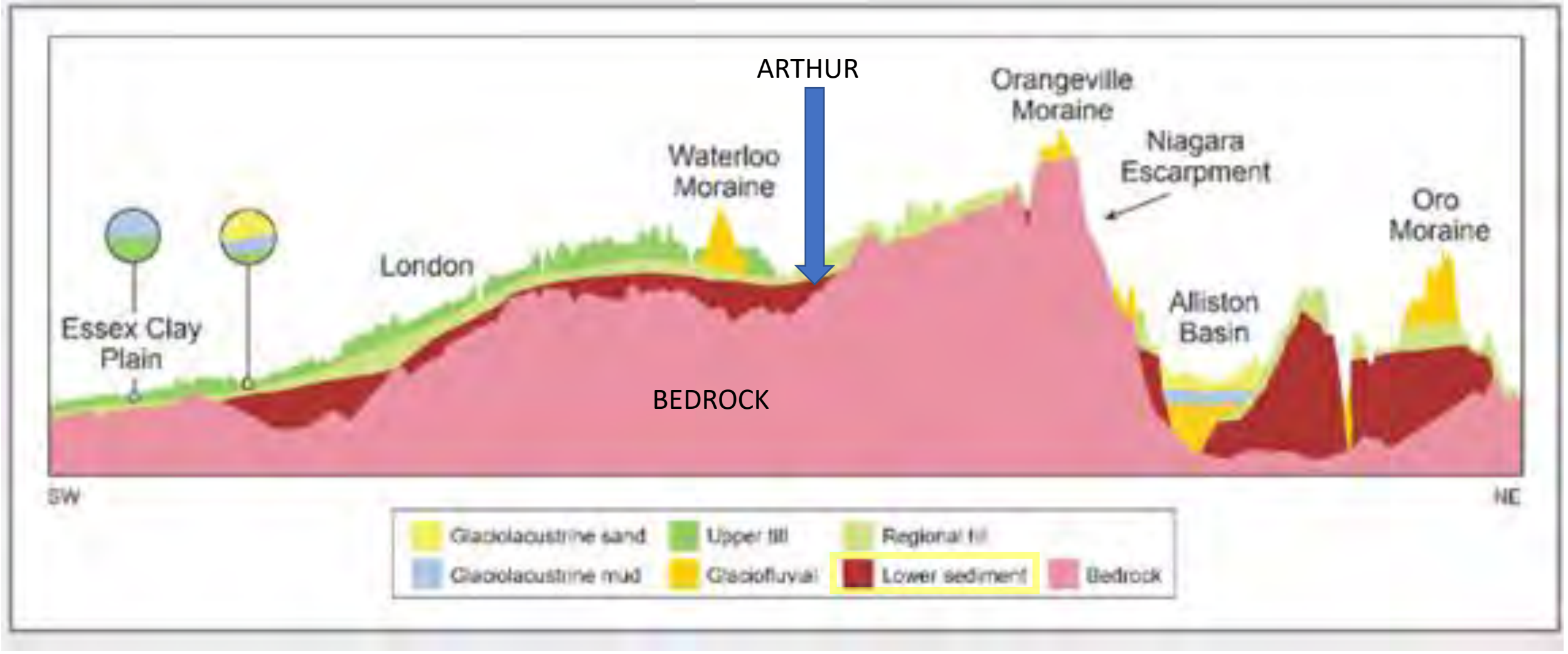
BURNSIDE

Existing Water Sources – Wells 8A and 8B

- Drilled in 2005
- Gravel Aquifer above Bedrock
- 26.2 L/s (2261 m^3/day)
- Aquifer can produce more
- High Manganese
- New Health related Standard for Manganese in Ontario pending
- Twin Wells provide back-up in case one well fails

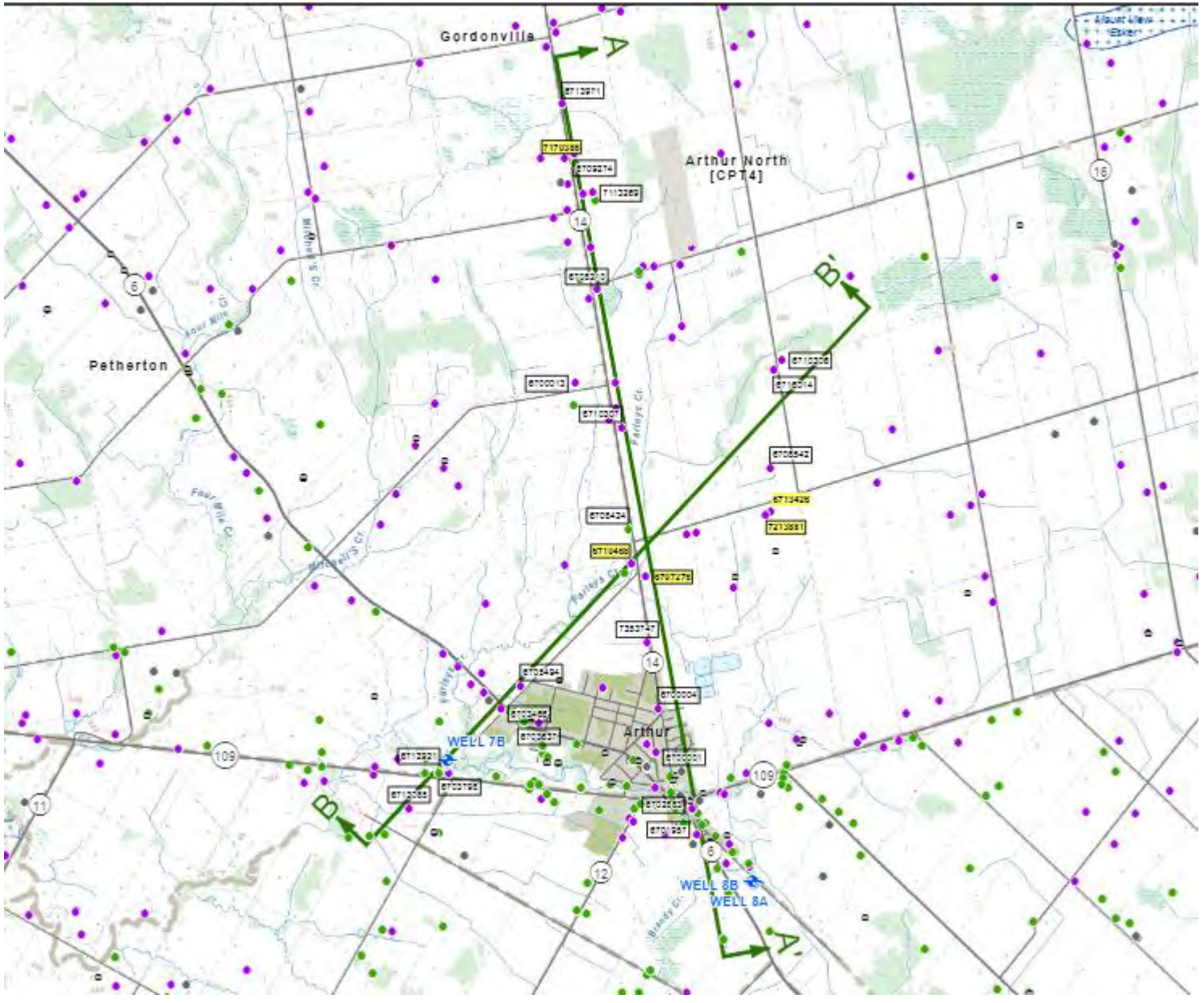
BURNSIDE

Hydrogeology of Arthur Area



Hydrogeology of Arthur Area

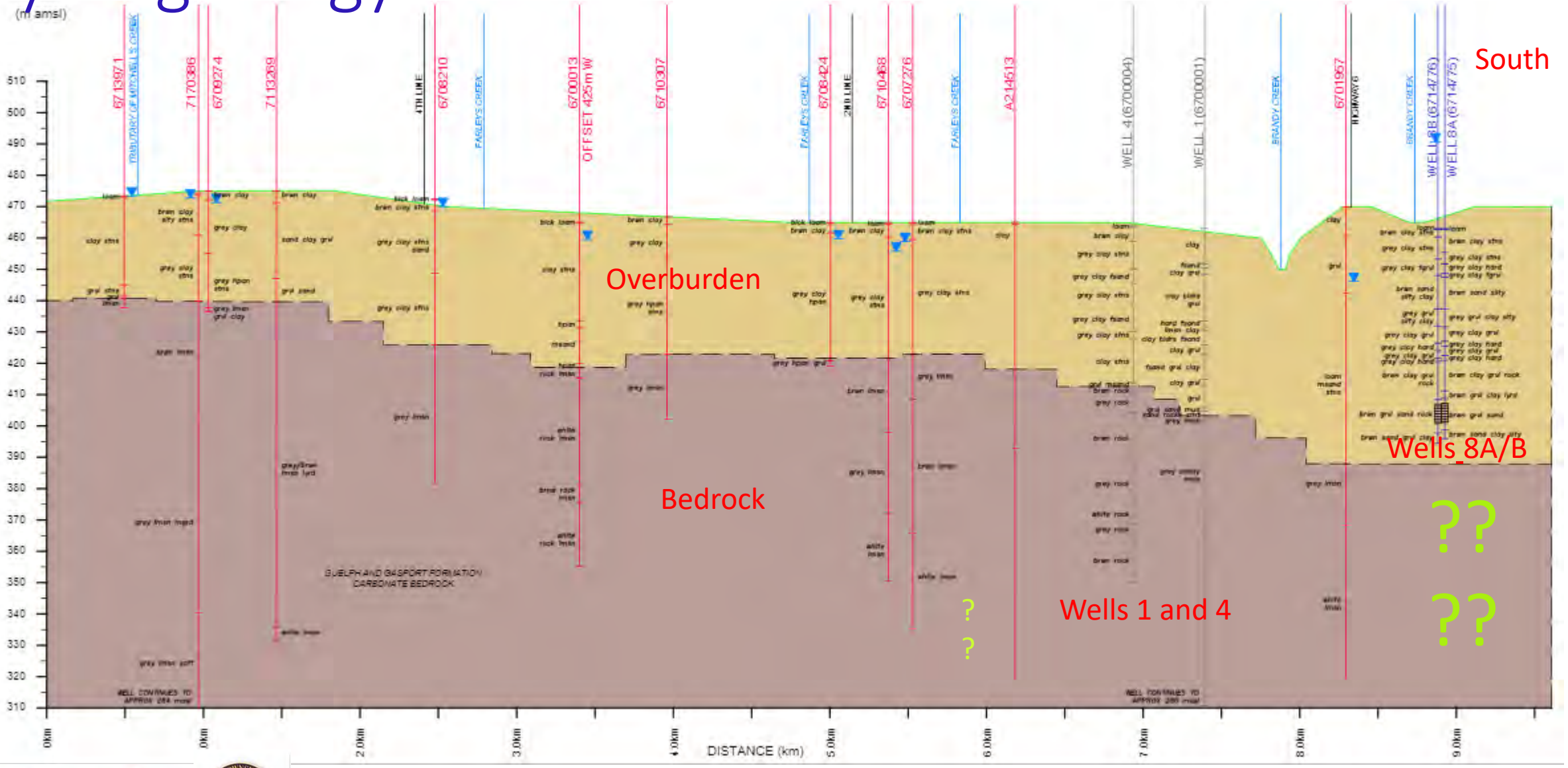
- Well Locations
- Cross Sections



Hydrogeology of Arthur Area – Cross Section

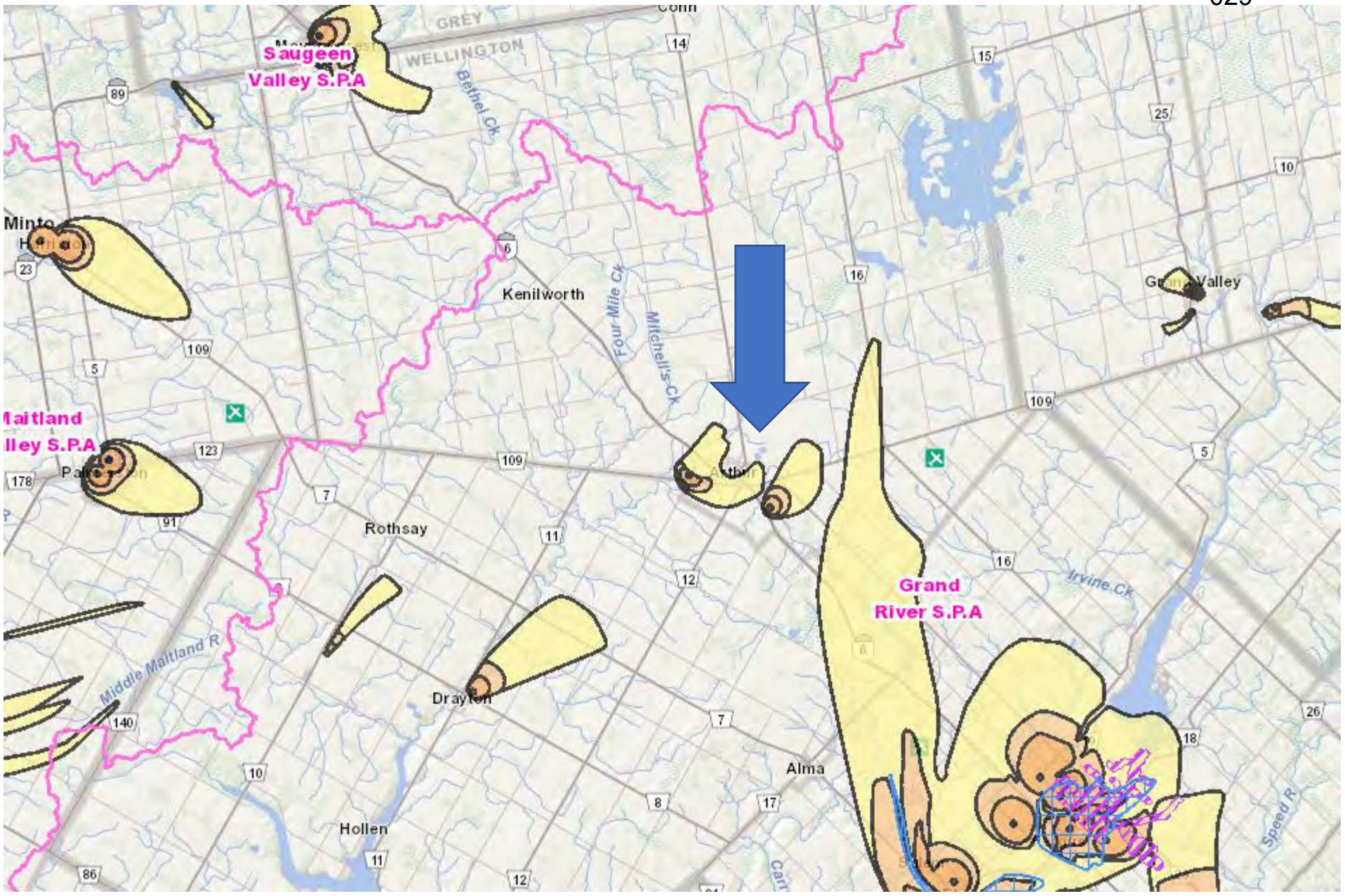
North

South



Wells In the Arthur Area

- Mount Forest
- Grand Valley
- Elora and Fergus
- Drayton
- Moorefield
- Palmerston
- Harriston
- Clifford



BURNSIDE

Well Exploration
Where to Drill

Well Exploration – Test Well Drilling

Well Exploration - Summary

Existing Overburden Wells

- Excess capacity for future expansion
- remote from the system
- treatment for Iron (7B/7C) and Manganese (8A/8B)
- **addition of 7C** required to back up 7B

Exploration for New Groundwater Source(s)

- Bedrock in Arthur Core Area proven to low capacity poor quality (Wells 1-6)
- Overburden Gravel (7B,8A,8B) present south of core but not in the north
- **Best potential in Bedrock beneath Wells 8A and 8B (existing site)**
- **Potential in Bedrock in the north in area of proposed development**

WELLINGTON NORTH
SEMPER PORRO

Staff Report

To:	Mayor and Members of Council Special Meeting of June 2, 2021
From:	Matthew Aston, Director of Operations Corey Schmidt, Environmental Services Manager
Subject:	OPS 2021-021 being a report on the Arthur water and wastewater technical update

RECOMMENDATION

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AND FURTHER THAT Council receive for information the presentation by Ray Kirtz, P.Eng., of Triton Engineering Services Limited;

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AND FURTHER THAT Council direct staff to proceed with the “single new tower” detailed in Section 3.4.2.2 in the Triton Engineering Services Limited report entitled “Water and Sanitary Systems Technical Study - Arthur” dated September 2020;

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PREVIOUS PERTINENT REPORTS/BY-LAWS/RESOLUTIONS

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BACKGROUND

As a part of the 2020 capital budget, technical updates to the existing Master Plans for drinking water and wastewater, in Arthur and Mount Forest, was approved. The resulting reports were presented at the February 8, 2021, meeting of Council and these reports have since been added to the Township website as directed:

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Also, at the February 9, 2021, meeting of Council staff were directed to bring these reports to a Special Meeting of Council to provide opportunity for further discussion and Council project prioritization.

With respect to the Arthur drinking water and sanitary system, wastewater treatment, water storage, water supply and water treatment are the four large-scale forecasted projects. Additional project details for these projects are included in Report OPS 2021-012.

The existing water supply in Arthur would benefit from additional available quantity, better quality source water (less iron and manganese) and increased water supply redundancy. As the sourcing of a new water supply is a long term project, Township staff continue to recommend that test wells be drilled in 2021 or 2022 in order to develop a feasible plan to increase water quantity and redundancy. If higher quality water was encountered this would be an added bonus to the activity. It is worth noting that within the drinking water community there is discussion about compliance limits eventually being established for manganese, which would then require the Township to either have sourced a higher quality water supply or construct water treatment facilities at our existing well locations.

A decision that will have to be made is how to proceed with the future water storage (water tower) configuration in Arthur. Within the Triton report they provide an overview of two options:

1. Construct new single tower at the north-end of Arthur (~$3.7 Million*); or
2. Maintain the existing Spheroid Tower and construct a new secondary tower at the north-end of Arthur (~$4.2 Million*).

*- These figures do not include watermain extension and looping.

Triton report details the benefits and disadvantage of each alternative. I will provide a summary here of the advantages of the recommended option:

- Lowest total capital costs;
- Operating level (pressure) of the system in Arthur could be increased with no need to establish different pressure zones;
- Operations and maintenance of one tower is lower cost than two towers;

FINANCIAL CONSIDERATIONS

$100,000 in 2021 Capital Budget for new Arthur water supply

Project	Estimated Cost*
Arthur Wastewater Plant Project – Phase 2	$8.3 Million (2018)
Arthur Water Tower	$3.7 Million (2020)
Arthur Water Supply	$3.5 Million (2021)
Arthur Water Treatment	Unknown

*- Estimate costs are approximate and parenthesis' indicate year of engineered or preliminary estimate.

ATTACHMENTS

Schedule A - Memorandum from Triton Engineering dated February 25, 2021

Schedule B – Report entitled "Arthur Preliminary Well Exploration Assessment" by R.J. Burnside & Associates Limited dated May 6, 2021

STRATEGIC PLAN 2019 – 2022

Do the report's recommendations align with our Strategic Areas of Focus?

☒ Yes ☐ No ☐ N/A

Which priority does this report support?

☐ Modernization and Efficiency
☒ Municipal Infrastructure
☐ Partnerships
☐ Alignment and Integration

Prepared By:	Matthew Aston, Director of Operations Corey Schmidt, Environmental Services Manager
Recommended By:	Michael Givens, Chief Administrative Officer *Michael Givens*

WELLINGTON NORTH
SEMPER PORRO

Staff Report

To:	Mayor and Members of Council Special Meeting of June 2, 2021
From:	Matthew Aston, Director of Operations Corey Schmidt, Environmental Services Manager
Subject:	OPS 2021-012 being a report to prioritize major Wellington North water and wastewater projects

RECOMMENDATION

THAT Council of the Township of Wellington North receive Report OPS 2021-012 being a report to prioritize major Wellington North water and wastewater capital projects;

AND FURTHER THAT Council, as the system Owner prioritized upcoming major water and wastewater projects for consideration/information of staff when bringing forward future capital budgets and recommendations as follows:

1. Arthur Wastewater Plant Project – Phase 2

2A. Mount Forest Water Tower

2B. Arthur Water Tower

3. Arthur Water Supply

4. Mount Forest Wastewater Plant Capacity

5. Arthur Water Treatment

AND FURTHER THAT Council direct staff to give due consideration to this priority listing when bringing forward future capital budget recommendations, development charge studies, water and wastewater rate studies, etc.

PREVIOUS PERTINENT REPORTS/BY-LAWS/RESOLUTIONS

Report OPS 2021-001 being a report on the water meters

Report OPS 2021-005 being a report on the water and wastewater technical update(s) included in this agenda package.

BACKGROUND

Township staff and our engineering consultants focussed on large dollar value projects in developing this report. Linear infrastructure replacement and developer funded sanitary pumping stations have been excluded from this report. The replacement of existing linear infrastructure (watermains, sanitary sewers) continue to remain an important part of the annual capital budget.

Water meters have been excluded from the discussion of this report as Township staff have previously been directed by Council to bring a 2022 capital budget project for a water meter study for consideration (February 8, 2021).

Some additional considerations for each project:

Arthur Wastewater Treatment Plant – Phase 2

- Environmental Compliance Approval for Arthur Wastewater Treatment project specifies that construction is to start five years from the approval date of September 2020;
- Township has a completed detailed design for Phase 2 of this project;
- Wastewater treatment capacity will remain a constraint of development / growth;
- Project completion is likely two years from date of project award, if Phase 1 can be used as a project timeline gauge;

Arthur and Mount Forest Water Storage

- Water storage support peak demand loads on the system;
- Water storage improvements help supply fire events;
- Township could gain some efficiencies by pursuing the design of both projects simultaneously;
- Multi-leg tower in Arthur is at end of life;
- Development in Arthur provides opportunity for the Township to secure land for future infrastructure needs;

Arthur Water Supply and Mount Forest Wastewater Treatment

- Nominal amounts of funding should continue to be invested in the Arthur Water Supply and Mount Forest Wastewater Treatment capacity upgrade projects to better understand projects;

Arthur Water Treatment

- Existing water supplies in Arthur contain iron and manganese but produce safe drinking water;
- Manganese may become a compliance requirement for drinking water systems in the future;
- Existing well locations do not have sanitary sewers local to them which creates an issue for the regular disposal of filter (treatment) effluent;

It should be noted that items 2A and 2B in the recommendation to this report were used to denote a tie for these projects, however, as more information becomes available over the next five years the expectation is a preferred project will become evident.

PROPOSED TIMELINES	
Project Name	Project Execution
Arthur Wastewater Plant Project – Phase 2	2-4 YRS
Mount Forest Water Tower	3-7 YRS
Arthur Water Tower	3-7 YRS
Arthur Water Supply	8-15 YRS
Mount Forest Wastewater Plant Capacity	3-10 YRS
Arthur Water Treatment	7-12 YRS

FINANCIAL CONSIDERATIONS

$100,000 in 2021 Capital Budget for new Arthur water supply
$75,000 in 2020 Capital Budget for Mount Forest Water Tower Design
$950,000 in 2021 Capital Budget for Mount Forest Stand-Pipe Rehabilitation

Project	Estimated Cost*
Arthur Wastewater Plant Project – Phase 2	$8.3 Million (2018)
Mount Forest Water Tower	$5 Million (2021)
Arthur Water Tower	$3.7 Million (2020)
Arthur Water Supply	$3.5 Million (2021)
Mount Forest Wastewater Plant Capacity	Unknown
Arthur Water Treatment	Unknown

*- Estimate costs are approximate and parenthesis' indicate year of engineered or preliminary estimate.

ATTACHMENTS

NA

STRATEGIC PLAN 2019 – 2022

Do the report's recommendations align with our Strategic Areas of Focus?

☒ Yes ☐ No ☐ N/A

Which priority does this report support?

☐ Modernization and Efficiency
☒ Municipal Infrastructure
☐ Partnerships
☐ Alignment and Integration

Prepared By: Matthew Aston, Director of Operations
Corey Schmidt, Environmental Services Manager

Recommended By: Michael Givens, Chief Administrative Officer *Michael Givens*

TRITON ENGINEERING SERVICES LIMITED
Consulting Engineers

Memorandum

DATE:	February 26, 2021
TO:	Matt Aston
FROM:	Ray Kirtz & Dustin Lyttle
RE:	Arthur Major Capital Projects; Identified & Prioritized
FILE:	A5514B & A5514C

Introduction:

The following is brief summary of the significant capital projects identified in the 2020 Technical Study (Study) including; the future need for increased sewage treatment capacity, a new elevated water storage facility (i.e., tower) and increased municipal water supply.

These projects, and our opinion regarding prioritization of them, is discussed below.

Wastewater Treatment Capacity Expansion:

The Wastewater Class EA previously completed by CIMA+ had identified that a two-phase approach to the expansion of the Arthur Wastewater Treatment Plant (WWTP) was the preferred alternative. Phase 1 has already been completed, achieving an Average Day Flow (ADF) treatment capacity of 1,860m^3/day.

Phase 2 of the WWTP expansion will allow for treatment of 2,300m^3/day (ADF). Based on the growth assumptions presented in the Study, Phase 2 should be completed at some point between 2025 and 2030.

However, based on the current development proposals put forth within the community, we expect that by the end of 2025 there will be no additional uncommitted reserve capacity available, and development within Arthur will be halted once again.

For this reason, we suggest that Phase 2 of the WWTP expansion be scheduled for completion by the year 2025. However, annual review of the Wastewater reserve capacity is imperative to track both available capacity and near-term development requirements so that adjustments to this schedule can be made as required.

New Elevated Storage Facility:

Based on the assessment presented within the Study, the storage provided by the existing facilities is only sufficient to accommodate the existing population, with no surplus available to provide for future development.

However, the calculations used to determine storage requirements do not account for the surplus supply which currently exists within the community. This surplus does have an impact on the realistic storage available, however due to operational and demand variation it can be difficult to quantify. In an effort to estimate the impact of this surplus supply, it would be reasonable (and conservative) to assume that the surplus supply from the Municipal Wells will provide the equalization storage (B) component of the storage required.

There is currently a surplus supply of **683m^3/day** available to be discounted from the equalization storage requirement, based on the current three-year maximum day demand of 1,572m^3/day and Firm Capacity of 2,255m^3/day.

Additionally, it is our understanding that the multi-leg Tower storage (227m^3) may require significant upgrades/replacement within the near future. Therefore, this volume should be removed from the current available storage.

The amended storage requirement calculations are provided below, based on the MECP guidelines noted:

MECP design guidelines for water distribution systems require municipal storage facilities to be designed to allow maintenance of adequate flows and pressures in the distribution system during peak hour water demand and to meet critical demands during fire and emergency events. MECP design guidelines use the following equation to determine water system storage requirement:

Total Treated Water Storage Requirement (m^3) = A + B + C

Where: A (m^3) = fire storage

B (m^3) = equalization storage (25% of Maximum Day Demand)

C (m^3) = emergency storage (25% of (A + B))

Planning Period (years)	Population	Fire Flow (L/s)	A (m^3)	Max. Day Demand (m^3)	B (m^3)	C (m^3)	Total Required (m^3)	Total Available (m^3)
2020	2,410	100	720	1,572	~~393~~	278	998	1,137
2025	3,351	110	792	1,675	~~419~~	303	1,095	
2030	3,698	120	864	1,849	~~462~~	332	1,196	
2035	4,046	120	864	2,023	~~506~~	342	1,206	
2040	4,391	130	936	2,195	~~549~~	371	1,307	
2045	4,736	130	936	2,368	~~592~~	382	1,318	

Note: the emergency storage (C) has not been revised, and reflects the necessary volume if the equalization storage was not discounted.

Based on the above, the increase in storage is not recommended until sometime after the year 2025, but before 2030. A new water tower is a Schedule B Class EA, and therefore will require sometime for planning. As such the EA should be initiated no later than 2025, with the Tower constructed by the year 2030. However, annual review of the water reserve capacity and storage requirements is imperative to track both available surplus supply and near-term development requirements so that adjustments to this schedule can be made as required.

Increased Municipal Water Supply

Existing Water Supply infrastructure is expected to have sufficient capacity to supply up to the year 2040, however this will depend on development growth and usage rates. Therefore, it is imperative that the Township continue to complete annual water supply reserve capacity calculations to track these items.

Finding new water sources can be a very long and complicated process, therefore we recommend that at this time, the town complete two things:

1) An update to the Well Exploration program completed in 2003. (It is our understanding that this is currently underway.)
2) An evaluation of the existing municipal water supply systems.

The evaluation of the water supply systems should be a holistic review of the existing and potential sources in order to establish the water quality and supply rates sufficient to meet the future demands.

Based on the above, we recommend that the above background studies be completed to a point that future source(s) are identified with confidence (i.e., pumping test, quality testing). However, putting the new source into production should be held off until a future supply deficit is identified within the Water Reserve Capacity calculations.

If you have any questions, please contact us.

Arthur Preliminary Well Exploration Assessment

Township of Wellington North

R.J. Burnside & Associates Limited
292 Speedvale Avenue West Unit 20
Guelph ON N1H 1C4 CANADA

May 6, 2021
300052287.0000

Distribution List

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-	Yes	Yes	Matt Aston, Township of Wellington North
-	Yes	Yes	Cory Schmidt. Township of Wellington North

Record of Revisions

Revision	Date	Description
0	February 19, 2021	Initial Submission to Township of Wellington North
1	May 6, 2021	Final Submission to Township of Wellington North

R.J. Burnside & Associates Limited

Report Prepared By:

Jim Baxter, P.Eng.
Groundwater Resource Engineer
JB:js

Report Reviewed By:

Dwight Smikle
Senior Hydrogeologist
DS:js

1.0 Introduction

R.J Burnside & Associates Limited (Burnside) was retained by the Township of Wellington North (Wellington North) to complete an assessment and initial exploration into the potential to increase the capacity of the existing water supply system for the community of Arthur. A Class Environmental Assessment Master Plan Study for Water Supply and Sanitary Sewage Systems, Community of Arthur was completed in 2012 and an update entitled Water and Sanitary Systems, Technical Study - Arthur was submitted in September 2020 (Triton, 2020). The 2020 report identifies the 2045 maximum day demand as 2,368 m^3/day. The report also notes that the current supply is obtained from three sources (Well 7B, Well 8A and Well 8B) and if Well 7B was to be out of service the system capacity is limited to 2,255 m^3/day which is less than the 2045 maximum day demand. The report states that "it is crucial to that the township be proactive in securing future water sources"

Burnside has provided Wellington North with professional hydrogeological services for the construction and monitoring of their existing Well 7B and Wells 8A/8B sites since 1984. These two sites, located 3 km apart in the southwest and southeast corners of Arthur, are both high capacity overburden wells that are capable of producing in excess of the current permitted total flow of 4216 m^3/day. However, the Well 7B site produces water that contains elevated levels of iron and the Well 8A/8B site produces water that contains elevated concentrations of manganese that affect the aesthetic water quality. Environment Canada has created a health related guideline of for manganese that the Province of Ontario is in the process of adopting as a standard that would require treatment of water from the Well 8A/8B site. The timing of the adopting of this new standard is not known but as outlined above, water from Well 8A/8B would need to be treated to meet the new standard. In addition, Wellington North staff indicate that recent pressure for growth in rural Ontario has resulted in increased current and future demands.

Treatment of high capacity wells such as 7B and 8A/8B would involve the construction of larger pumphouses and locations to discharge wastewater from the treatment process as neither well site has sanitary sewers. An alternative to treatment of the existing wells is to explore for a new well with better water quality and no need for treatment.

The purpose of this report is to consider the option of a new well and potential locations for test drilling. The new well to be developed would ideally:

1. Produce in excess of 10 L/s and,

2. Provide water with concentrations of sulphate, iron and manganese that are ideally below the current and future Ontario Drinking Water Standards.

This report provides the background and preliminary hydrogeological assessment to move forward with active groundwater exploration in 2021.

The preparation of this report included review of previous studies completed in the area including the most recent studies in the area, some as recent as 2020. We have included a number of hydrogeologic maps and figures from government studies inserted within the text to provide information relevant to this study. A detailed review of existing well records through the creation of a database has also been completed in specific locations relevant to this assessment.

2.0 Background

The Village of Arthur municipal water system was established in the early 1930's with the construction of Arthur Well 1 at the east end water tower. Review of the original Well 1 Water Well Record indicates that the drilling of Well 1 at the water tower located on Charles Street took approximately one year and included installation of 600 mm and 300 mm well casing and drilling to a depth of 183 m (600 ft). Well 1 was tested by Burnside during the 2001 Groundwater Management Study when its capacity was identified as about 6 L/s of water with elevated levels of dissolved minerals including iron and sulphate.

Following the completion of Well 1 in the early 1930's a series of shallower bedrock wells (2, 3, 4, 5 and 6) were drilled in the following 50 years with the most recent bedrock well (Arthur Well 6) constructed in 1977. The shallower bedrock wells typically produced generally better quality water with lower dissolved minerals but also had relatively low capacities for municipal wells (less than 7 L/s). Detailed analysis using video logging and flow profiling of the bedrock wells identified the primary source of water for wells 2 to 6 as fractures within the upper 10 m of the weathered bedrock surface. Attempts to enlarge deep fractures in the bedrock aquifer with acidic solutions to increase capacity were completed in the 1990's but had limited success.

In 1984 Burnside, with the assistance of Mr. David Crowely, established a new higher capacity overburden well called Arthur Well 7 in the southwest corner of the community. Arthur Well 7 was a 150 mm diameter well, had a capacity of 12.5 L/s (165 Igpm) and became the primary water supply for the Arthur municipal water system.

In 1997, Arthur Well 7 developed a hole in the casing due to corrosion and required repair. Once repaired, it was determined that Arthur Well 7 should be replaced with a new larger diameter well, Arthur Well 7B. Arthur Well 7B was constructed in 1998 on the west side of the Well 7 pumphouse and became the primary water supply source for the Village of Arthur water supply system. Through its design as a 250 mm diameter well, the capacity of Arthur Well 7B was increased to 22.7 L/s (300 Igpm). Potential for even high pumping from this well is possible as the current pumping senerio at about 20 L/s

results in pumping water levels that make use of less than 50% of the available drawdown in the well. Well 7B could likely produce in excess of 35 L/s (500 Igpm)

A groundwater management study (GMS) was completed by Burnside for the Township of Wellington North in 2001. The GMS included the construction of several test wells one of which was located at the intersection of Highway 6 and County Road 109 on Eliza St. in an unopened road allowance. This Test Well indicated the presence of a deep overburden aquifer with a capacity in excess of 15.2 L/sec (200 Igpm).

Exploration at the southeast corner of Arthur continued in 2002 as part of a water supply environmental assessment. Due to less than ideal aquifer conditions and potential sources of contamination close to Arthur, Wells 8A/8B were eventually commissioned on the Jones Baseline about 2 km south of Arthur in November 2005.

The locations of Well 7B in the southwest corner of Arthur and Wells 8A/8B in the southeast corner of the community are relatively remote from the developed area and potential sources of contamination that are common in developed areas. While the remote locations are ideal from a source protection standpoint the locations also put the chlorination sources in remote corners of the distribution system and make the pipelines that connect to the distribution system from these remote location sites for potential pipeline failure.

3.0 Hydrogeology of the Arthur Area

A set of six Figures have been prepared as part of this assessment. These figures include:

1. Figure 1 Site Plan – showing an air photo of Arthur dated 2015 and the location of wells of interest and the municipal wells, both old abandoned and existing wells.

2. MECP Well Location Map – shows the location of wells included in the MECP water well record database. Wells of interest are highlighted.

3. Surficial Geology Map of the Arthur Area.

4. Bedrock Geology Map of the Arthur Area.

5. Cross Section A-A’ along County Road 14 down to Arthur Wells 8A/8B.

6. Cross Section B-B’ along Wells Street.

Additional five imbedded plates obtained from regional reports are referenced separate from the Burnside Figures listed above.

The hydrogeology of the Arthur area consists of about 50 to 75 m of glacial derived overburden materials underlain by Paleozoic aged carbonate and shale bedrock. The glacial overburden consists primarily of thick layers of glacial till with thinner layers of sand and gravel sediments. The layers were laid down from glaciers that advanced and retreated (melted) multiple times from the north about 10,000 years ago. The thickest sand and gravel layers are typically found just above the bedrock in what are sometimes referred to as contact aquifers.

The Ontario Geologic Survey (OGS) has completed numerous investigations of the surficial geology in southern Ontario to support groundwater understanding since the 2000 Walkerton tragedy and ensuing O'Connor report in 2002. Plate 1, inserted below, obtained from a progress report on a new three dimensional geological model of southern Ontario was published in 2020 and shows the closest study to Arthur (Study 4) was completed on the Orangeville Moraine just east of Arthur.

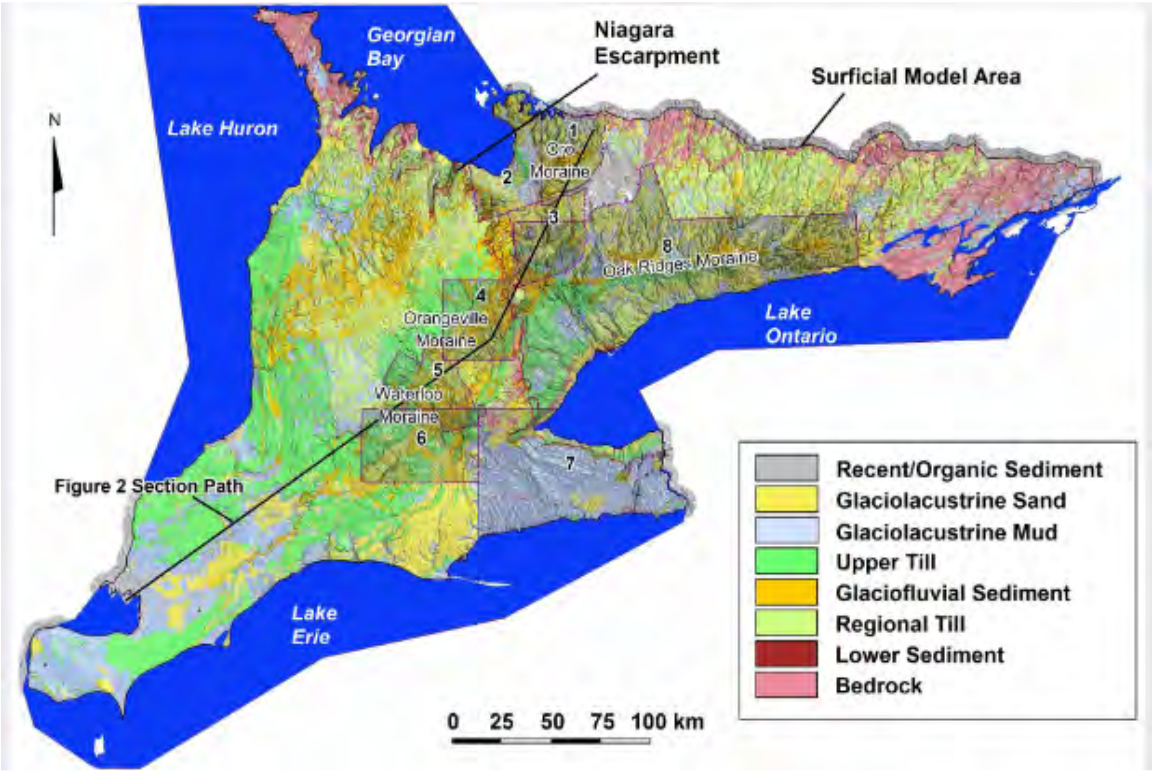

Plate 1: Simplified 8 unit surficial sediment geology draped on a hill-shaded DEM.

The above excerpt provides a legend showing the layering that is currently being used to model the overburden in southern Ontario.

The following figure is a *"Conceptual representation of stratigraphic architecture for southern Ontario along a southwest-northeast cross-section from Essex Clay Plain to the Oro Moraine."* Along the line shown in the above Plate 1.

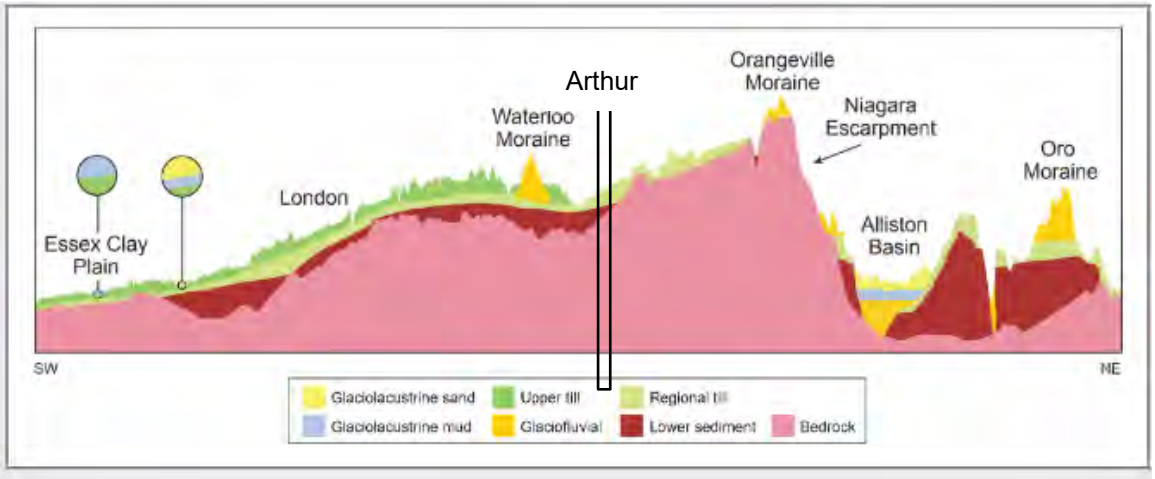

Plate 2: Lower Overburden Sediments in the Arthur Area

The approximate location of Arthur is shown on the cross section above and its location with regard to the dark maroon layer called the "Lower Sediments" is noted. The Lower Sediments are interpreted to be the source of water for Wells 7B, 8A and 8B and the section shows that these sediments thin out to the north east of Arthur. These sediments are thought to provide ideal conditions for high capacity wells to be developed. Despite the high capacity, it is noted that the high iron and manganese content of the water from these sediments is inherently due to mineralization within the sediments.

The bedrock geology of the Wellington North area (See pink layer above) consists of about 100 to 120 m of shale, limestone and dolostone that is considered to be part of a regional bedrock aquifer that traverses southern Ontario from Hamilton to Lake Huron. The following maps (Plate 3) of southern Ontario show the Salina and Guelph Formations that are the bedrock aquifers in the Arthur area. The upper right hand box on the individual maps identifies the Orangeville Moraine study area which is just east of Arthur.

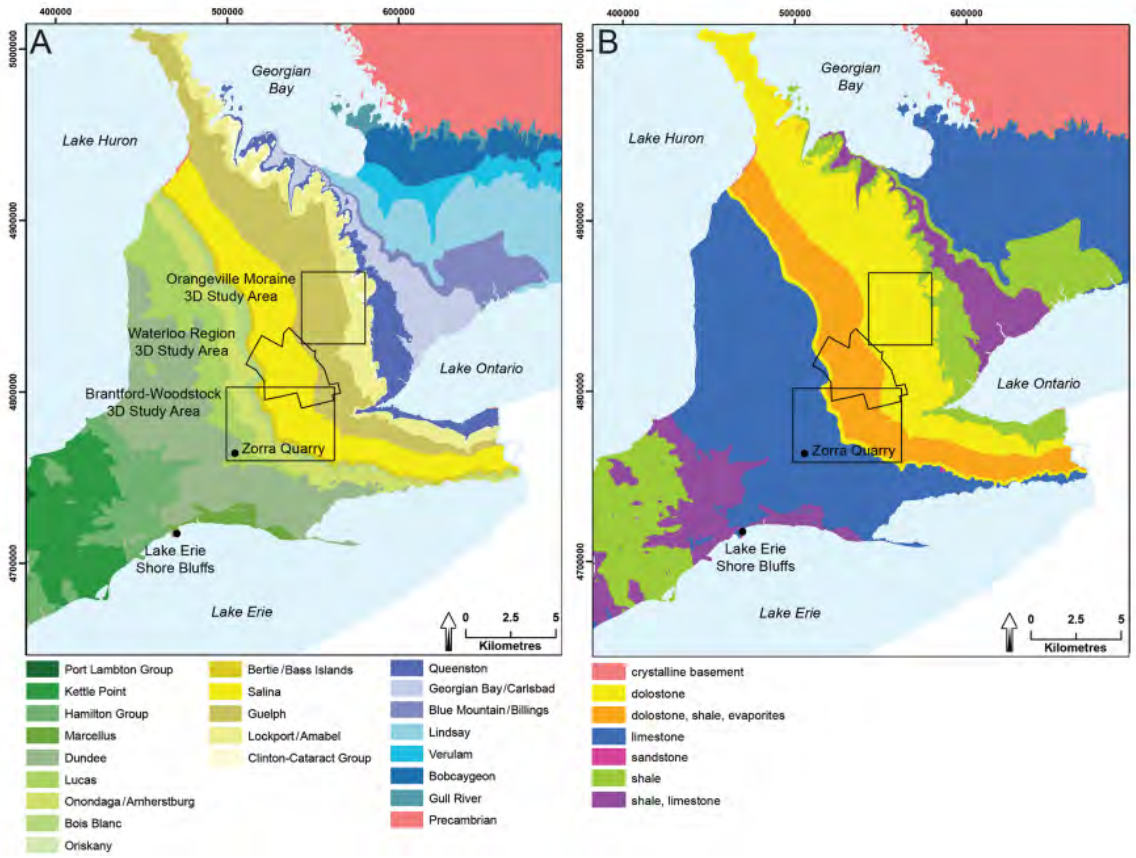

Plate 3: Bedrock Geology of Southern Ontario

Arthur is located above the buried transition from the Guelph Formation dolostone in the east and the Salina dolostone, limestone and shale in the west. Plate 3 shows the interpreted boundary between these formations. The Guelph formation is the source for high capacity wells in Grand Valley where Burnside designed and supervised the construction and testing a new 25 L/s well in 2020. The Guelph and underlying Gasport formations are also the source of water for Mount Forest to the north and Fergus / Elora to the south.

The lack of water production in the Arthur area where Wells 1 to 6 were drilled indicates a low permeability portion of the carbonate bedrock aquifer in Wellington County. Carbonate aquifers such as the Guelph Formation are formed from the fractured bedrock and within these aquifers high capacity production is often limited to specific zones and fractures. Outside of these fractured zones, permeability can be quite low. Often time the zone of high capacity is the so called contact aquifer zone at the top of the bedrock aquifer. The lack of water production in the Arthur area may be due to the fact that high capacity zones have not been encountered or fully intercepted in Arthur.

Plate 4: Bedrock Geology of Southern Ontario

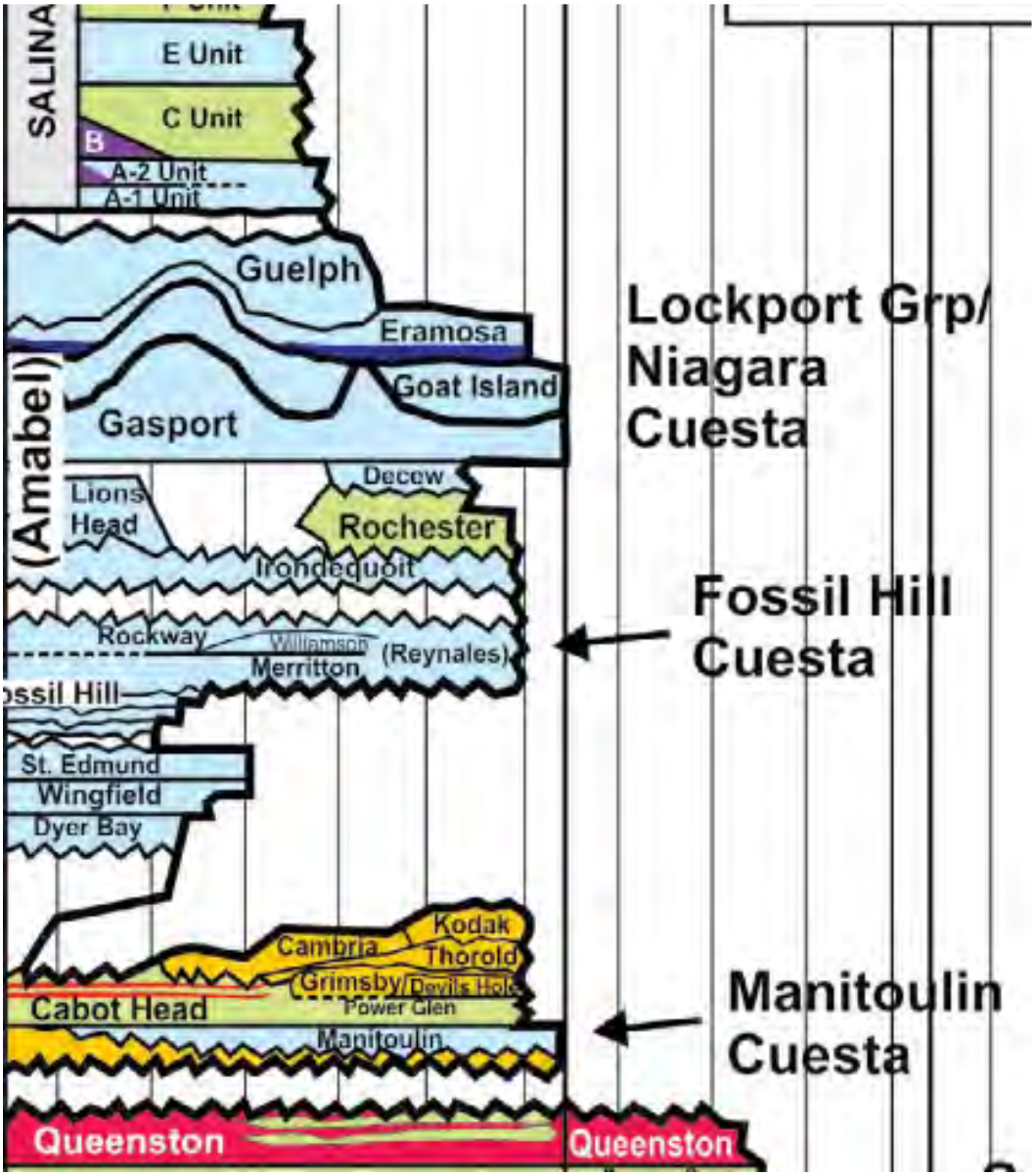

Plate 4 provides the layers that are present beneath Arthur. The Gasport Formation is a common source of high capacity groundwater encountered in the wells in the surrounding communities. The Queenston red shale marks the bottom of the carbonate bedrock aquifer.

The overburden and bedrock geology in the Arthur area was included in the Center Wellington Tier 3 Source Protection Characterization report. Burnside reviewed the Characterization report for Wellington County from Wellington North's perspective. The cross section included below as Plate 5 (Matrix, 2019) indicates the layers of the groundwater model developed as part of the study. The red yellow and green layers are relatively high hydraulic conductivity layers such as sand, gravel and fractured and/or micro karst bedrock. The blue and purple layers are low hydraulic conductivity layers such as silt, clay, glacial till and unfractured bedrock. The section includes both the Well 7 and Well 8A/8B sites on the left (NW) side.

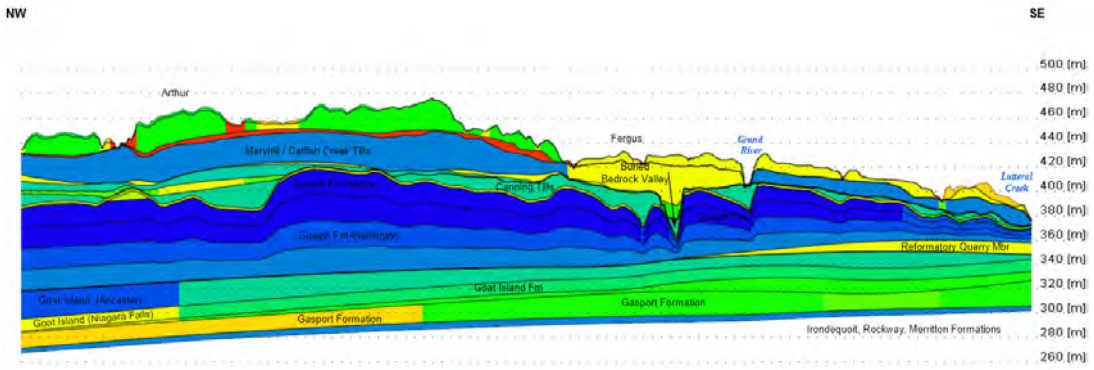

Plate 5: Centre Wellington Tier 3 Water Budget, Model Layers

We note that the bedrock beneath Arthur is included in the low hydraulic conductivity portion of the deep bedrock aquifer. This is likely based on the low capacity of Arthur Wells 1 to 6 and the lack of a significant thickness of sand and gravel layer above the bedrock. It is important to note that in the area south of Arthur the deep bedrock is modeled as a higher hydraulic conductivity. If this characterization of the bedrock is correct it suggests potential for high capacity bedrock wells just south of Arthur. The potential is discussed further in section 4.2.

4.0 Alternatives for Additional Water

The existing wells 7B, 8A and 8B are high capacity wells that are completed in two separate aquifers. Both sites can produce significantly more water than the current PTTW, infrastructure and associated approvals allow. The fact that there are two separate sources/aquifers is ideal for a municipal system so if one source becomes contaminated by an unforeseen event the other source is available. The quality of the water from the sources is the only issue of concern for these sources. The potential implementation of a new health related manganese standard in Ontario is currently the most significant issue.

The options that are available to increase the capacity of the water system are summarized below in order of degree of predictability.

1. **Install treatment** for removal of iron and manganese at either or both the Well 7B and Well 8A/8B sites. This will require expansion of the pumphouses sites and construction of Well 7C to provide mechanical duplication of Well 7B. This work would require an increase in the maximum day capacity of the PTTW at either or both sites. Long term testing at both well sites indicates that additional water is available beyond the 22.7 L/s (1,961m3/d) at Well 7B and the 25 L/s (2,160 m3/d) currently permitted but additional testing at the higher rates will be required. This would be most simply completed at the 8A/8B site where the two wells could be operated together to the system under a Category 2 PTTW to confirm the higher capacity.

2. Drill a test well into the **deep bedrock at the Well 8A/8B** site that would ideally produce 10 L/s or more and could potentially be blended with water from Well 8A/8B. Although bedrock wells in Arthur are typically moderate to low capacity the Well 8A/8B site is 2 km in the direction of Fergus where much higher bedrock well capacities are present. If a test well were successful and the level of manganese were low two new municipal bedrock wells could be constructed, and the water pumped individually or blended with the existing wells to meet maximum day capacities.

3. **Exploration at a new well site at the north end of Arthur**. This area would be approximately 1 km north the old Arthur Well 4 site. A test well constructed on a road allowance in this area would evaluate both potential for an overburden well or a bedrock well. A bedrock well would likely produce at a minimum of 6 L/s from the top of the bedrock and ideally more water at depth. A site as far north and west should be considered.

A detailed review of the existing wells listed in the water well database was completed as part of this study. A summary of higher capacity deep wells and original water well

records are included in Appendix A. Assessment of the wells listed in the area north of Arthur and in the area of Wells 8A/8B are included in sections 4.1 and 4.2.

4.1 North Arthur Exploration

The potential for a municipal well in the north portion of Arthur was discussed with Wellington North staff during a site visit in September 2020. The initial review of regional studies included in sections 2.0 and 3.0 does not specifically address the potential for a high capacity well in the north area. Although the Tier 3 study in Centre Wellington does support the low to moderate quantity of water available from the bedrock aquifer and a lack of a deep overburden aquifer of significant thickness

The specific conditions of specific wells at known locations is the key to determining the potential for a well with high capacity. Our review of the area began with a review of the old, abandoned Arthur Wells 1 to 6 in the center of Arthur shown on Figure 1. We then reviewed the water well database for an area of about 5 km surrounding Arthur which included over 500 wells. A detailed GIS database of all the wells was prepared which allowed sorting according to various well parameters such and depth and theoretical capacity.

Approximately 100 wells were identified as being greater than 70 m deep and of these about 30 were identified as high capacity (> 7 L/s) deep wells. The individual well information for the old Arthur wells and the 30 selected deep high capacity wells are included in Appendix A along with a summary table that includes comments about each well.

Arthur Wells 1, 4 and 5 were drilled for the Village of Arthur water supply between 1930 and 1970. The depth and quality of water from these wells is summarized in Table 1 along with seven(7) privately owned wells north of Arthur.

Table 1 includes the distance of each well from the McCauley Street right of way in the area of proposed development.

Table 1: Summary of Wells in North Arthur

Well	Distance (m)		Gravel (m)	Bedrock Depth (m)	Capacity (L/s)	Sulphate (mg/L)
Arthur 1	900	SE			6	685-960
Arthur 4	300	SE	51-52	52-113	4.5	8-25
Arthur 5	700	SW	0	57-107	2	83-143
Clark (7353747)	< 100	E	0	47-72	1	
Martin (6707276)	< 100	N	0	73-130	1	14
6710468	<100	N	0	43-114	1	
Obelink (7213881)	1500	E	50-52	52-129	2.5	

Well	Distance (m)		Gravel (m)	Bedrock Depth (m)	Capacity (L/s)	Sulphate (mg/L)
7113269	3600	N	28-35	35-143	~3	
Furmanek Bedrock (7170386)	4000	N	0	34-184	3	Low capacity abandoned
Furmanek Gravel(7180284)	4000	N	30-35	-	15	Reported high iron

As noted in the records, the abandoned Arthur municipal wells were all bedrock wells. The wells were drilled as large diameter high-capacity wells but unfortunately the capacity of the wells was below 7L/s. Sulphate concentration in the deepest wells (Well 1 and 6) were above the drinking water limit of 500 mg/L. Sulphate is a mineral that is derived from gypsum in the bedrock and cannot be removed with a water softener. Wells 4 and 5 produced acceptable quality water but the capacity of the wells was even lower, below 4.5 L/s.

A nearby deep bedrock well at the Martin farm at 8565 Eliza Street just south of the intersection of Wells Street was sampled to determine what would potentially be the deep bedrock quality in this area. The results are appended, and the sulphate concentration water determined to be 14 mg/L. However, the capacity of the well is listed to be less than 1 L/s and likely draws water from the weathered shallow bedrock similar to the old Well 4 and Well 5.

Obelink Farms is located 1500 m east of Arthur at 8135 Second Line. This dairy farm has a deep bedrock well whose “very hard” water is typically avoided in favour of a shallower bedrock well that reportedly produces more water.

Furmanek Farms 4000 m to the north drilled a bedrock wells with an open hole in the bedrock from 34 to 184 m in an attempt to obtain a high capacity well. This well reportedly produced only 3 L/s and was eventually abandoned in favour of a gravel overburden well that produces about 15 L/s. The gravel reportedly produces water that contains high concentrations of iron.

To summarize the conditions in the area north of Arthur:

- The overburden gravel aquifer that is present just above the bedrock is not reported in most of the wells north of Arthur as noted above. The Furmanek overburden well 4 km north of Arthur is the closest known indication of a deep overburden aquifer,
- The top of the bedrock is at about 50 m in the north end of Arthur; and
- The bottom of the carbonate aquifer is likely at about 180 m below grade.

Exploration in the northern portion of Arthur would ideally be completed on Township owned land as far north and west but within the future area of growth. Further north and

west locations would be ideal in order to encounter a different portion of the bedrock aquifer than the old, abandoned town wells. As noted above, the deep bedrock wells in that area are all in the range of 1-4 L/s and completed to depths of up to 114 m. It is expected that drilling into the bedrock will require enhanced development with low pH solutions to enlarge fractures in the bedrock that produce the water to maximize the test well capacity. Plate 6 shows the north end of Arthur that could be accessed by a drill rig on the Wells Street unopened road allowance.

Plate 6: North Arthur; The Conn Road and Wells Street looking south.

Plate 7– Jones Baseline looking North at Wells 8A/8B on the west side.

4.2 Arthur Well 8A/8B Bedrock Exploration

All of the municipal wells in the communities of Grand Valley, Fergus and Elora are high capacity bedrock wells that produce water at rates in excess of 15 L/s. It is interpreted that the bedrock aquifer becomes more permeable than what was described for the old Arthur Wells 1 to 6 in section 4.3 moving south and east from Arthur. The furthest south deep bedrock well in Arthur is Arthur Well 6 that was abandoned due to a capacity of less than 7 L/s and sulphates that were above the limit of 500 mg/L.

The point at which the bedrock becomes more permeable between Arthur and Fergus is difficult to determine because the majority of wells south of Arthur are completed in the same high-capacity overburden aquifer as Wells 8A and 8B. As a result, there are very few deep bedrock wells in the area. Considering that Arthur Wells 8A and 8B are located on a parcel of land that is owned by Wellington North and equipped with existing water source infrastructure we considered the possibility of exploration of the bedrock aquifer in this area.

Review of bedrock wells along the Jones Baseline indicated that most of the bedrock wells are completed in the top 10 m of the bedrock that is typically in direct connection with the deep overburden aquifer. About 4 km south of Arthur (500 m south of Figure 2) there are a few deeper bedrock wells with high capacity. The Knight domestic well (6706641) is an example of a well that appears to have a high capacity. The original pumping test indicated less than 0.4 m of drawdown when pumped at a rate of about 0.5 L/s.

It is therefore recommended that in order to define the bedrock conditions at the Well 8A/8B site a 150 mm diameter test well be drilled on the existing site. The test well should be cased at least 10 m into the top of the bedrock to ensure that the test well is not directly connected to the deep overburden aquifer that supplies 8A and 8B. An open hole in the bedrock should be drilled to the bottom of the carbonate bedrock aquifer or until poor quality water is encountered. The well should be video logged and characterized to identify the quantity and quality of water produced from fractures in the bedrock. Enhanced development using low pH solutions should be used to optimize the capacity of the water producing intervals. The test hole should then be tested and sampled to determine the potential for this to provide a municipal water supply.

If the bedrock test well at the Well 8A/8B is not successful in obtaining a source in excess of 10 L/s another test hole could be drilled at the extreme south end of the Jones Baseline Road allowance to improve the opportunity for a higher capacity source in the bedrock. Plate 7 (Page 12) is a view of the Jones Baseline from the south end looking north.

5.0 Conclusions

Based on the review of existing information in this report we can conclude:

1. The existing wells 7B and 8A/8B in Arthur draw water from the deep overburden contact aquifer between 40 and 70 m. This aquifer has high capacity with potential for significant expansion on existing and potentially additional sites.

2. The most predicable but likely most expensive method to increase the capacity of the Arthur water system would be to expand the existing pump houses and construct treatment for the removal of manganese at Wells 8A/8B and iron at Well 7B.

3. A second well at the Well7B is required to provide a duplicate water source to maintain this source of water in the case that Well 7B were to fail.

4. Exploration for a bedrock water source that may contain less iron and manganese is likely a possible source of water that is used in surrounding communities but to date has not been available in the Arthur area.

5. The capacity of the bedrock at the 8A/8B site has not been determined as no deep bedrock wells have been drilled in this area. This groundwater resource is the least understood in the Arthur area and considered to provide the best potential for a new water source at a site where infrastructure already exists.

6. Drilling in the area north of the old Arthur Wells 1-6, north of the Arthur Arena would provide a water source in the community that would be an alternate supply to the existing wells that are connected to the system with individual pipelines. Although bedrock wells can have highly variable and unpredicable capacities, review of the existing wells in the area indicates that a test would likely produce 4 to 7 L/s. A higher capacity well may be possible with greater depth, but quality tends to decline with depth. Significant thickness of sand above the bedrock in this area is not expected.

7. The drilling of test wells does not require approvals and the results of this drilling can be used to support future decisions regarding the need for treatment or potential new water sources.

8. Proposed new regulations by the MECP that are slated for implementation in the summer of 2021 would allow for well testing to proceed without a PTTW and for pumping tests to be conducted after an online registration on the Environmental Activity Sector Registry (EASR).

6.0 Recommendations

1. Exploratory Test Wells should be drilled into the deep carbonate bedrock aquifer to evaluate the potential of this groundwater source at locations outside of the Arthur core area where the low capacity and poor quality Wells 1 to 6 provided water before their abandonment in 2005.

    a. Arthur Well 8A/8B site; A test well should should be drilled at this existing well site. Casing should be installed 10 m into the top of the bedrock to protect the existing wells from the drilling program. The extreme south end of the Jones Baseline should also be considered if drilling at the Well 8A/8B site is not successful. (See Plate 7)

    b. North Arthur; the area as far north and west of the Arthur Arena as possible, within the proposed development area on a municipally owned road allowance; possibly the Wells Street unopened road allowance. (See Plate 6)

2. The costs to treat the water from Wells 8A/8B to remove manganese should be investigated. The costs to remove iron from water at Well 7B should also be determined. Both assessments should address the requirement for the disposal of water from the treatment process.

3. A second well at the Arthur Well 7B site should be constructed to provide mechanical duplication at this site. This well, likely called Well 7C, should be constructed with stainless steel casing to match the stainless steel riser pipe and pumps that are now used in all municipal wells.

7.0 References

Burnside, 2001, Township of Wellington North, Groundwater Management and Protection Study.

Burnside, 2003, Exploration for a new Water Source for the Village of Arthur, Ontario, Hydrogeolgic Report, Construction and Testing of TW4/02.

Burnside, 2020, Village of Arthur Municipal Wells 7B, 8A, 8B 2019 Annual PTTW Monitoring Report, PTTW No.8202-9DNKD3

Matrix, 2019, Center Wellington Tier Three Water Budget Study and Risk Assessment, Groundwater Flow Model Development and Calibration Report, Version 1.0 (Plate 5)

Carter and Brunton et al, 2020, Three-dimensional geological modelling of the Paleozoic bedrock of southern Ontario: Status update. In Russell, H.A.J. and Kjarsgaard, B.A. Eds. Southern Ontario groundwater project 2014–2019: summary report. Geological Survey of Canada, Open File 8536, 7-21. (Plates 3 and 4)

Singer, Cheng and Scafe, 2003, The hydrogeology of Southern Ontario, Environmental Monitoring and Reporting Branch, Ministry of the Environment.

Triton, 2020, Water Supply and Sanitary Sewage Systems, Technical Study - Arthur

Logan, C.E., Russell, H.A.J., Bajc, A.F., Burt, A., Mulligan, R.P.M. and Sharpe, D.R. 2020. A three-dimensional surficial geology model of southern Ontario: Progress report. In Russell, H.A.J. and Kjarsgaard, B.A. Eds. Southern Ontario groundwater project 2014–2019: summary report. Geological Survey of Canada, Open File 8536, 49-64. https://doi.org/10.4095/321084 (Plates 1 and 2)

BURNSIDE

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Figures

LEGEND

- Approximate Village Boundary
- Municipal Well
- Monitoring Well
- Abandoned Municipal Well
- MECP Bedrock Well Location
- Deep Bedrock Well Sampled

Sources:

1. Ministry of Natural Resources, © Queen's Printer for Ontario
2. Natural Resources Canada © Her Majesty the Queen in Right of Canada.
3. Background 2016 Air Photo Source: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Datum: North American 1983 CSRS

Coord. System: NAD 1983 CSRS UTM Zone 17N

N

0 250 500 750 1,000

Metres

BURNSIDE

Client

TOWNSHIP OF WELLINGTON NORTH
VILLAGE OF ARTHUR

Figure Title

WELL EXPLORATION REPORT

ARTHUR PRODUCTION
WELL LOCATION PLAN

Drawn	Checked	Date	Figure No.
CD	JB	December 2020	1
Scale		Project No.	
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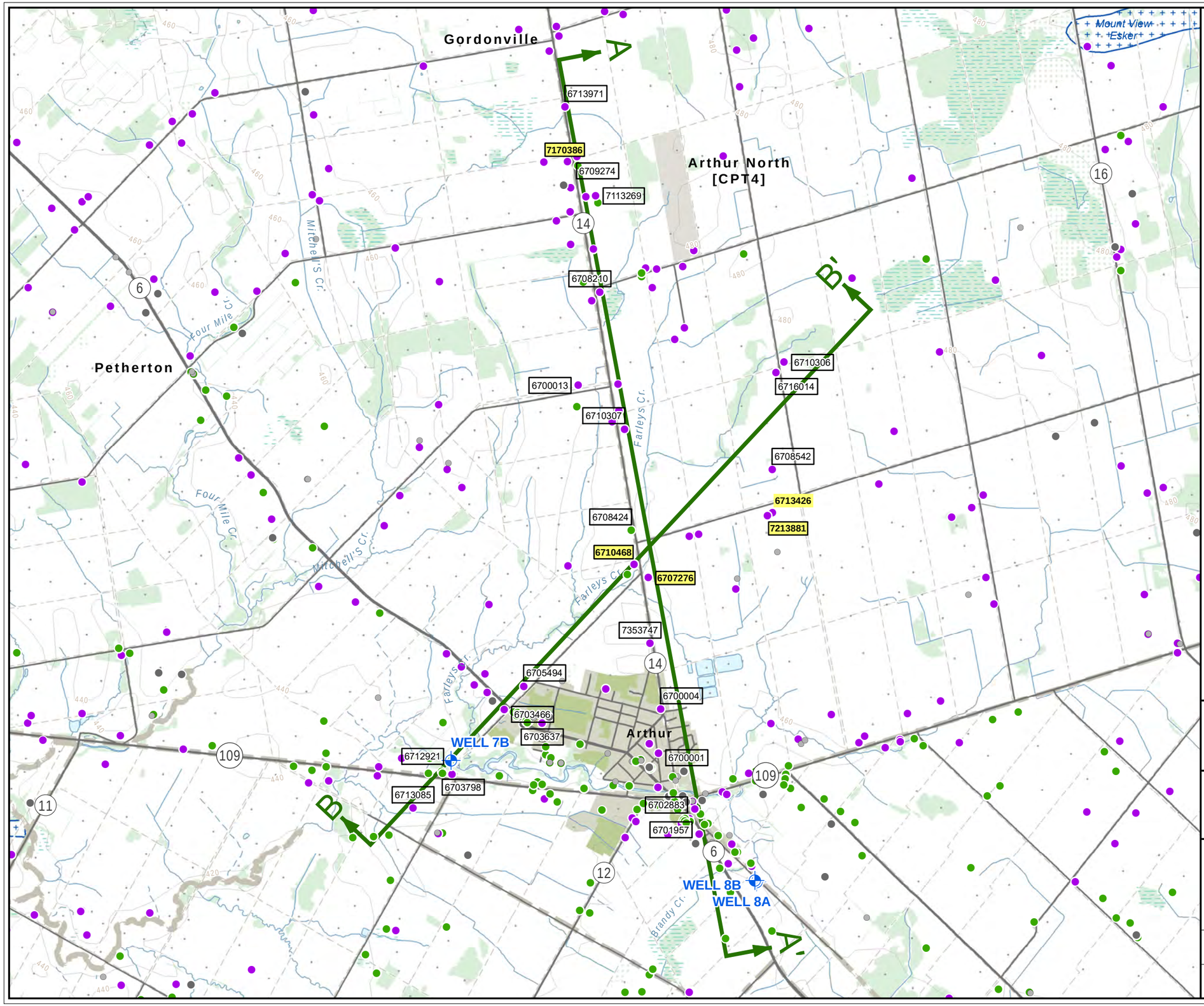

- Municipal Well
- MECP Bedrock Well Location
- MECP Overburden Well Location
- MECP Well - Unknown Status/Formation
- MECP Abandoned Well Location
- Cross Section Orientation
- Expressway / Highway
- Arterial / Collector Road
- Local Road
- Contour (25m Interval)
- Spot Elevation
- Municipal Boundary
- Geographic Township Boundary
- Lot Boundary
- ANSI (MNR)
- Wetland
- Waterbody: Permanent
- Stream: Permanent
- Stream: Intermittent
- Airports and Related Lands
- Wooded Area
- Plantation
- Built-Up Area: Impervious
- Built-Up Area: Pervious

Sources:

1. Ministry of Natural Resources, © Queen's Printer for Ontario
2. Natural Resources Canada © Her Majesty the Queen in Right of Canada.

Datum: North American 1983 CSRS

Coord. System: NAD 1983 CSRS UTM Zone

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Metres

BURNSIDE

Client

TOWNSHIP OF WELLINGTON NORTH
VILLAGE OF ARTHUR

Figure Title

WELL EXPLORATION REPORT

REGIONAL TOPOGRAPHY AND MECP WELL LOCATIONS

Drawn	Checked	Date	Figure No.
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Scale		Project No.	
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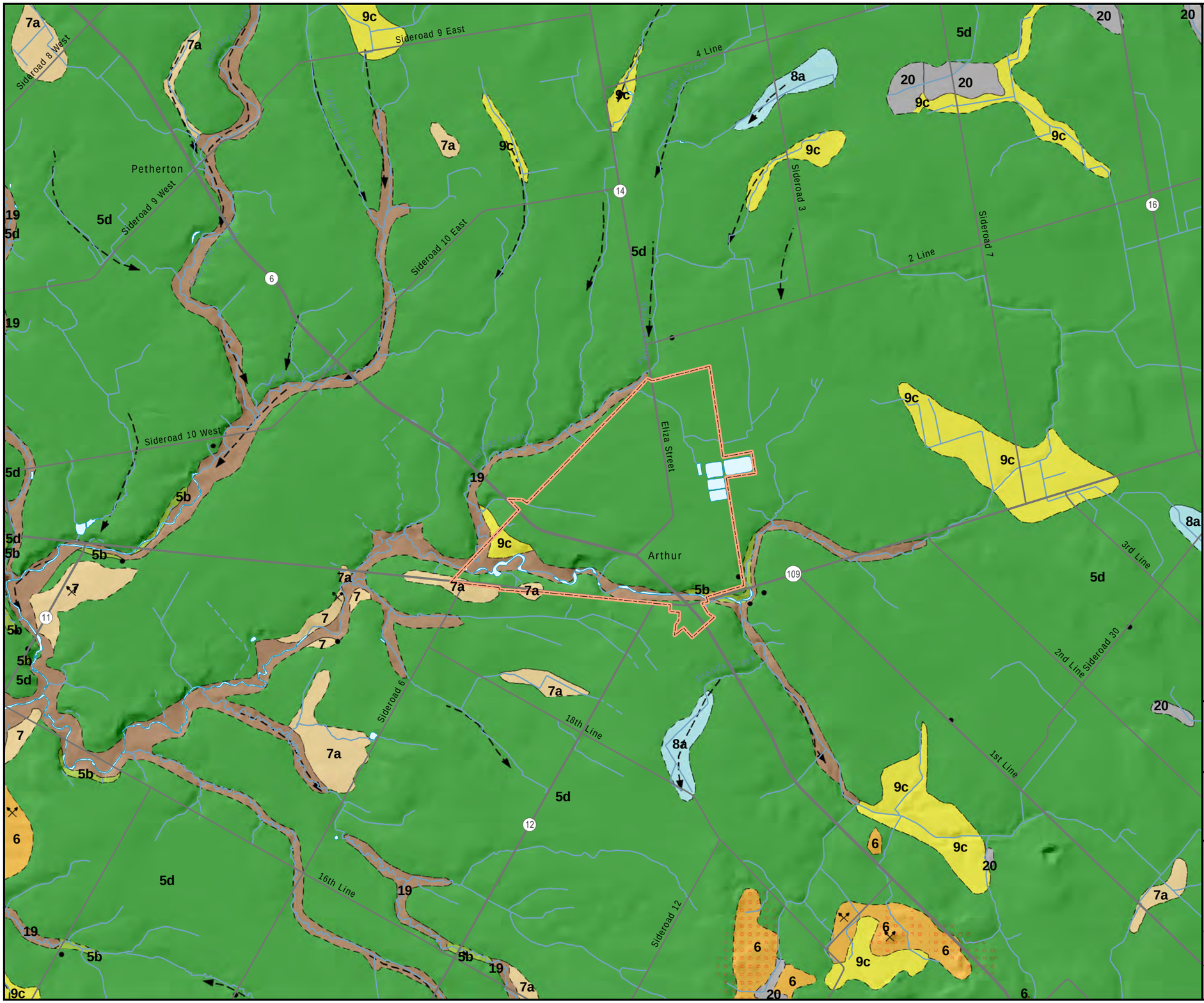

LEGEND

- Approximate Village Boundary
- Stream: Permanent
- Stream: Intermittent
- Expressway / Highway
- Arterial / Collector Road
- Local Road
- Waterbody

Surficial Geology

- 5b: Till: Stone-poor, carbonate-derived silty to sandy till
- 5d: Till: Glaciolacustrine-derived silty to clayey till
- 6: Ice-contact stratified deposits
- 7: Glaciofluvial deposits
- 7a: Glaciofluvial deposits: Sandy deposits
- 8a: Fine-textured glaciolacustrine deposits: Massive-well laminated
- 9c: Coarse-textured glaciolacustrine deposits: Foreshore-basinal deposits
- 19: Modern alluvial deposits
- 20: Organic deposits
- Unit Contact Boundary
- Sand and Gravel Pit
- Meltwater Channel: Inferred Direction of Flow
- Meltwater Channel: Unknown Direction of Flow
- Sample Location
- Hummocky Topography

Sources:

1. Ministry of Natural Resources, © Queen's Printer for Ontario
2. Natural Resources Canada © Her Majesty the Queen in Right of Canada.
3. Ontario Geological Survey 2010. Surficial geology of southern Ontario; Ontario Geological Survey, Miscellaneous Release—Data 128 – Revised.

N

Datum: North American 1983 CSRS

Coord. System: NAD 1983 CSRS UTM Zone 17N

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Metres

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TOWNSHIP OF WELLINGTON NORTH
VILLAGE OF ARTHUR

Figure Title

WELL EXPLORATION REPORT

SURFICIAL GEOLOGY

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Scale		Project No.	
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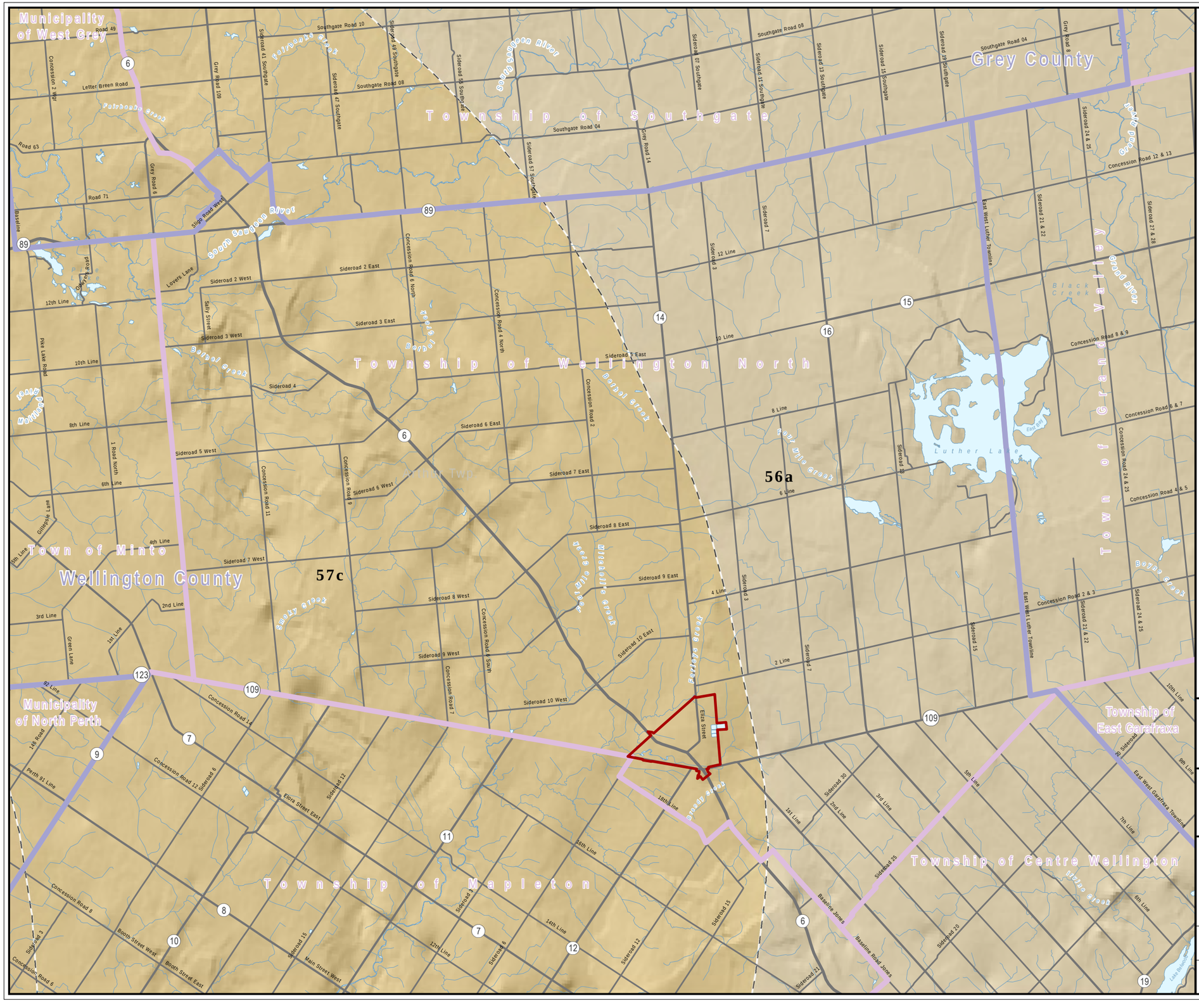

LEGEND

- Approximate Village Boundary
- County, Regional Municipality, District Boundary
- Municipal Boundary
- Watercourse
- Waterbody
- Expressway / Highway
- Arterial / Collector Road
- Local Road

LOWER SILURIAN - 56 Sandstone, shale, dolostone, siltstone

- 56a Guelph Fm.

UPPER SILURIAN - 57 Limestone, dolostone, shale, sandstone, gypsum, salt

- 57a Bass Islands Fm.
- 57c Salina Fm.

Sources:

1. Ontario Geological Survey 2011. 1:250 000 scale bedrock geology of Ontario; Ontario Geological Survey, Miscellaneous Release–Data 126 - Revision 1.
2. Ministry of Natural Resources, © Queen's Printer for Ontario
3. Natural Resources Canada © Her Majesty the Queen in Right of Canada

Datum: North American 1983 CSRS

Coord. System: NAD 1983 CSRS UTM Zone 18N

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0 1 2 3 4 5 6 7 8 9 10

Kilometers

BURNSIDE

Client

TOWNSHIP OF WELLINGTON NORTH VILLAGE OF ARTHUR

Figure Title

WELL EXPLORATION REPORT

BEDROCK GEOLOGY

Drawn	Checked	Date	Figure No.
CD	JB	January 2021	4
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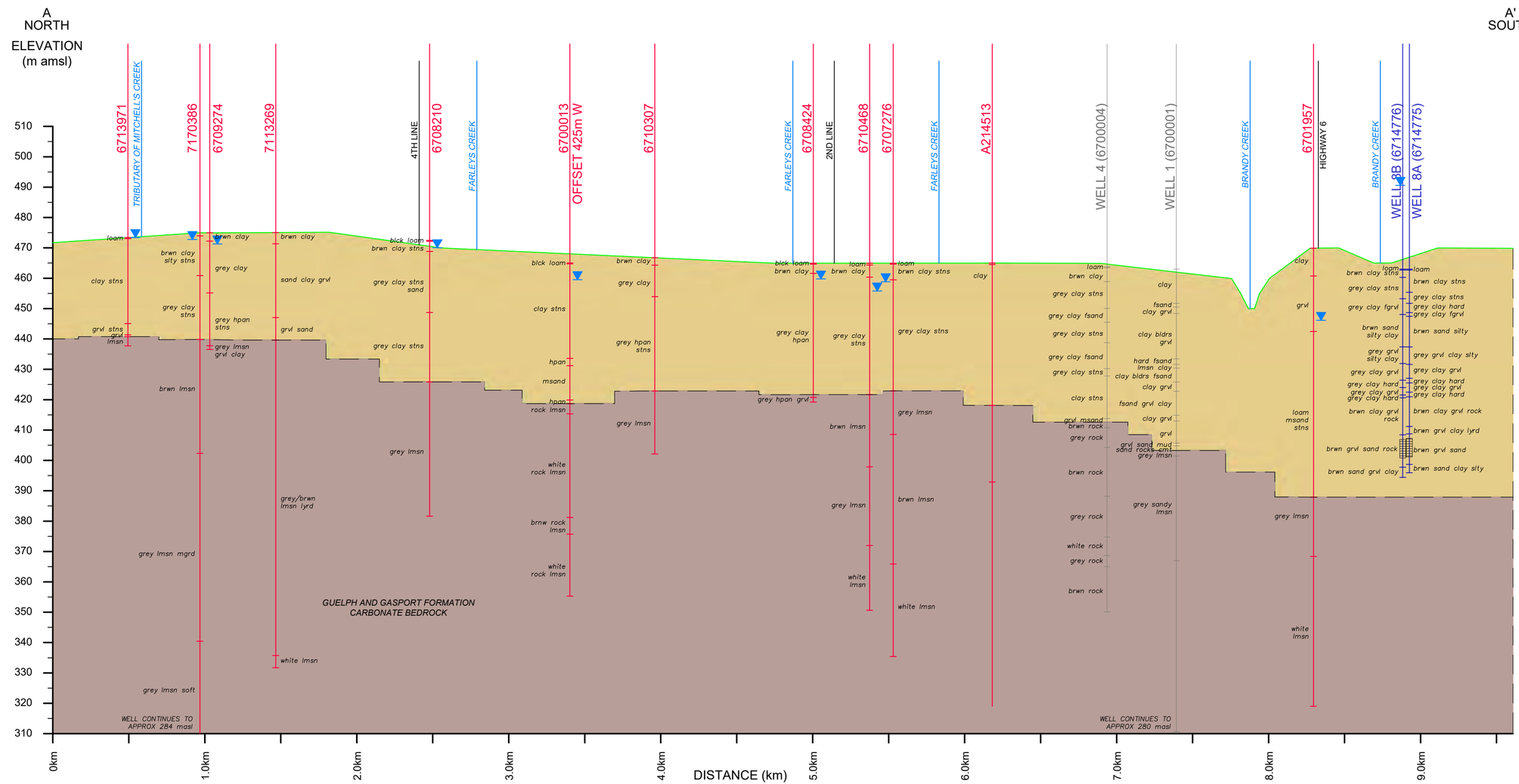

LEGEND

5883 — WELL LOCATION & NUMBER

EXISTING GROUND PROFILE

silty sand — GEOLOGICAL STRATIGRAPHY

STATIC WATER LEVEL
(At Time of Drilling)

WELL SCREEN

Horizontal Scale: 1:20,000
Vertical Scale: 1:1,000
Vertical Exaggeration: 20X

BURNSIDE

Client
TOWNSHIP OF WELLINGTON NORTH
VILLAGE OF ARTHUR

Figure Title
WELL EXPLORATION REPORT

INTERPRETED CROSS SECTION A-A'

Drawn	Checked	Date	Figure No.
CD	JB	December 2020	**5**
Scale		Project No.	
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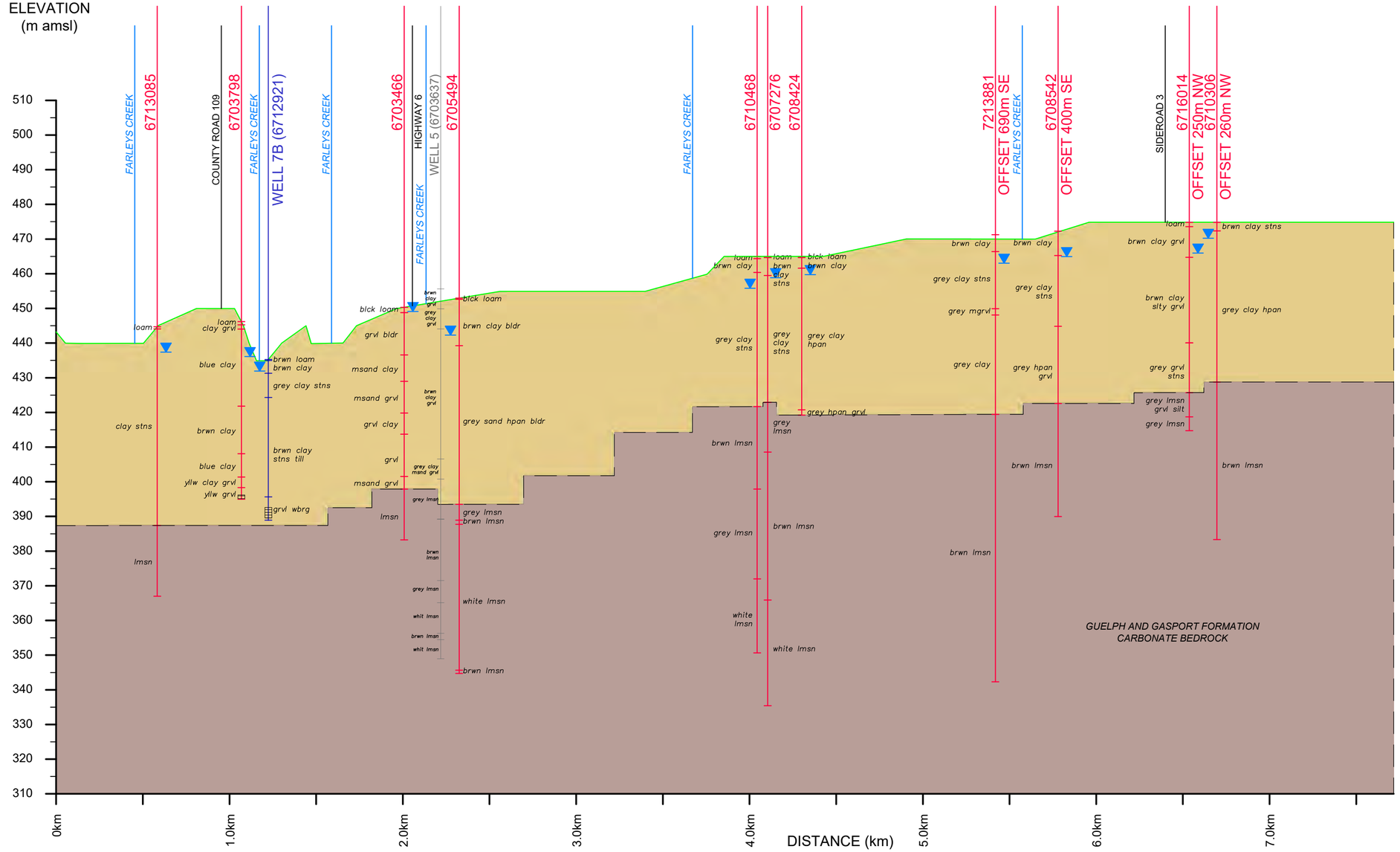
B
SOUTHWEST

B'
NORTHEAST

ELEVATION
(m amsl)



LEGEND

5893 — WELL LOCATION & NUMBER

EXISTING GROUND PROFILE

silty sand — GEOLOGICAL STRATIGRAPHY

STATIC WATER LEVEL
(At Time of Drilling)

WELL SCREEN

Horizontal Scale: 1:20,000
Vertical Scale: 1:1,000
Vertical Exaggeration: 20X

BURNSIDE

Client
TOWNSHIP OF WELLINGTON NORTH
VILLAGE OF ARTHUR

Figure Title
WELL EXPLORATION REPORT

INTERPRETED CROSS SECTION B-B'

Drawn	Checked	Date	Figure No.
CD	JB	December 2020	**6**
Scale		Project No.	
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Appendix A

Water Well Records

Burnside ID	Date Completed	Screen Top (m)	Casing Bottom (m)	Borehole Depth (m)	Bedrock Depth (m)	Static water Level (m)	Test Flow Rate (l/min)	Level End Pump Test (m)	Available Drawdown (l/m	Specific Capacity (l/min/m	Theoretical Yield (l/s)	Water	Elevation	Comments
MOE.7334364	23-May-19			86.9	81.4	11.9	68.2	13	72.2	62	75	(1) Untested 85.3m		south of hwy 9, Rulkay Farms, 2019, WIL
MOE.6702883	24-Oct-56			74.4	69.5	21.3	68.2	22.9	48.2	42.6	34	(1) Fresh 74.4m	462.2	old 4 inch 200 m SE of 6 and 9
MOE.6713857	07-Aug-01	67.1	67.1	71.3		10.7	181.8	16.2	56.4	33.1	31	(1) Fresh 68.3m	461.1	Overburden SW of 6 and 9
MOE.7288592	02-May-17			80.2	66.8	10.5	154.6	15.7	58.4	29.7	29	(1) Fresh 77.7m	451.4	top of rock 2 km SW of 6 and 9
MOE.6702118	15-Sep-64			82	51.2	9.1	68.2	13.7	71.7	14.8	18	(1) Fresh 81.4m	454.8	2 km SW of 6 and 9, top of rock
MOE.6710396	24-Jul-90			75.3	12.2	11.9	68.2	15.8	58.2	17.5	17	(1) Fresh 75.3m	470.9	4 km SE of 6 and 9, top of rock
MOE.6711738	13-Jun-95			80.8	62.5	12.5	45.5	15.2	50.9	16.9	14	(1) Fresh 76.2m	472.9	3 km SE of 6 and 9,top of Rock
MOE.7254812	01-Sep-15			120.4	5.2	7.3	68.2	11	44.5	18.4	14		461.5	8inch well 4 km NW of Arthur, deep rock
MOE.6706641	23-Jun-77			95.1	59.4	21.6	27.3	23.5	52.5	14.4	13	(1) Fresh 85.3m	470.5	jonesbaseline (Knight) 6km SE of 6and 7, deep rock
MOE.6704178	07-Oct-71			75.9	69.8	21.6	45.5	25.9	49.4	10.6	9	(1) Fresh 74.1m	470	jonesbaseline 6km SE of 6and 9, top of rock
MOE.6710971	30-Jun-92			94.5	93.9	23.2	27.3	27.1	71	7	8	(1) Fresh 94.5m	469.5	HWY6 5km SE of 6and 9, top of rock
MOE.6703847	07-Aug-70			76.2	63.1	10.1	31.8	13.7	53.9	8.8	8	(1) Fresh 67.1m	474.5	4km east of arthur, top of rock
MOE.6703000	09-Mar-65			98.8	73.8	12.2	45.5	18.3	62.8	7.5	8	(1) Fresh 96m	462.9	1 km east of arthur, 80' of rock
MOE.7333175	29-Apr-19			79.3	55.8	10.7	45.5	15.2	46	10.1	8			8586 hwy 6 NW of arthur,80' of rock
MOE.6700002	28-Jun-50			93	48.5	9.1	318.2	39.6	39.4	10.4	7	(1) Fresh 86.9m	454	Arthur Well 3
MOE.6702129	07-Apr-58			122.8	51.2	9.1	54.6	18.3	58	5.9	6	(1) Fresh 122.8m	454.7	hwy 9 1 km west of 6, deep bedrock, 4 inch
MOE.6714404	25-Feb-03			103.6	67.7	16.5	113.7	34.7	54.2	6.2	6	(1) Fresh 103.6m	468.7	
MOE.6703637	18-Mar-70			106.7	56.7	10.1	277.3	53.3	48.1	6.4	5	(1) Fresh 73.2m	455.8	
MOE.7185589	06-Aug-12			135.6	131.4	10.4	22.7	20.4	121.6	2.3	5	(1) Fresh 132.9m	475	
MOE.6700004	29-Nov-66			113.4	51.2	10.7	386.4	71.6	41.1	6.3	4	(1) Fresh 61m	463.4	Arthur Well 4, near the pool
MOE.6711333	25-Aug-93			82.3	61.9	8.5	45.5	18.3	54.3	4.6	4	(1) Fresh 76.2m	452.3	
MOE.6703976	20-May-71			85.3	71.3	14	22.7	19.8	58.5	3.9	4	(1) Fresh 84.7m	462.6	
MOE.6703003	09-Feb-62			99.1	54.9	8.5	54.6	23.2	58.6	3.7	4	(1) Fresh 91.4m	468	
MOE.6705980	05-Apr-76			86	76.8	27.4	45.5	32	19.8	9.9	3	(1) Fresh 86m	467.3	
MOE.6703001	21-May-63			86.6	74.1	13.1	45.5	27.4	61	3.2	3	(1) Fresh 83.8m	464.4	
MOE.6703707	03-Jun-70			80.8	46.3	3.7	45.5	15.2	42.6	4	3	(1) Fresh 80.8m	475.4	
MOE.7050300	13-Aug-07			82.3	69.5	15.9	34	29.2	56.5	2.6	2	(1) Fresh 74m	457	
MOE.1703073	05-Oct-84			71.6	32	11.3	54.6	19.8	22.2	6.4	2	(1) Fresh 61m	460.1	
MOE.6708230	10-Jul-85			70.1	2.4	0.6	54.6	19.8	47.9	2.8	2	(1) Fresh 67.1m	437.6	
MOE.6705420	02-Jan-75			86.6	71.9	15.2	36.4	32	56.7	2.2	2	(1) Fresh 82.3m	461.8	
MOE.6712404	16-Oct-97			78	64	7.3	36.4	28.3	58.2	1.7	2	(1) Fresh 75m	463.8	

7353747 (Clark)

19-17

Ontario — Ministry of the Environment and Climate Change

Measurements recorded in: ☑ Metric ☐ Imperial

Well Tag No. *(Place Sticker and/or Print Below)* Tag#: A 214513

Well Record

068

Regulation 903 Ontario Water Resources Act

Page ____ of ____

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	☐ Well Constructed by Well Owner
	CLARK BROS CONTRACTING		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
510 ELIZA ST	ARTHUR	ON	N0G1A0	519 848 3070

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
510 ELIZA ST.	ARTHUR	28	1

County/District/Municipality	City/Town/Village	Province	Postal Code
WELLINGTON		Ontario	N0G1A0

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 8 3	17	537401	4854520		

Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
BROWN	TOPSOIL			0	.5
	CLAY	GRAVEL		.5	46.9
GREY	LIMESTONE	BROWN LAYERS		46.9	72.1
			DEPTH	236½'	

Annular Space

Depth Set at (m/ft) From	Depth Set at (m/ft) To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
0	7.0	BENTONITE	.2

Method of Construction

☐ Cable Tool ☐ Diamond
☑ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☐ Boring ☐ Digging
☐ Air percussion
☐ Other, specify

Well Use

☐ Public ☐ Commercial ☐ Not used
☑ Domestic ☐ Municipal ☐ Dewatering
☐ Livestock ☐ Test Hole ☐ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, specify

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
15.9	STEEL	.48	+.8	48.0
15.6	OPEN HOLE		48.0	72.1

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To

Status of Well

☑ Water Supply
☐ Replacement Well
☐ Test Hole
☐ Recharge Well
☐ Dewatering Well
☐ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☐ Abandoned, other, specify
☐ Other, specify

Water Details

Water found at Depth	Kind of Water: ☐ Fresh ☑ Untested

Hole Diameter

Depth (m/ft) From	Depth (m/ft) To	Diameter (cm/in)

Results of Well Yield Testing

After test of well yield, water was:
☑ Clear and sand free
☐ Other, specify

If pumping discontinued, give reason:

Pump intake set at (m/ft): 46M 150'

Pumping rate (l/min / GPM): 45 LPM 12GPM

Duration of pumping: 1 hrs + 0 min

Final water level end of pumping (m/ft): 33.68M 110.5'

If flowing give rate (l/min / GPM):

Recommended pump depth (m/ft): 46M 150'

Recommended pump rate (l/min / GPM): 38LPM 10GPM

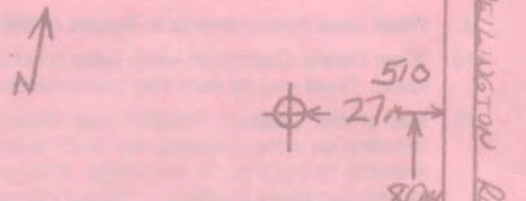
Well production (l/min / GPM):

Disinfected? ☑ Yes ☐ No

	Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level		11.34		33.68
1	1	13.32	1	31.91
2	2	14.94	2	30.36
3	3	16.35	3	28.91
4	4	17.60	4	27.87
5	5	18.75	5	26.35
10	10	23.10	10	21.50
15	15	26.06	15	18.32
20	20	28.12	20	16.29
25	25	29.67	25	14.91
30	30	30.82	30	14.04
40	40	32.25	40	13.09
50	50	33.07	50	12.65
60	60	33.68	60	12.37

Map of Well Location

Please provide a map below following instructions on the back.



Method of Construction		Well Use		
☐ Cable Tool	☐ Diamond	☐ Public	☐ Commercial	☐ Not used
☑ Rotary (Conventional)	☐ Jetting	☑ Domestic	☐ Municipal	☐ Dewatering
☐ Rotary (Reverse)	☐ Driving	☐ Livestock	☐ Test Hole	☐ Monitoring
☐ Boring	☐ Digging	☐ Irrigation	☐ Cooling & Air Conditioning	
☐ Air percussion		☐ Industrial		
☐ Other, *specify*		☐ Other, *specify*		

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
15.9	STEEL	.48	+.8	48.0
15.6	OPEN HOLE		48.0	72.1

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To

Status of Well

- ☑ Water Supply
- ☐ Replacement Well
- ☐ Test Hole
- ☐ Recharge Well
- ☐ Dewatering Well
- ☐ Observation and/or Monitoring Hole
- ☐ Alteration (Construction)
- ☐ Abandoned, Insufficient Supply
- ☐ Abandoned, Poor Water Quality
- ☐ Abandoned, other, *specify*
- ☐ Other, *specify*

Water Details

Water found at Depth	Kind of Water
60-72 (m/ft) ☐ Gas	☐ Fresh ☑ Untested ☐ Other, *specify*
(m/ft) ☐ Gas	☐ Fresh ☐ Untested ☐ Other, *specify*
(m/ft) ☐ Gas	☐ Fresh ☐ Untested ☐ Other, *specify*

Hole Diameter

Depth (m/ft) From	Depth (m/ft) To	Diameter (cm/in)
0	7.0	25.1
7.0	48.0	22.3
48.0	72.1	15.6

46M 150

Pumping rate (l/min / GPM): 45 LPM 12GPM

Duration of pumping: 1 hrs + 0 min

Final water level end of pumping (m/ft): 33.68M 110.5'

If flowing give rate (l/min / GPM):

Recommended pump depth (m/ft): 46M 150'

Recommended pump rate (l/min / GPM): 38LPM 10GPM

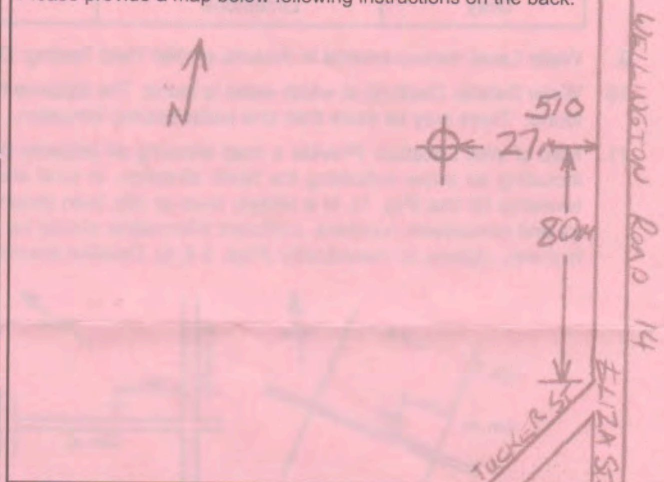
Well production (l/min / GPM):

Disinfected? ☑ Yes ☐ No

2	14.[illegible]	2	30.[illegible]
3	16.35	3	28.91
4	17.60	4	27.87
5	18.75	5	26.35
10	23.10	10	21.50
15	26.06	15	18.32
20	28.12	20	16.29
25	29.67	25	14.91
30	30.82	30	14.04
40	32.25	40	13.09
50	33.07	50	12.65
60	33.68	60	12.37

Map of Well Location

Please provide a map below following instructions on the back.



Comments:

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
MEADOW BANK DRILLING SERVICES	6 8 6 5

Business Address (Street Number/Name)	Municipality
RR5	MT FOREST

Province	Postal Code	Business E-mail Address
ON	N0G2L0	

Bus.Telephone No. *(inc. area code)*	Name of Well Technician (Last Name, First Name)
5193233548	HUGH BROADFOOT

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
1 8 9 7	[signature]	20140830

Well owner's information package delivered	Date Package Delivered	Date Work Completed
☑ Yes ☐ No	20140830	20140826

Ministry Use Only

Audit No. Z298683

Received

0506E (2014/11)

Well Owner's Copy

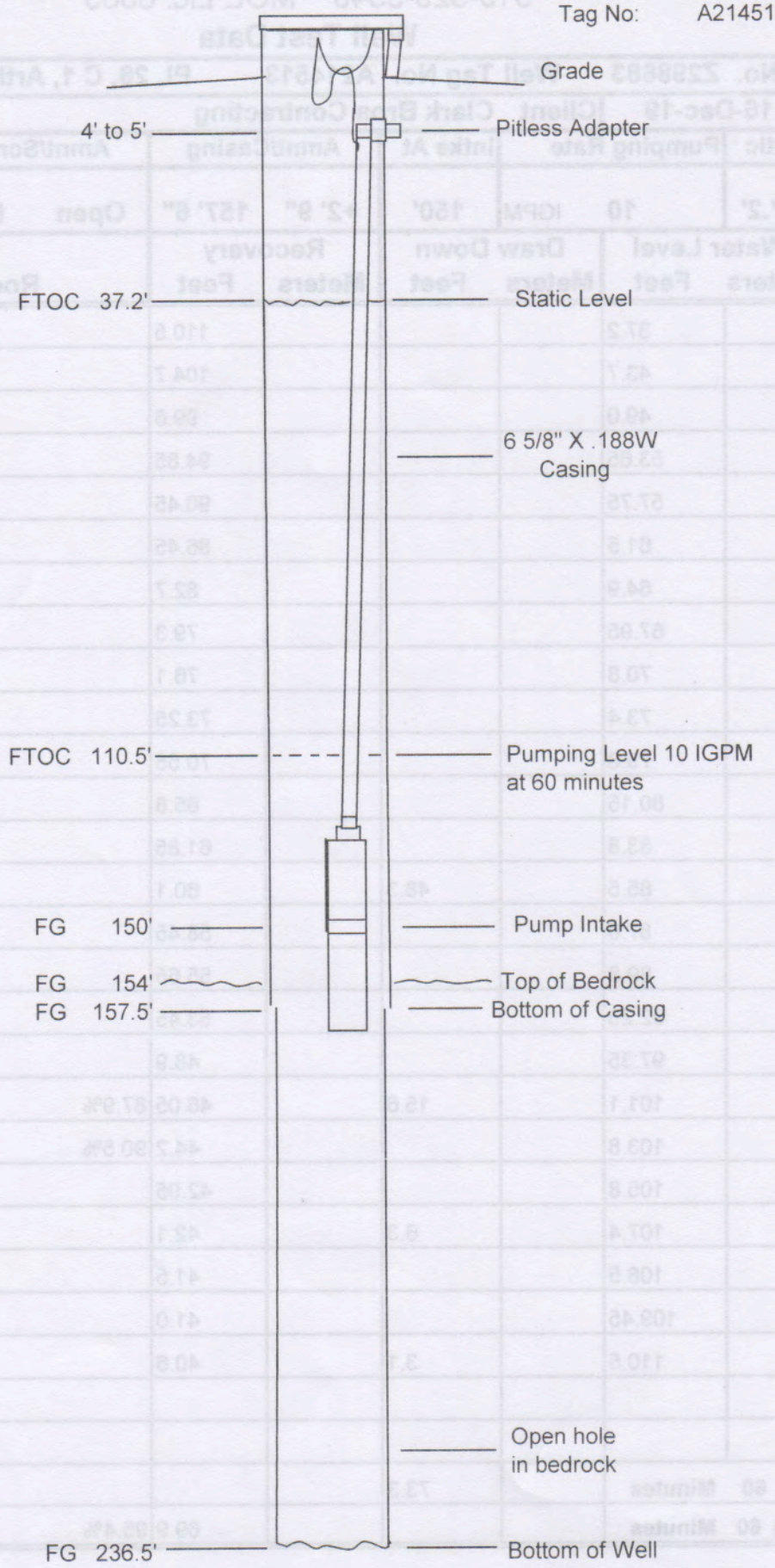
Meadowbank Drilling Services
RR 5, Mt Forest, ON, N0G 2L0
519-323-3548
MOE Lic. 6865

Date: 16-Dec-19
Well Record: Z298683
Tag No: A214513

Well No. 19-17
Clark Bros Contracting
510 Eliza St,
Arthur, ON, N0G 1A0
Part Lot 28,
Conc.1,
Arthur Twp.,
Wellington County.

GPS NAD 83 17
537401
4854520

FTOC from top of casing
FG from grade



Not to Scale

Meadowbank Drilling Services

RR 5, Mt Forest, Ont. N0G 2L0
519-323-3548 MOE Lic. 6865

Well Test Data

MOE Audit No. Z298683			Well Tag No. A214513			PL 28, C 1, Arthur Twp, Wellington Cty		
Date 16-Dec-19			Client Clark Bros Contracting			510 Eliza St, Arthur, ON		
Well #	Static	Pumping Rate	Intke At	Amnt/Casing		Amnt/Screen	Ttl Dpth	Datum
19-17	37.2'	10 IGPM	150'	+2' 9"	157' 6"	Open Hole	To Grade 236.5'	Top of Casing

Elapsd Time	Water Level Meters	Water Level Feet	Draw Down Meters	Draw Down Feet	Recovery Meters	Recovery Feet	Remarks
							Rock starts @ 154'
0		37.2				110.5	
1		43.7				104.7	
2		49.0				99.6	
3		53.65				94.85	
4		57.75				90.45	
5		61.5				86.45	
6		64.9				82.7	
7		67.95				79.3	
8		70.8				76.1	
9		73.4				73.25	
10		75.8				70.55	
12		80.15				65.8	
14		83.8				61.85	
15		85.5		48.3		60.1	
16		87.0				58.45	
18		89.8				55.65	
20		92.25				53.45	
25		97.35				48.9	
30		101.1		15.6		46.05	87.9%
35		103.8				44.2	90.5%
40		105.8				42.95	
45		107.4		6.3		42.1	
50		108.5				41.5	
55		109.45				41.0	
60		110.5		3.1		40.6	
Drawdown @ 60 Minutes				73.3			
Recovery @ 60 Minutes						69.9	95.4%

Comments

Well Screening Report
Arthur 8A (MOE.6714775)

Geographic Location		
Long/Lat: 80.520851°W 43.820147°N UTM: 17T 538531 4852008		
County (1)		CON
Wellington		A
Municipality (1)		Lot
Peel Twp.		020
MOE ID	Tag	Audit No.
6714775		253367
Burnside Well Class		Construction Date
Well: Municiplal Supply		9/8/2003
MOE Well Class		
Water Supply		
MOE Well Uses (Primary Use | Secondary Use)		
Municipal | Not Recorded		
Ground Elevation	Bedrock Depth	Borehole Depth
462.1 (masl)		67.1 m
Static Water Lev.	Lev. After Pump Test	Test Flow Pump Rate
27 m	32 m	690 l/min
Available Drawdown	Specific Capacity	Theoretical Yield
28.8 m	138 l/min/m	3974.4 l/min

Geology Description

(1) Topsoil 0m ~ .3m | (2) Clay, Stones (Brown) .3m ~ 7.6m | (3) Clay, Stones (Grey) 7.6m ~ 11.3m | (4) Clay, Hard (Grey) 11.3m ~ 14.3m | (5) Clay, Fine Gravel (Grey) 14.3m ~ 15.5m | (6) Sand, Silty (Brown) 15.5m ~ 25.6m | (7) Gravel, Clay, Silty (Grey) 25.6m ~ 31.4m | (8) Clay, Gravel (Grey) 31.4m ~ 36m | (9) Clay, Hard (Grey) 36m ~ 37.5m | (10) Clay, Gravel (Grey) 37.5m ~ 40.5m | (11) Clay, Hard (Grey) 40.5m ~ 42.1m | (12) Clay, Gravel, Rock (Brown) 42.1m ~ 51.8m | (13) Gravel, Clay, Layered (Brown) 51.8m ~ 54.3m | (14) Gravel, Sand (Brown) 54.3m ~ 64.3m | (15) Sand, Clay, Silty (Brown) 64.3m ~ 67.1m

Casing Description

(1) 10″ø Steel ~ 55.8m

Screens	Water Encountered (at time of drilling)
(1) 55.8m ~ 61.9m	(1) Not Stated 61.9m

Project Notes

Elevation updated with LiDAR DTM.

Link to MOE Water Well Record

https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/671/6714775.pdf

(1) Names may reflect former municipalities at the time of construction.

0 500 1,000
Metres

Well: Municipal Supply

Geographic Location		
Long/Lat: 80.521148°W 43.820333°N UTM: 17T 538507 4852029		
County (1)		CON
Wellington		A
Municipality (1)		Lot
Peel Twp.		020
MOE ID	Tag	Audit No.
6714776		253368
Burnside Well Class		Construction Date
Well: Municiplal Supply		9/23/2003
MOE Well Class		
Water Supply		
MOE Well Uses (Primary Use | Secondary Use)		
Municipal | Not Recorded		
Ground Elevation	Bedrock Depth	Borehole Depth
462 (masl)		68.6 m
Static Water Lev.	Lev. After Pump Test	Test Flow Pump Rate
27 m	30 m	690 l/min
Available Drawdown	Specific Capacity	Theoretical Yield
29.1 m	230 l/min/m	6693 l/min

Geology Description

(1) Topsoil 0m ~ .3m | (2) Clay, Stones (Brown) .3m ~ 2.7m | (3) Clay, Stones (Grey) 2.7m ~ 9.8m | (4) Clay, Fine Gravel (Grey) 9.8m ~ 14.9m | (5) Sand, Silty, Clay (Brown) 14.9m ~ 25.6m | (6) Gravel, Silty, Clay (Grey) 25.6m ~ 31.1m | (7) Clay, Gravel (Grey) 31.1m ~ 36.6m | (8) Clay, Hard (Grey) 36.6m ~ 39m | (9) Clay, Gravel (Grey) 39m ~ 41.5m | (10) Clay, Hard (Grey) 41.5m ~ 42.4m | (11) Clay, Gravel, Rock (Brown) 42.4m ~ 54.6m | (12) Gravel, Sand, Rock (Brown) 54.6m ~ 65.2m | (13) Sand, Gravel, Clay (Brown) 65.2m ~ 68.6m

Casing Description

(1) 10″ø Steel ~ 55.8m

Screens	Water Encountered (at time of drilling)
(1) 56.1m ~ 62.2m	

Project Notes

Elevation updated with LiDAR DTM.

Link to MOE Water Well Record

https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/671/6714776.pdf

(1) Names may reflect former municipalities at the time of construction.

Geographic Location		
Long/Lat: 80.495779°W 43.808995°N UTM: 17T 540554 4850782		
County (1)		CON
Dufferin		01
Municipality (1)		Lot
East Garafraxa Twp.		031
MOE ID	Tag	Audit No.
1703073		
Burnside Well Class		Construction Date
Well: Domestic Supply		10/5/1984
MOE Well Class		
Water Supply		
MOE Well Uses (Primary Use | Secondary Use)		
Domestic | Not Recorded		
Ground Elevation	Bedrock Depth	Borehole Depth
460.1 (masl)	32 m	71.6 m
Static Water Lev.	Lev. After Pump Test	Test Flow Pump Rate
11.3 m	19.8 m	54.6 l/min
Available Drawdown	Specific Capacity	Theoretical Yield
22.2 m	6.4 l/min/m	142.6 l/min

Geology Description

(1) Clay, Stones (Brown) 0m ~ 32m | (2) Limestone 32m ~ 71.6m

Casing Description

(1) 5″ø Steel ~ 33.5m | (2) 5″ø Open ~ 71.6m

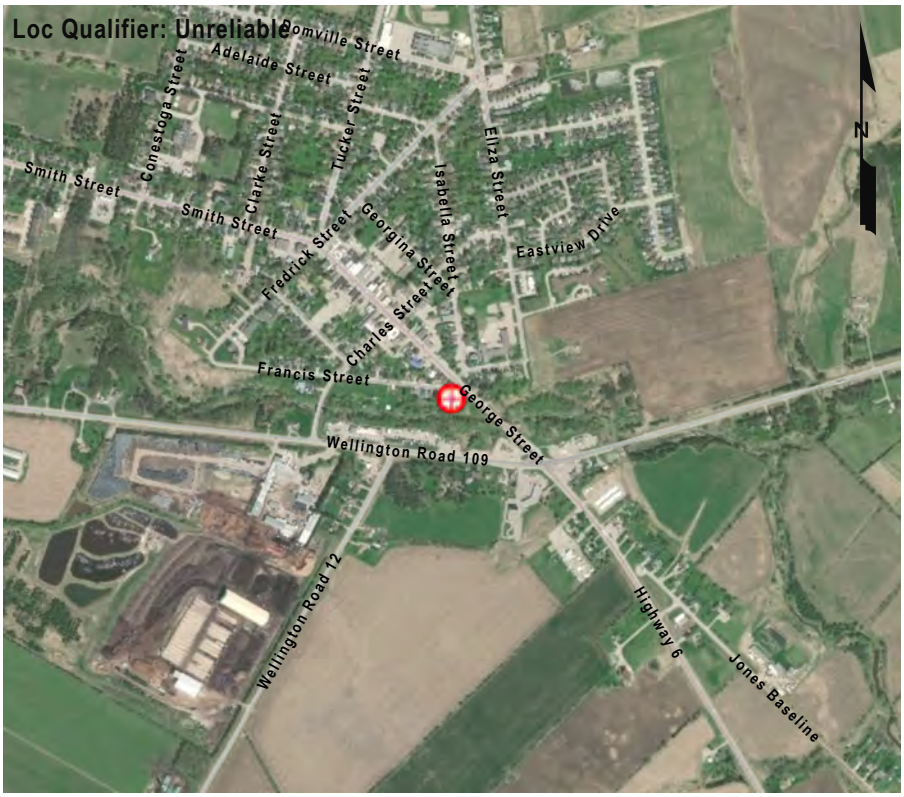
Screens	Water Encountered (at time of drilling)
	(1) Fresh 61m

Project Notes

Link to MOE Water Well Record

https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/170/1703073.pdf

(1) Names may reflect former municipalities at the time of construction.



Geographic Location		
Long/Lat: 80.533802°W 43.829163°N UTM: 17T 537484 4853004		
County (1)		CON
Wellington		
Municipality (1)		Lot
Arthur Village		
MOE ID	Tag	Audit No.
6700002		
Burnside Well Class		Construction Date
Well: Municiplal Supply		6/28/1950
MOE Well Class		
Water Supply		
MOE Well Uses (Primary Use | Secondary Use)		
Municipal | Not Recorded		
Ground Elevation	Bedrock Depth	Borehole Depth
454 (masl)	48.5 m	93 m
Static Water Lev.	Lev. After Pump Test	Test Flow Pump Rate
9.1 m	39.6 m	318.2 l/min
Available Drawdown	Specific Capacity	Theoretical Yield
39.4 m	10.4 l/min/m	411.1 l/min

Geology Description

(1) Fill 0m ~ 1.5m | (2) Clay (Brown) 1.5m ~ 10.7m | (3) Fine Sand (Brown) 10.7m ~ 15.2m | (4) Clay (Blue) 15.2m ~ 18.3m | (5) Clay, Medium Sand (Blue) 18.3m ~ 47.2m | (6) Gravel, Silt 47.2m ~ 48.5m | (7) Limestone (Brown) 48.5m ~ 55.8m | (8) Limestone (White) 55.8m ~ 57m | (9) Rock (Blue) 57m ~ 59.1m | (10) Rock (Grey) 59.1m ~ 61.9m | (11) Rock (Brown) 61.9m ~ 73.2m | (12) Rock (Blue) 73.2m ~ 78.9m | (13) Rock (White) 78.9m ~ 81.4m | (14) Rock (Blue) 81.4m ~ 82m | (15) Rock (Grey) 82m ~ 83.2m | (16) Rock (Brown) 83.2m ~ 87.8m | (17) Rock (Blue) 87.8m ~ 93m

Casing Description

(1) 10″ø Steel ~ 48.5m | (2) 10″ø Open ~ 93m

Screens	Water Encountered (at time of drilling)
	(1) Fresh 86.9m

Project Notes

Link to MOE Water Well Record

https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/670/6700002.pdf

(1) Names may reflect former municipalities at the time of construction.

Geographic Location		
Long/Lat: 80.533371°W 43.83659°N UTM: 17T 537514 4853829		
County (1)		CON
Wellington		
Municipality (1)		Lot
Arthur Village		
MOE ID	Tag	Audit No.
6700004		
Burnside Well Class		Construction Date
Well: Municiplal Supply		11/29/1966
MOE Well Class		
Water Supply		
MOE Well Uses (Primary Use | Secondary Use)		
Municipal | Not Recorded		
Ground Elevation	Bedrock Depth	Borehole Depth
463.4 (masl)	51.2 m	113.4 m
Static Water Lev.	Lev. After Pump Test	Test Flow Pump Rate
10.7 m	71.6 m	386.4 l/min
Available Drawdown	Specific Capacity	Theoretical Yield
41.1 m	6.3 l/min/m	260.8 l/min

Geology Description

(1) Topsoil 0m ~ .3m | (2) Clay (Brown) .3m ~ 4.9m | (3) Clay, Stones (Grey) 4.9m ~ 13.7m | (4) Clay, Fine Sand (Grey) 13.7m ~ 18.3m | (5) Clay, Stones (Grey) 18.3m ~ 25m | (6) Clay, Fine Sand (Grey) 25m ~ 33.5m | (7) Clay, Stones (Grey) 33.5m ~ 36m | (8) Clay, Stones 36m ~ 50m | (9) Gravel, Medium Sand 50m ~ 51.2m | (10) Rock (Brown) 51.2m ~ 53m | (11) Rock (Grey) 53m ~ 59.4m | (12) Rock (Brown) 59.4m ~ 75.6m | (13) Rock (Grey) 75.6m ~ 89m | (14) Rock (White) 89m ~ 95.1m | (15) Rock (Grey) 95.1m ~ 98.8m | (16) Rock (Brown) 98.8m ~ 113.4m

Casing Description

(1) 10″ø Steel ~ 51.8m | (2) 10″ø Open ~ 113.4m

Screens	Water Encountered (at time of drilling)
	(1) Fresh 61m | (2) Not Stated 113.4m

Project Notes

Link to MOE Water Well Record

https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/670/6700004.pdf

(1) Names may reflect former municipalities at the time of construction.

Geographic Location		
Long/Lat: 80.5554°W 43.804939°N UTM: 17T 535761 4850304		
County (1)		CON
Wellington		17
Municipality (1)		Lot
Peel Twp.		009
MOE ID	Tag	Audit No.
6702118		
Burnside Well Class		Construction Date
Well: Agricultural Supply		9/15/1964
MOE Well Class		
Water Supply		
MOE Well Uses (Primary Use | Secondary Use)		
Livestock | Domestic		
Ground Elevation	Bedrock Depth	Borehole Depth
454.8 (masl)	51.2 m	82 m
Static Water Lev.	Lev. After Pump Test	Test Flow Pump Rate
9.1 m	13.7 m	68.2 l/min
Available Drawdown	Specific Capacity	Theoretical Yield
71.7 m	14.8 l/min/m	1063 l/min

Geology Description

(1) Clay (Brown) 0m ~ 21.9m | (2) Medium Sand, Clay 21.9m ~ 51.2m | (3) Hardpan 51.2m ~ 80.8m | (4) Limestone 80.8m ~ 82m

Casing Description

(1) 4″ø Steel ~ 80.8m | (2) 4″ø Open ~ 82m

Screens	Water Encountered (at time of drilling)
	(1) Fresh 81.4m

Project Notes

Link to MOE Water Well Record

https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/670/6702118.pdf

(1) Names may reflect former municipalities at the time of construction.

Geographic Location		
Long/Lat: 80.548698°W 43.828107°N UTM: 17T 536287 4852880		
County (1)		CON
Wellington		19
Municipality (1)		Lot
Peel Twp.		008
MOE ID	Tag	Audit No.
6702129		
Burnside Well Class		Construction Date
Well: Agricultural Supply		4/7/1958
MOE Well Class		
Water Supply		
MOE Well Uses (Primary Use | Secondary Use)		
Livestock | Domestic		
Ground Elevation	Bedrock Depth	Borehole Depth
454.7 (masl)	51.2 m	122.8 m
Static Water Lev.	Lev. After Pump Test	Test Flow Pump Rate
9.1 m	18.3 m	54.6 l/min
Available Drawdown	Specific Capacity	Theoretical Yield
58 m	5.9 l/min/m	344.2 l/min

Geology Description

(1) Clay (Blue) 0m ~ 15.5m | (2) Gravel, Clay 15.5m ~ 51.2m | (3) Shale (Brown) 51.2m ~ 67.1m | (4) Limestone 67.1m ~ 122.8m

Casing Description

(1) 4″ø Steel ~ 67.1m | (2) 4″ø Open ~ 122.8m

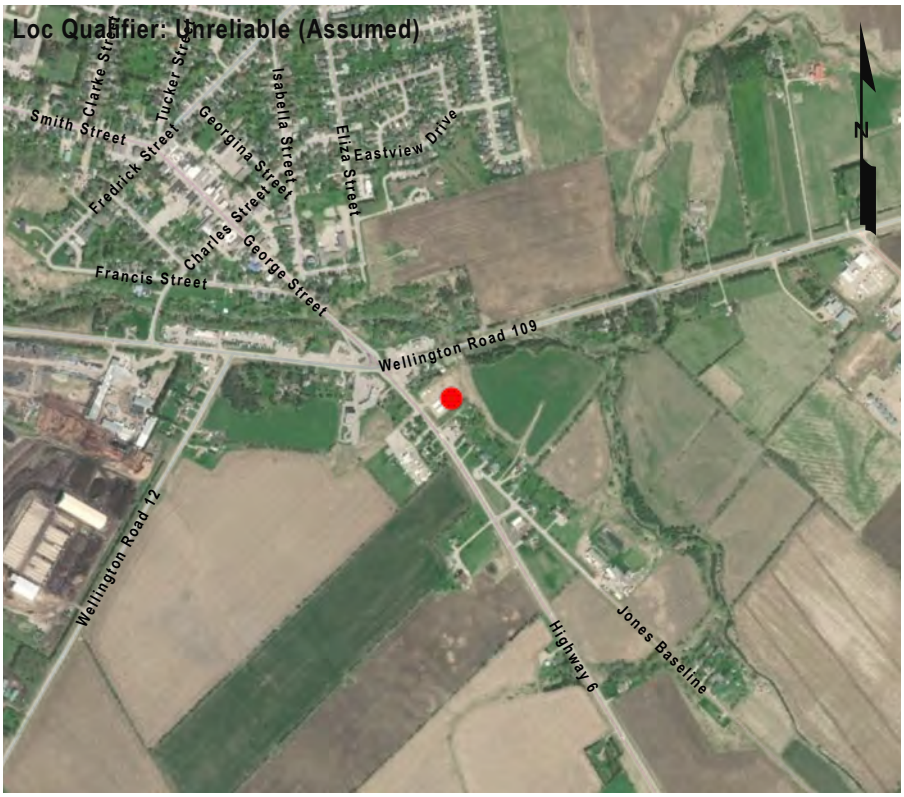
Screens	Water Encountered (at time of drilling)
	(1) Fresh 122.8m

Project Notes

Link to MOE Water Well Record

https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/670/6702129.pdf

(1) Names may reflect former municipalities at the time of construction.



Geographic Location		
Long/Lat: 80.528981°W 43.827091°N UTM: 17T 537873 4852776		
County (1)		CON
Wellington		01
Municipality (1)		Lot
West Garafraxa Twp.		037
MOE ID	Tag	Audit No.
6702883		
Burnside Well Class		Construction Date
Well: Domestic Supply		10/24/1956
MOE Well Class		
Water Supply		
MOE Well Uses (Primary Use | Secondary Use)		
Domestic | Not Recorded		
Ground Elevation	Bedrock Depth	Borehole Depth
462.2 (masl)	69.5 m	74.4 m
Static Water Lev.	Lev. After Pump Test	Test Flow Pump Rate
21.3 m	22.9 m	68.2 l/min
Available Drawdown	Specific Capacity	Theoretical Yield
48.2 m	42.6 l/min/m	2054.5 l/min

Geology Description

(1) Previously Dug 0m ~ 3.7m | (2) Clay 3.7m ~ 69.5m | (3) Limestone 69.5m ~ 74.4m

Casing Description

(1) 4″ø Steel ~ 69.5m | (2) 4″ø Open ~ 74.4m

Screens	Water Encountered (at time of drilling)
	(1) Fresh 74.4m

Project Notes

Link to MOE Water Well Record

https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/670/6702883.pdf

(1) Names may reflect former municipalities at the time of construction.

Geographic Location	
Long/Lat: 80.515359°W 43.833678°N UTM: 17T 538964 4853514	
County (1)	CON
Wellington	01
Municipality (1)	Lot
West Luther Twp.	003

MOE ID	Tag	Audit No.
6703000		
Burnside Well Class		**Construction Date**
Well: Agricultural Supply		3/9/1965
MOE Well Class		
Water Supply		
MOE Well Uses (Primary Use | Secondary Use)		
Livestock | Domestic		
Ground Elevation	**Bedrock Depth**	**Borehole Depth**
462.9 (masl)	73.8 m	98.8 m
Static Water Lev.	**Lev. After Pump Test**	**Test Flow Pump Rate**
12.2 m	18.3 m	45.5 l/min
Available Drawdown	**Specific Capacity**	**Theoretical Yield**
62.8 m	7.5 l/min/m	468.4 l/min

Geology Description

(1) Clay, Stones (Grey) 0m ~ 12.2m | (2) Medium Sand 12.2m ~ 18.3m | (3) Clay, Medium Sand (Grey) 18.3m ~ 54.9m | (4) Gravel, Stones 54.9m ~ 65.5m | (5) Medium Sand 65.5m ~ 71.6m | (6) Clay, Stones (Grey) 71.6m ~ 73.8m | (7) Rock (Blue) 73.8m ~ 80.8m | (8) Limestone (White) 80.8m ~ 98.8m

Casing Description

(1) 4"ø Steel ~ 75m | (2) 4"ø Open ~ 98.8m

Screens	Water Encountered (at time of drilling)
	(1) Fresh 96m

Project Notes

Link to MOE Water Well Record

https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/670/6703000.pdf

(1) Names may reflect former municipalities at the time of construction.

Geographic Location		
Long/Lat: 80.507402°W 43.833284°N UTM: 17T 539604 4853474		
County (1)		CON
Wellington		01
Municipality (1)		Lot
West Luther Twp.		004
MOE ID	Tag	Audit No.
6703001		
Burnside Well Class		Construction Date
Well: Agricultural Supply		5/21/1963
MOE Well Class		
Water Supply		
MOE Well Uses (Primary Use | Secondary Use)		
Livestock | Domestic		
Ground Elevation	Bedrock Depth	Borehole Depth
464.4 (masl)	74.1 m	86.6 m
Static Water Lev.	Lev. After Pump Test	Test Flow Pump Rate
13.1 m	27.4 m	45.5 l/min
Available Drawdown	Specific Capacity	Theoretical Yield
61 m	3.2 l/min/m	194.1 l/min

Geology Description

(1) Topsoil 0m ~ .6m | (2) Stones, Gravel .6m ~ 7.6m | (3) Clay, Gravel 7.6m ~ 24.4m | (4) Gravel, Medium Sand, Boulders 24.4m ~ 39.6m | (5) Clay, Medium Sand, Gravel 39.6m ~ 47.2m | (6) Gravel, Stones 47.2m ~ 53.3m | (7) Medium Sand, Clay 53.3m ~ 65.5m | (8) Gravel, Medium Sand 65.5m ~ 68.6m | (9) Quicksand 68.6m ~ 74.1m | (10) Rock (Brown) 74.1m ~ 86.6m

Casing Description

(1) 4"ø Steel ~ 74.1m | (2) 4"ø Open ~ 86m

Screens	Water Encountered (at time of drilling)
	(1) Fresh 83.8m

Project Notes

Link to MOE Water Well Record

https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/670/6703001.pdf

(1) Names may reflect former municipalities at the time of construction.

Geographic Location		
Long/Lat: 80.496673°W 43.837199°N UTM: 17T 540464 4853914		
County (1)		CON
Wellington		01
Municipality (1)		Lot
West Luther Twp.		006
MOE ID	Tag	Audit No.
6703003		
Burnside Well Class		Construction Date
Well: Agricultural Supply		2/9/1962
MOE Well Class		
Water Supply		
MOE Well Uses (Primary Use | Secondary Use)		
Livestock | Domestic		
Ground Elevation	Bedrock Depth	Borehole Depth
468 (masl)	54.9 m	99.1 m
Static Water Lev.	Lev. After Pump Test	Test Flow Pump Rate
8.5 m	23.2 m	54.6 l/min
Available Drawdown	Specific Capacity	Theoretical Yield
58.6 m	3.7 l/min/m	217.7 l/min

Geology Description

(1) Previously Dug 0m ~ 13.7m | (2) Clay, Medium Sand 13.7m ~ 18.3m | (3) Clay, Medium Sand, Gravel (Brown) 18.3m ~ 54.9m | (4) Shale (Brown) 54.9m ~ 64m | (5) Limestone (Brown) 64m ~ 99.1m

Casing Description

(1) 4"ø Steel ~ 67.1m | (2) 4"ø Open ~ 99.1m

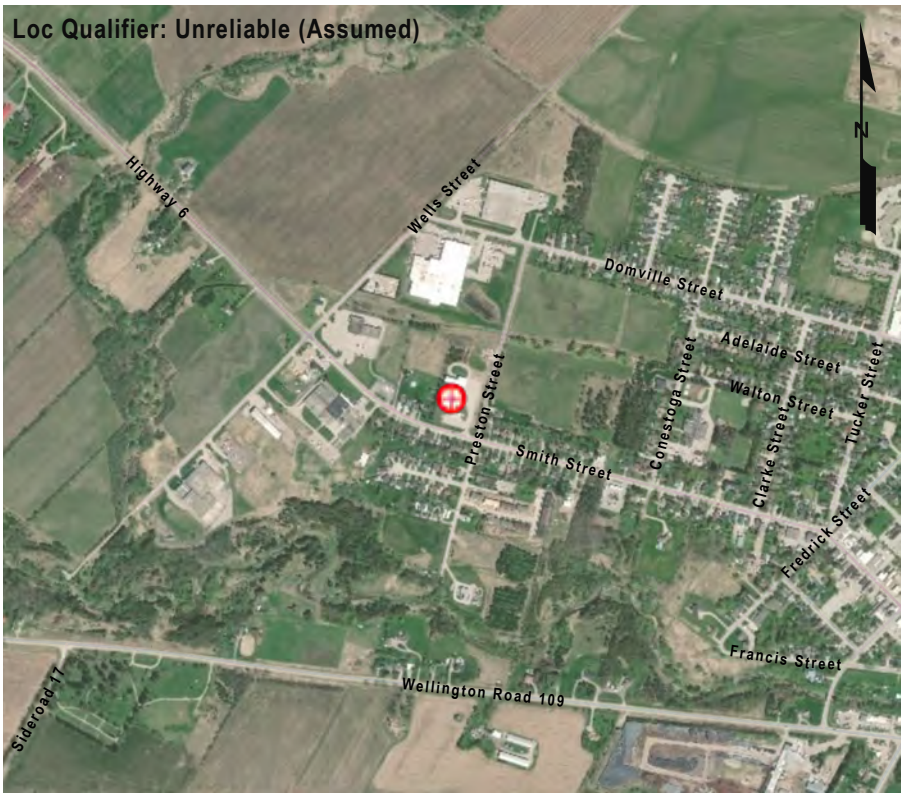
Screens	Water Encountered (at time of drilling)
	(1) Fresh 91.4m

Project Notes

Link to MOE Water Well Record

https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/670/6703003.pdf

(1) Names may reflect former municipalities at the time of construction.



Geographic Location		
Long/Lat: 80.54893°W 43.835347°N UTM: 17T 536264 4853684		
County (1)		CON
Wellington		
Municipality (1)		Lot
Arthur Village		
MOE ID	Tag	Audit No.
6703637		
Burnside Well Class		Construction Date
Well: Municiplal Supply		3/18/1970
MOE Well Class		
Water Supply		
MOE Well Uses (Primary Use | Secondary Use)		
Municipal | Not Recorded		
Ground Elevation	Bedrock Depth	Borehole Depth
455.8 (masl)	56.7 m	106.7 m
Static Water Lev.	Lev. After Pump Test	Test Flow Pump Rate
10.1 m	53.3 m	277.3 l/min
Available Drawdown	Specific Capacity	Theoretical Yield
48.1 m	6.4 l/min/m	308.8 l/min

Geology Description

(1) Clay, Gravel (Brown) 0m ~ 5.8m | (2) Clay, Gravel (Grey) 5.8m ~ 11.6m | (3) Clay, Gravel (Brown) 11.6m ~ 49.1m | (4) Clay, Medium Sand, Gravel (Grey) 49.1m ~ 54.9m | (5) Clay, Gravel (Brown) 54.9m ~ 56.7m | (6) Limestone (Grey) 56.7m ~ 66.4m | (7) Limestone (Brown) 66.4m ~ 84.1m | (8) Limestone (Grey) 84.1m ~ 90.5m | (9) Limestone (White) 90.5m ~ 99.4m | (10) Limestone (Brown) 99.4m ~ 101.2m | (11) Limestone (White) 101.2m ~ 106.7m

Casing Description

(1) 10″ø Steel ~ 58.2m | (2) Open ~ 106.7m

Screens	Water Encountered (at time of drilling)
	(1) Fresh 73.2m

Project Notes

Link to MOE Water Well Record

https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/670/6703637.pdf

(1) Names may reflect former municipalities at the time of construction.

Geographic Location		
Long/Lat: 80.546702°W 43.882967°N UTM: 17T 536414 4858974		
County (1)		CON
Wellington		01
Municipality (1)		Lot
Arthur Twp.		022
MOE ID	Tag	Audit No.
6703707		
Burnside Well Class		Construction Date
Well: Agricultural Supply		6/3/1970
MOE Well Class		
Water Supply		
MOE Well Uses (Primary Use | Secondary Use)		
Livestock | Domestic		
Ground Elevation	Bedrock Depth	Borehole Depth
475.4 (masl)	46.3 m	80.8 m
Static Water Lev.	Lev. After Pump Test	Test Flow Pump Rate
3.7 m	15.2 m	45.5 l/min
Available Drawdown	Specific Capacity	Theoretical Yield
42.6 m	4 l/min/m	168.5 l/min

Geology Description

(1) Topsoil 0m ~ .3m | (2) Clay, Stones .3m ~ 13.7m | (3) Clay, Gravel 13.7m ~ 46.3m | (4) Rock (Brown) 46.3m ~ 67.4m | (5) Rock (Grey) 67.4m ~ 68m | (6) Rock (Brown) 68m ~ 80.8m

Casing Description

(1) 5"ø Steel ~ 46.3m | (2) Open ~ 80.8m

Screens	Water Encountered (at time of drilling)
	(1) Fresh 80.8m

Project Notes

Link to MOE Water Well Record

https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/670/6703707.pdf

(1) Names may reflect former municipalities at the time of construction.

Well Screening Report
MOE.6703847

Geographic Location		
Long/Lat: 80.473198°W 43.833312°N UTM: 17T 542353 4853494		
County (1)		CON
Wellington		04
Municipality (1)		Lot
West Garafraxa Twp.		031
MOE ID	Tag	Audit No.
6703847		
Burnside Well Class		Construction Date
Well: Agricultural Supply		8/7/1970
MOE Well Class		
Water Supply		
MOE Well Uses (Primary Use | Secondary Use)		
Livestock | Domestic		
Ground Elevation	Bedrock Depth	Borehole Depth
474.5 (masl)	63.1 m	76.2 m
Static Water Lev.	Lev. After Pump Test	Test Flow Pump Rate
10.1 m	13.7 m	31.8 l/min
Available Drawdown	Specific Capacity	Theoretical Yield
53.9 m	8.8 l/min/m	476.1 l/min

Geology Description
(1) Clay, Stones (Brown) 0m ~ 15.8m | (2) Gravel, Medium Sand 15.8m ~ 18m | (3) Clay, Boulders 18m ~ 63.1m | (4) Limestone (White) 63.1m ~ 76.2m

Casing Description
(1) 4"ø Steel ~ 64m | (2) 4"ø Open ~ 76.2m

Screens	Water Encountered (at time of drilling)
	(1) Fresh 67.1m

Project Notes

Link to MOE Water Well Record
https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/670/6703847.pdf

(1) Names may reflect former municipalities at the time of construction.

Geographic Location		
Long/Lat: 80.537183°W 43.826296°N UTM: 17T 537214 4852684		
County (1)		CON
Wellington		19
Municipality (1)		Lot
Peel Twp.		009
MOE ID	Tag	Audit No.
6703976		
Burnside Well Class		Construction Date
Well: Domestic Supply		5/20/1971
MOE Well Class		
Water Supply		
MOE Well Uses (Primary Use | Secondary Use)		
Domestic | Not Recorded		
Ground Elevation	Bedrock Depth	Borehole Depth
462.6 (masl)	71.3 m	85.3 m
Static Water Lev.	Lev. After Pump Test	Test Flow Pump Rate
14 m	19.8 m	22.7 l/min
Available Drawdown	Specific Capacity	Theoretical Yield
58.5 m	3.9 l/min/m	229 l/min

Geology Description

(1) Clay, Stones 0m ~ 71.3m | (2) Limestone (Grey) 71.3m ~ 85.3m

Casing Description

(1) 4″ø Steel ~ 72.5m | (2) 4″ø Open ~ 85.3m

Screens	Water Encountered (at time of drilling)
	(1) Fresh 84.7m

Project Notes

Link to MOE Water Well Record

https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/670/6703976.pdf

(1) Names may reflect former municipalities at the time of construction.

Geographic Location		
Long/Lat: 80.468542°W 43.783409°N UTM: 17T 542763 4847954		
County (1)		CON
Wellington		01
Municipality (1)		Lot
West Garafraxa Twp.		025
MOE ID	Tag	Audit No.
6704178		
Burnside Well Class		Construction Date
Well: Agricultural Supply		10/7/1971
MOE Well Class		
Water Supply		
MOE Well Uses (Primary Use | Secondary Use)		
Livestock | Domestic		
Ground Elevation	Bedrock Depth	Borehole Depth
470 (masl)	69.8 m	75.9 m
Static Water Lev.	Lev. After Pump Test	Test Flow Pump Rate
21.6 m	25.9 m	45.5 l/min
Available Drawdown	Specific Capacity	Theoretical Yield
49.4 m	10.6 l/min/m	522.7 l/min

Geology Description

(1) Clay, Stones (Brown) 0m ~ 9.1m | (2) Clay, Stones, Boulders (Grey) 9.1m ~ 69.8m | (3) Limestone 69.8m ~ 75.9m

Casing Description

(1) 4″ø Steel ~ 71m | (2) 4″ø Open ~ 74.7m

Screens	Water Encountered (at time of drilling)
	(1) Fresh 74.1m

Project Notes

Link to MOE Water Well Record

https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/670/6704178.pdf

(1) Names may reflect former municipalities at the time of construction.

Geographic Location		
Long/Lat: 80.538106°W 43.824427°N UTM: 17T 537141 4852476		
County (1)		CON
Wellington		B
Municipality (1)		Lot
Peel Twp.		023
MOE ID	Tag	Audit No.
6705420		
Burnside Well Class		Construction Date
Well: Domestic Supply		1/2/1975
MOE Well Class		
Water Supply		
MOE Well Uses (Primary Use | Secondary Use)		
Domestic | Not Recorded		
Ground Elevation	Bedrock Depth	Borehole Depth
461.8 (masl)	71.9 m	86.6 m
Static Water Lev.	Lev. After Pump Test	Test Flow Pump Rate
15.2 m	32 m	36.4 l/min
Available Drawdown	Specific Capacity	Theoretical Yield
56.7 m	2.2 l/min/m	122.9 l/min

Geology Description

(1) Topsoil (Black) 0m ~ .3m | (2) Clay (Red) .3m ~ 42.7m | (3) Clay, Boulders, Gravel (Blue) 42.7m ~ 57.9m | (4) Sand, Gravel, Clay (Brown) 57.9m ~ 71.9m | (5) Rock (Brown) 71.9m ~ 82.3m | (6) Rock (Grey) 82.3m ~ 86.6m

Casing Description

(1) 4″ø Steel ~ 71.9m | (2) 4″ø Open ~ 86.6m

Screens	Water Encountered (at time of drilling)
	(1) Fresh 82.3m

Project Notes

Link to MOE Water Well Record

https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/670/6705420.pdf

(1) Names may reflect former municipalities at the time of construction.

Geographic Location		
Long/Lat: 80.529852°W 43.809699°N UTM: 17T 537813 4850844		
County (1)		CON
Wellington		B
Municipality (1)		Lot
Peel Twp.		019
MOE ID	Tag	Audit No.
6705980		
Burnside Well Class		Construction Date
Well: Domestic Supply		4/5/1976
MOE Well Class		
Water Supply		
MOE Well Uses (Primary Use | Secondary Use)		
Domestic | Not Recorded		
Ground Elevation	Bedrock Depth	Borehole Depth
467.3 (masl)	76.8 m	86 m
Static Water Lev.	Lev. After Pump Test	Test Flow Pump Rate
27.4 m	32 m	45.5 l/min
Available Drawdown	Specific Capacity	Theoretical Yield
19.8 m	9.9 l/min/m	195.8 l/min

Geology Description

(1) Clay (Brown) 0m ~ 5.5m | (2) Clay, Boulders (Grey) 5.5m ~ 38.4m | (3) Clay, Hardpan (Grey) 38.4m ~ 76.8m | (4) Rock (Grey) 76.8m ~ 86m

Casing Description

(1) 6″ø Steel ~ 31.1m | (2) 6″ø Steel ~ 47.2m

Screens	Water Encountered (at time of drilling)
	(1) Fresh 86m

Project Notes

Link to MOE Water Well Record

https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/670/6705980.pdf

(1) Names may reflect former municipalities at the time of construction.

Geographic Location		
Long/Lat: 80.470408°W 43.783148°N UTM: 17T 542613 4847924		
County (1)		CON
Wellington		A
Municipality (1)		Lot
Peel Twp.		006
MOE ID	Tag	Audit No.
6706641		
Burnside Well Class		Construction Date
Well: Domestic Supply		6/23/1977
MOE Well Class		
Water Supply		
MOE Well Uses (Primary Use | Secondary Use)		
Domestic | Not Recorded		
Ground Elevation	Bedrock Depth	Borehole Depth
470.5 (masl)	59.4 m	95.1 m
Static Water Lev.	Lev. After Pump Test	Test Flow Pump Rate
21.6 m	23.5 m	27.3 l/min
Available Drawdown	Specific Capacity	Theoretical Yield
52.5 m	14.4 l/min/m	754.3 l/min

Geology Description

(1) Clay (Brown) 0m ~ 4.3m | (2) Coarse Sand (Brown) 4.3m ~ 6.4m | (3) Clay, Stones (Grey) 6.4m ~ 59.4m | (4) Hardpan, Soapstone, Boulders 59.4m ~ 73.2m | (5) Rock (White) 73.2m ~ 95.1m

Casing Description

(1) 4"ø Steel ~ 74.1m | (2) 4"ø Open ~ 95.1m

Screens	Water Encountered (at time of drilling)
	(1) Fresh 85.3m

Project Notes

Link to MOE Water Well Record

https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/670/6706641.pdf

(1) Names may reflect former municipalities at the time of construction.

Geographic Location		
Long/Lat: 80.579581°W 43.829791°N UTM: 17T 533802 4853054		
County (1)		CON
Wellington		18
Municipality (1)		Lot
Peel Twp.		004
MOE ID	Tag	Audit No.
6708230		
Burnside Well Class		Construction Date
Well: Domestic Supply		7/10/1985
MOE Well Class		
Water Supply		
MOE Well Uses (Primary Use | Secondary Use)		
Domestic | Livestock		
Ground Elevation	Bedrock Depth	Borehole Depth
437.6 (masl)	2.4 m	70.1 m
Static Water Lev.	Lev. After Pump Test	Test Flow Pump Rate
0.6 m	19.8 m	54.6 l/min
Available Drawdown	Specific Capacity	Theoretical Yield
47.9 m	2.8 l/min/m	136.2 l/min

Geology Description

(1) Topsoil (Black) 0m ~ .3m | (2) Clay (Brown) .3m ~ 2.4m | (3) Hardpan, Stones (Grey) 2.4m ~ 46m | (4) Limestone (Grey) 46m ~ 54.9m | (5) Limestone (Brown) 54.9m ~ 70.1m

Casing Description

(1) 5″ø Steel ~ 48.5m | (2) 5″ø Open ~ 70.1m

Screens	Water Encountered (at time of drilling)
	(1) Fresh 67.1m

Project Notes

Link to MOE Water Well Record

https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/670/6708230.pdf

(1) Names may reflect former municipalities at the time of construction.

Geographic Location		
Long/Lat: 80.459375°W 43.821434°N UTM: 17T 543473 4852182		
County (1)		CON
Wellington		03
Municipality (1)		Lot
West Garafraxa Twp.		029
MOE ID	Tag	Audit No.
6710396		34384
Burnside Well Class		Construction Date
Well: Domestic Supply		7/24/1990
MOE Well Class		
Water Supply		
MOE Well Uses (Primary Use | Secondary Use)		
Domestic | Not Recorded		
Ground Elevation	Bedrock Depth	Borehole Depth
470.9 (masl)	12.2 m	75.3 m
Static Water Lev.	Lev. After Pump Test	Test Flow Pump Rate
11.9 m	15.8 m	68.2 l/min
Available Drawdown	Specific Capacity	Theoretical Yield
58.2 m	17.5 l/min/m	1017.8 l/min

Geology Description

(1) Topsoil (Black) 0m ~ .6m | (2) Clay (Brown) .6m ~ 6.1m | (3) Clay (Grey) 6.1m ~ 12.2m | (4) Hardpan (Grey) 12.2m ~ 38.1m | (5) Hardpan, Stones (Grey) 38.1m ~ 56.4m | (6) Hardpan, Gravel (Grey) 56.4m ~ 69.2m | (7) Limestone (Grey) 69.2m ~ 75.3m

Casing Description

(1) 5"ø Steel ~ 70.1m | (2) 5"ø Open ~ 75.3m

Screens	Water Encountered (at time of drilling)
	(1) Fresh 75.3m

Project Notes

Link to MOE Water Well Record

https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/671/6710396.pdf

(1) Names may reflect former municipalities at the time of construction.

Geographic Location		
Long/Lat: 80.507777°W 43.805933°N UTM: 17T 539591 4850436		
County (1)		CON
Wellington		A
Municipality (1)		Lot
Peel Twp.		016
MOE ID	Tag	Audit No.
6710971		109284
Burnside Well Class		Construction Date
Well: Domestic Supply		6/30/1992
MOE Well Class		
Water Supply		
MOE Well Uses (Primary Use | Secondary Use)		
Domestic | Not Recorded		
Ground Elevation	Bedrock Depth	Borehole Depth
469.5 (masl)	93.9 m	94.5 m
Static Water Lev.	Lev. After Pump Test	Test Flow Pump Rate
23.2 m	27.1 m	27.3 l/min
Available Drawdown	Specific Capacity	Theoretical Yield
71 m	7 l/min/m	497 l/min

Geology Description

(1) Topsoil 0m ~ .3m | (2) Clay, Sandy .3m ~ 25.6m | (3) Clay, Stones 25.6m ~ 93.9m | (4) Shale (Brown) 93.9m ~ 94.5m

Casing Description

(1) 5"ø Steel ~ 94.2m | (2) Open ~ 94.5m

Screens	Water Encountered (at time of drilling)
	(1) Fresh 94.5m

Project Notes

Link to MOE Water Well Record

https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/671/6710971.pdf

(1) Names may reflect former municipalities at the time of construction.

Geographic Location		
Long/Lat: 80.561444°W 43.841932°N UTM: 17T 535254 4854410		
County (1)		CON
Wellington		
Municipality (1)		Lot
Arthur Twp.		034
MOE ID	Tag	Audit No.
6711333		128299
Burnside Well Class		Construction Date
Well: Domestic Supply		8/25/1993
MOE Well Class		
Water Supply		
MOE Well Uses (Primary Use | Secondary Use)		
Domestic | Not Recorded		
Ground Elevation	Bedrock Depth	Borehole Depth
452.3 (masl)	61.9 m	82.3 m
Static Water Lev.	Lev. After Pump Test	Test Flow Pump Rate
8.5 m	18.3 m	45.5 l/min
Available Drawdown	Specific Capacity	Theoretical Yield
54.3 m	4.6 l/min/m	252.1 l/min

Geology Description

(1) Clay, Stones (Brown) 0m ~ 3m | (2) Clay, Sticky (Grey) 3m ~ 26.8m | (3) Clay, Stones (Grey) 26.8m ~ 61.9m | (4) Limestone (Grey) 61.9m ~ 82.3m

Casing Description

(1) 6″ø Steel ~ 62.8m | (2) 6″ø Open ~ 82.3m

Screens	Water Encountered (at time of drilling)
	(1) Fresh 76.2m | (2) Fresh 80.5m

Project Notes

Link to MOE Water Well Record

https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/671/6711333.pdf

(1) Names may reflect former municipalities at the time of construction.

Geographic Location		
Long/Lat: 80.466698°W 43.82851°N UTM: 17T 542879 4852964		
County (1)		CON
Wellington		04
Municipality (1)		Lot
West Garafraxa Twp.		030
MOE ID	Tag	Audit No.
6711738		158301
Burnside Well Class		Construction Date
Well: Domestic Supply		6/13/1995
MOE Well Class		
Water Supply		
MOE Well Uses (Primary Use | Secondary Use)		
Domestic | Livestock		
Ground Elevation	Bedrock Depth	Borehole Depth
472.9 (masl)	62.5 m	80.8 m
Static Water Lev.	Lev. After Pump Test	Test Flow Pump Rate
12.5 m	15.2 m	45.5 l/min
Available Drawdown	Specific Capacity	Theoretical Yield
50.9 m	16.9 l/min/m	857.8 l/min

Geology Description

(1) Clay (Brown) 0m ~ 4.6m | (2) Clay, Sticky (Grey) 4.6m ~ 10.4m | (3) Clay (Grey) 10.4m ~ 15.8m | (4) Clay, Sand (Grey) 15.8m ~ 19.8m | (5) Clay, Stones (Grey) 19.8m ~ 35.1m | (6) Clay, Stones (Brown) 35.1m ~ 39m | (7) Clay, Stones, Boulders (Grey) 39m ~ 46.9m | (8) Clay (Grey) 46.9m ~ 51.8m | (9) Sand, Clay 51.8m ~ 62.5m | (10) Limestone (Grey) 62.5m ~ 80.8m

Casing Description

(1) 6″ø Steel ~ 63.4m | (2) 6″ø Open ~ 80.8m

Screens	Water Encountered (at time of drilling)
	(1) Fresh 76.2m

Project Notes

Link to MOE Water Well Record

https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/671/6711738.pdf

(1) Names may reflect former municipalities at the time of construction.

Geographic Location		
Long/Lat: 80.479161°W 43.819996°N UTM: 17T 541883 4852012		
County (1)		CON
Wellington		03
Municipality (1)		Lot
West Garafraxa Twp.		030
MOE ID	Tag	Audit No.
6712404		184530
Burnside Well Class		Construction Date
Well: Domestic Supply		10/16/1997
MOE Well Class		
Water Supply		
MOE Well Uses (Primary Use | Secondary Use)		
Domestic | Not Recorded		
Ground Elevation	Bedrock Depth	Borehole Depth
463.8 (masl)	64 m	78 m
Static Water Lev.	Lev. After Pump Test	Test Flow Pump Rate
7.3 m	28.3 m	36.4 l/min
Available Drawdown	Specific Capacity	Theoretical Yield
58.2 m	1.7 l/min/m	100.9 l/min

Geology Description

(1) Clay (Brown) 0m ~ 1.8m | (2) Clay, Rock (Grey) 1.8m ~ 46.6m | (3) Gravel, Clay (Grey) 46.6m ~ 64m | (4) Shale (Blue) 64m ~ 64.3m | (5) Limestone (Grey) 64.3m ~ 68.9m | (6) Limestone (Brown) 68.9m ~ 73.2m | (7) Limestone (Grey) 73.2m ~ 75m | (8) Limestone (Brown) 75m ~ 78m

Casing Description

(1) 6″ø Steel ~ 65.5m | (2) 6″ø Open ~ 78m

Screens	Water Encountered (at time of drilling)
	(1) Fresh 75m

Project Notes

Link to MOE Water Well Record

https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/671/6712404.pdf

(1) Names may reflect former municipalities at the time of construction.

Geographic Location		
Long/Lat: 80.548418°W 43.789804°N UTM: 17T 536332 4848626		
County (1)		CON
Wellington		17
Municipality (1)		Lot
Peel Twp.		011
MOE ID	Tag	Audit No.
6713857		236112
Burnside Well Class		Construction Date
Well: Industrial/Other		8/7/2001
MOE Well Class		
Water Supply		
MOE Well Uses (Primary Use | Secondary Use)		
Not Recorded | Not Recorded		
Ground Elevation	Bedrock Depth	Borehole Depth
461.1 (masl)		71.3 m
Static Water Lev.	Lev. After Pump Test	Test Flow Pump Rate
10.7 m	16.2 m	181.8 l/min
Available Drawdown	Specific Capacity	Theoretical Yield
56.4 m	33.1 l/min/m	1864.3 l/min

Geology Description

(1) Topsoil (Brown) 0m ~ .6m | (2) Clay, Stones (Red) .6m ~ 5.8m | (3) Clay, Stones (Grey) 5.8m ~ 25.6m | (4) Hardpan (Grey) 25.6m ~ 52.4m | (5) Clay, Stones (Brown) 52.4m ~ 63.1m | (6) Fine Sand 63.1m ~ 65.5m | (7) Medium Gravel, Silt 65.5m ~ 69.2m | (8) Hardpan (Grey) 69.2m ~ 71.3m

Casing Description

(1) 6″ø Steel | (2) 6″ø Steel | (3) 6″ø Steel

Screens	Water Encountered (at time of drilling)
(1) 67.1m ~ 68.3m	(1) Fresh 68.3m

Project Notes

Link to MOE Water Well Record

https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/671/6713857.pdf

(1) Names may reflect former municipalities at the time of construction.

Geographic Location		
Long/Lat: 80.477575°W 43.826579°N UTM: 17T 542006 4852744		
County (1)		CON
Wellington		03
Municipality (1)		Lot
West Garafraxa Twp.		031
MOE ID	Tag	Audit No.
6714404		253317
Burnside Well Class		Construction Date
Well: Industrial/Other		2/25/2003
MOE Well Class		
Water Supply		
MOE Well Uses (Primary Use | Secondary Use)		
Industrial | Not Recorded		
Ground Elevation	Bedrock Depth	Borehole Depth
468.7 (masl)	67.7 m	103.6 m
Static Water Lev.	Lev. After Pump Test	Test Flow Pump Rate
16.5 m	34.7 m	113.7 l/min
Available Drawdown	Specific Capacity	Theoretical Yield
54.2 m	6.2 l/min/m	338.6 l/min

Geology Description

(1) Clay (Brown) 0m ~ 1.8m | (2) Clay, Gravel, Sand (Brown) 1.8m ~ 54.9m | (3) Gravel, Boulders, Clay (Brown) 54.9m ~ 60m | (4) Boulders (Brown) 60m ~ 61m | (5) Clay, Gravel (Grey) 61m ~ 67.7m | (6) Limestone, Shale, Soft (Brown) 67.7m ~ 69.5m | (7) Limestone, Hard (Brown) 69.5m ~ 70.7m | (8) Limestone, Hard (Brown) 70.7m ~ 84.7m | (9) Limestone (Grey) 84.7m ~ 103.6m

Casing Description

(1) 6″ø Steel ~ 70.7m | (2) 6″ø Open ~ 103.6m

Screens	Water Encountered (at time of drilling)
	(1) Fresh 103.6m

Project Notes

Link to MOE Water Well Record

https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/671/6714404.pdf

(1) Names may reflect former municipalities at the time of construction.

Geographic Location		
Long/Lat: 80.518945°W 43.835134°N UTM: 17T 538674 4853674		
County (1)		CON
Wellington		01
Municipality (1)		Lot
West Luther Twp.		002
MOE ID	Tag	Audit No.
7050300	A034736	Z74787
Burnside Well Class		Construction Date
Well: Domestic Supply		8/13/2007
MOE Well Class		
Water Supply		
MOE Well Uses (Primary Use | Secondary Use)		
Domestic | Not Recorded		
Ground Elevation	Bedrock Depth	Borehole Depth
457 (masl)	69.5 m	82.3 m
Static Water Lev.	Lev. After Pump Test	Test Flow Pump Rate
15.9 m	29.2 m	34 l/min
Available Drawdown	Specific Capacity	Theoretical Yield
56.5 m	2.6 l/min/m	144.4 l/min

Geology Description

(1) Clay, Gravel (Brown) 0m ~ 3.7m | (2) Clay, Gravel, Stones (Grey) 3.7m ~ 28.4m | (3) Clay, Sand (Brown) 28.4m ~ 40m | (4) Clay, Gravel (Grey) 40m ~ 49.4m | (5) Gravel, Clay (Grey) 49.4m ~ 69.5m | (6) Limestone (Grey) 69.5m ~ 78.6m | (7) Limestone (White) 78.6m ~ 82.3m

Casing Description

(1) 6"ø Steel -.8m ~ 72.4m | (2) Open 72.4m ~ 82.3m

Screens	Water Encountered (at time of drilling)
	(1) Fresh 74m | (2) Fresh 82m

Project Notes

Link to MOE Water Well Record

https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/705/7050300.pdf

(1) Names may reflect former municipalities at the time of construction.

Geographic Location		
Long/Lat: 80.490617°W 43.848922°N UTM: 17T 540942 4855219		
County (1)		CON
Wellington		01
Municipality (1)		Lot
West Luther Twp.		006
MOE ID	Tag	Audit No.
7185589	A125537	Z152153
Burnside Well Class		Construction Date
Well: Domestic Supply		8/6/2012
MOE Well Class		
Water Supply		
MOE Well Uses (Primary Use | Secondary Use)		
Domestic | Not Recorded		
Ground Elevation	Bedrock Depth	Borehole Depth
475 (masl)	131.4 m	135.6 m
Static Water Lev.	Lev. After Pump Test	Test Flow Pump Rate
10.4 m	20.4 m	22.7 l/min
Available Drawdown	Specific Capacity	Theoretical Yield
121.6 m	2.3 l/min/m	276 l/min

Geology Description

(1) Clay, Stones (Brown) 0m ~ 21m | (2) Clay, Stones (Grey) 21m ~ 69.2m | (3) Clay, Rock (Grey) 69.2m ~ 73.5m | (4) Clay, Stones, Silty (Brown) 73.5m ~ 131.4m | (5) Limestone (Grey) 131.4m ~ 135.6m

Casing Description

(1) 6″ø Steel 0m ~ 71.6m | (2) 6″ø Steel 71m ~ 132m | (3) 5″ø Open 132m ~ 135.6m

Screens	Water Encountered (at time of drilling)
	(1) Fresh 132.9m

Project Notes

Link to MOE Water Well Record

https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/718/7185589.pdf

(1) Names may reflect former municipalities at the time of construction.

Geographic Location		
Long/Lat: 80.56228°W 43.86557°N UTM: 17T 535172 4857035		
County (1)		CON
Wellington		02
Municipality (1)		Lot
Arthur Twp.		026
MOE ID	Tag	Audit No.
7254812	A147771	Z217637
Burnside Well Class		Construction Date
Well: Agricultural Supply		9/1/2015
MOE Well Class		
Water Supply		
MOE Well Uses (Primary Use | Secondary Use)		
Livestock | Not Recorded		
Ground Elevation	Bedrock Depth	Borehole Depth
461.5 (masl)	5.2 m	120.4 m
Static Water Lev.	Lev. After Pump Test	Test Flow Pump Rate
7.3 m	11 m	68.2 l/min
Available Drawdown	Specific Capacity	Theoretical Yield
44.5 m	18.4 l/min/m	820.2 l/min

Geology Description

(1) Topsoil (Brown) 0m ~ .3m | (2) Clay, Stones (Brown) .3m ~ 5.2m | (3) Hardpan (Grey) 5.2m ~ 32m | (4) Hardpan, Stoney (Grey) 32m ~ 32.3m | (5) Limestone (Brown) 32.3m ~ 53.3m | (6) Limestone (White) 53.3m ~ 60.4m | (7) Limestone (Brown) 60.4m ~ 108.2m | (8) Limestone, Layered (Brown) 108.2m ~ 120.4m

Casing Description

(1) Steel -.6m ~ 51.8m | (2) Open 51.8m ~ 120.4m

Screens	Water Encountered (at time of drilling)

Project Notes

Link to MOE Water Well Record

https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/725/7254812.pdf

(1) Names may reflect former municipalities at the time of construction.

Geographic Location		
Long/Lat: 80.556353°W 43.800864°N UTM: 17T 535687 4849851		
County (1)		CON
Wellington		17
Municipality (1)		Lot
Peel Twp.		010
MOE ID	Tag	Audit No.
7288592	A222572	Z256321
Burnside Well Class		Construction Date
Well: Domestic Supply		5/2/2017
MOE Well Class		
Water Supply		
MOE Well Uses (Primary Use | Secondary Use)		
Domestic | Not Recorded		
Ground Elevation	Bedrock Depth	Borehole Depth
451.4 (masl)	66.8 m	80.2 m
Static Water Lev.	Lev. After Pump Test	Test Flow Pump Rate
10.5 m	15.7 m	154.6 l/min
Available Drawdown	Specific Capacity	Theoretical Yield
58.4 m	29.7 l/min/m	1736.3 l/min

Geology Description
(1) Clay, Hard (Brown) 0m ~ 4.3m | (2) Clay, Hard (Grey) 4.3m ~ 14.6m | (3) Clay, Stones, Hard (Grey) 14.6m ~ 25.6m | (4) Till, Gravel, Layered (Grey) 25.6m ~ 29m | (5) Till, Clay, Stones (Grey) 29m ~ 66.8m | (6) Shale, Soft (Blue) 66.8m ~ 68.9m | (7) Limestone, Shale (Brown) 68.9m ~ 80.2m

Casing Description
(1) 6″ø Steel .9m ~ 68.9m | (2) 6″ø Open 68.9m ~ 80.2m

Screens	Water Encountered (at time of drilling)
	(1) Fresh 77.7m

Project Notes

Link to MOE Water Well Record
https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/728/7288592.pdf

(1) Names may reflect former municipalities at the time of construction.

Geographic Location		
Long/Lat: 80.566867°W 43.844051°N UTM: 17T 534816 4854643		
County (1)		CON
Wellington		
Municipality (1)		Lot
Arthur Twp.		033
MOE ID	Tag	Audit No.
7333175	A256296	Z308013
Burnside Well Class		Construction Date
Well: Domestic Supply		4/29/2019
MOE Well Class		
Water Supply		
MOE Well Uses (Primary Use | Secondary Use)		
Domestic | Not Recorded		
Ground Elevation	Bedrock Depth	Borehole Depth
	55.8 m	79.3 m
Static Water Lev.	Lev. After Pump Test	Test Flow Pump Rate
10.7 m	15.2 m	45.5 l/min
Available Drawdown	Specific Capacity	Theoretical Yield
46 m	10.1 l/min/m	465.1 l/min

Geology Description

(1) Sand, Stones (Brown) 0m ~ 3m | (2) Clay, Stones, Soft (Brown) 3m ~ 22.9m | (3) Clay, Boulders (Brown) 22.9m ~ 27.7m | (4) Clay, Soft (Brown) 27.7m ~ 36.6m | (5) Clay, Gravel, Stones (Brown) 36.6m ~ 55.8m | (6) Limestone (Brown) 55.8m ~ 58.5m | (7) Limestone, Hard (Grey) 58.5m ~ 67.1m | (8) Limestone, Hard (Brown) 67.1m ~ 73.2m | (9) Limestone, Hard (Grey) 73.2m ~ 79.2m

Casing Description

(1) 6″ø Steel -.9m ~ 56.7m | (2) Open 56.7m ~ 79.2m

Screens	Water Encountered (at time of drilling)

Project Notes

Link to MOE Water Well Record

https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/733/7333175.pdf

(1) Names may reflect former municipalities at the time of construction.

Geographic Location
Long/Lat: 80.55354°W 43.801358°N UTM: 17T 535913 4849907

County (1)	CON
Wellington	17
Municipality (1)	**Lot**
Peel Twp.	010

MOE ID	Tag	Audit No.
7334364	A252621	Z306241
Burnside Well Class		**Construction Date**
Well: Agricultural Supply		5/23/2019

MOE Well Class
Water Supply
MOE Well Uses (Primary Use | Secondary Use)
Livestock | Not Recorded

Ground Elevation	Bedrock Depth	Borehole Depth
	81.4 m	86.9 m
Static Water Lev.	**Lev. After Pump Test**	**Test Flow Pump Rate**
11.9 m	13 m	68.2 l/min
Available Drawdown	**Specific Capacity**	**Theoretical Yield**
72.2 m	62 l/min/m	4476.4 l/min

Geology Description

(1) Clay, Stones, Hard (Brown) 0m ~ 3.4m | (2) Clay, Stones, Hard (Grey) 3.4m ~ 29.3m | (3) Till, Stones, Sandy (Grey) 29.3m ~ 34.7m | (4) Till, Stones, Clay (Grey) 34.7m ~ 68.3m | (5) Clay, Stones, Hard (Grey) 68.3m ~ 81.4m | (6) Shale, Soft (Blue) 81.4m ~ 83.8m | (7) Limestone, Soft (Brown) 83.8m ~ 86.9m

Casing Description

(1) 6″ø Steel -.9m ~ 84.1m

Screens	Water Encountered (at time of drilling)
	(1) Untested 85.3m | (2) Untested 86.6m

Project Notes

Link to MOE Water Well Record

https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/733/7334364.pdf

(1) Names may reflect former municipalities at the time of construction.

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix B

Water Quality Data

Your Project #: 300052287
Your C.O.C. #: 020654

Attention: Jim Baxter

RJ Burnside Associates Ltd
292 Speedvale Ave W
Unit 20
Guelph, ON
CANADA N1H 1C4

Report Date: 2021/01/15
Report #: R6481965
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C107683
Received: 2021/01/12, 10:15

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	1	N/A	2021/01/14	CAM SOP-00448	SM 23 2320 B m
Carbonate, Bicarbonate and Hydroxide	1	N/A	2021/01/15	CAM SOP-00102	APHA 4500-CO2 D
Chloride by Automated Colourimetry	1	N/A	2021/01/14	CAM SOP-00463	SM 23 4500-Cl E m
Conductivity	1	N/A	2021/01/14	CAM SOP-00414	SM 23 2510 m
Dissolved Organic Carbon (DOC) (1)	1	N/A	2021/01/14	CAM SOP-00446	SM 23 5310 B m
Hardness (calculated as CaCO3)	1	N/A	2021/01/14	CAM SOP 00102/00408/00447	SM 2340 B
Metals Analysis by ICPMS (as received) (2)	1	N/A	2021/01/13	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	1	N/A	2021/01/15		
Anion and Cation Sum	1	N/A	2021/01/15		
Total Ammonia-N	1	N/A	2021/01/14	CAM SOP-00441	USGS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (3)	1	N/A	2021/01/14	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	1	2021/01/13	2021/01/14	CAM SOP-00413	SM 4500H+ B m
Orthophosphate	1	N/A	2021/01/14	CAM SOP-00461	EPA 365.1 m
Sat. pH and Langelier Index (@ 20C)	1	N/A	2021/01/15		Auto Calc
Sat. pH and Langelier Index (@ 4C)	1	N/A	2021/01/15		Auto Calc
Sulphate by Automated Colourimetry	1	N/A	2021/01/14	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids (TDS calc)	1	N/A	2021/01/15		Auto Calc

Remarks:

Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

BV Labs liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. BV Labs has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and

Your Project #: 300052287
Your C.O.C. #: 020654

Attention: Jim Baxter

RJ Burnside Associates Ltd
292 Speedvale Ave W
Unit 20
Guelph, ON
CANADA N1H 1C4

Report Date: 2021/01/15
Report #: R6481965
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C107683
Received: 2021/01/12, 10:15

use of test results are the sole responsibility of the Client and are not within the scope of services provided by BV Labs, unless otherwise agreed in writing. BV Labs is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by BV Labs, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
(2) Metals analysis was performed on the sample 'as received'.
(3) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Ashton Gibson, Project Manager
Email: Ashton.Gibson@bureauveritas.com
Phone# (905)817-5765
==========
This report has been generated and distributed using a secure automated process.
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BV Labs Job #: C107683
Report Date: 2021/01/15

RJ Burnside Associates Ltd
Client Project #: 300052287
Sampler Initials: JB

RESULTS OF ANALYSES OF WATER

BV Labs ID		OOW152			OOW152		
Sampling Date		2021/01/11 16:00			2021/01/11 16:00		
COC Number		020654			020654		
	UNITS	MARTIN WELL	RDL	QC Batch	MARTIN WELL Lab-Dup	RDL	QC Batch
Calculated Parameters							
Anion Sum	me/L	4.25	N/A	7146764			
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	190	1.0	7146157			
Calculated TDS	mg/L	230	1.0	7146141			
Carb. Alkalinity (calc. as CaCO3)	mg/L	1.9	1.0	7146157			
Cation Sum	me/L	4.49	N/A	7146764			
Hardness (CaCO3)	mg/L	140	1.0	7146134			
Ion Balance (% Difference)	%	2.72	N/A	7146763			
Langelier Index (@ 20C)	N/A	0.419		7146137			
Langelier Index (@ 4C)	N/A	0.170		7146139			
Saturation pH (@ 20C)	N/A	7.61		7146137			
Saturation pH (@ 4C)	N/A	7.86		7146139			
Inorganics							
Total Ammonia-N	mg/L	0.11	0.050	7148113			
Conductivity	umho/cm	410	1.0	7148441	400	1.0	7148441
Dissolved Organic Carbon	mg/L	0.94	0.40	7148823	0.93	0.40	7148823
Orthophosphate (P)	mg/L	ND	0.010	7147987	ND	0.010	7147987
pH	pH	8.03		7148443	8.08		7148443
Dissolved Sulphate (SO4)	mg/L	14	1.0	7148010	14	1.0	7148010
Alkalinity (Total as CaCO3)	mg/L	190	1.0	7148428	200	1.0	7148428
Dissolved Chloride (Cl-)	mg/L	3.9	1.0	7147998	4.1	1.0	7147998
Nitrite (N)	mg/L	ND	0.010	7148131			
Nitrate (N)	mg/L	ND	0.10	7148131			

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
ND = Not detected

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BV Labs Job #: C107683
Report Date: 2021/01/15

RJ Burnside Associates Ltd
Client Project #: 300052287
Sampler Initials: JB

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		OOW152	OOW152		
Sampling Date		2021/01/11 16:00	2021/01/11 16:00		
COC Number		020654	020654		
	UNITS	MARTIN WELL	MARTIN WELL Lab-Dup	RDL	QC Batch
Metals					
Aluminum (Al)	ug/L	5.9	ND	4.9	7148433
Antimony (Sb)	ug/L	ND	ND	0.50	7148433
Arsenic (As)	ug/L	ND	ND	1.0	7148433
Barium (Ba)	ug/L	44	46	2.0	7148433
Beryllium (Be)	ug/L	ND	ND	0.40	7148433
Boron (B)	ug/L	130	130	10	7148433
Cadmium (Cd)	ug/L	ND	ND	0.090	7148433
Calcium (Ca)	ug/L	32000	30000	200	7148433
Chromium (Cr)	ug/L	ND	ND	5.0	7148433
Cobalt (Co)	ug/L	ND	ND	0.50	7148433
Copper (Cu)	ug/L	11	11	0.90	7148433
Iron (Fe)	ug/L	ND	ND	100	7148433
Lead (Pb)	ug/L	ND	ND	0.50	7148433
Lithium (Li)	ug/L	ND	ND	5.0	7148433
Magnesium (Mg)	ug/L	14000	14000	50	7148433
Manganese (Mn)	ug/L	110	110	2.0	7148433
Molybdenum (Mo)	ug/L	5.7	5.8	0.50	7148433
Nickel (Ni)	ug/L	ND	ND	1.0	7148433
Phosphorus (P)	ug/L	ND	ND	100	7148433
Potassium (K)	ug/L	790	790	200	7148433
Selenium (Se)	ug/L	ND	ND	2.0	7148433
Silicon (Si)	ug/L	4500	4200	50	7148433
Silver (Ag)	ug/L	ND	ND	0.090	7148433
Sodium (Na)	ug/L	40000	41000	100	7148433
Strontium (Sr)	ug/L	350	360	1.0	7148433
Thallium (Tl)	ug/L	ND	ND	0.050	7148433
Titanium (Ti)	ug/L	ND	ND	5.0	7148433
Uranium (U)	ug/L	ND	ND	0.10	7148433

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
ND = Not detected

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BV Labs Job #: C107683
Report Date: 2021/01/15

RJ Burnside Associates Ltd
Client Project #: 300052287
Sampler Initials: JB

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		OOW152	OOW152		
Sampling Date		2021/01/11 16:00	2021/01/11 16:00		
COC Number		020654	020654		
	UNITS	MARTIN WELL	MARTIN WELL Lab-Dup	RDL	QC Batch
Vanadium (V)	ug/L	ND	ND	0.50	7148433
Zinc (Zn)	ug/L	ND	ND	5.0	7148433

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
ND = Not detected

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

BV Labs Job #: C107683
Report Date: 2021/01/15

RJ Burnside Associates Ltd
Client Project #: 300052287
Sampler Initials: JB

TEST SUMMARY

BV Labs ID: OOW152
Sample ID: MARTIN WELL
Matrix: Water

Collected: 2021/01/11
Shipped:
Received: 2021/01/12

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7148428	N/A	2021/01/14	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	7146157	N/A	2021/01/15	Automated Statchk
Chloride by Automated Colourimetry	KONE	7147998	N/A	2021/01/14	Deonarine Ramnarine
Conductivity	AT	7148441	N/A	2021/01/14	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7148823	N/A	2021/01/14	Nimarta Singh
Hardness (calculated as CaCO3)		7146134	N/A	2021/01/14	Automated Statchk
Metals Analysis by ICPMS (as received)	ICP/MS	7148433	N/A	2021/01/13	Azita Fazaeli
Ion Balance (% Difference)	CALC	7146763	N/A	2021/01/15	Automated Statchk
Anion and Cation Sum	CALC	7146764	N/A	2021/01/15	Automated Statchk
Total Ammonia-N	LACH/NH4	7148113	N/A	2021/01/14	Alina Dobreanu
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	7148131	N/A	2021/01/14	Chandra Nandlal
pH	AT	7148443	2021/01/13	2021/01/14	Surinder Rai
Orthophosphate	KONE	7147987	N/A	2021/01/14	Avneet Kour Sudan
Sat. pH and Langelier Index (@ 20C)	CALC	7146137	N/A	2021/01/15	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	7146139	N/A	2021/01/15	Automated Statchk
Sulphate by Automated Colourimetry	KONE	7148010	N/A	2021/01/14	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	7146141	N/A	2021/01/15	Automated Statchk

BV Labs ID: OOW152 Dup
Sample ID: MARTIN WELL
Matrix: Water

Collected: 2021/01/11
Shipped:
Received: 2021/01/12

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7148428	N/A	2021/01/14	Surinder Rai
Chloride by Automated Colourimetry	KONE	7147998	N/A	2021/01/14	Deonarine Ramnarine
Conductivity	AT	7148441	N/A	2021/01/14	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7148823	N/A	2021/01/14	Nimarta Singh
Metals Analysis by ICPMS (as received)	ICP/MS	7148433	N/A	2021/01/13	Azita Fazaeli
pH	AT	7148443	2021/01/13	2021/01/14	Surinder Rai
Orthophosphate	KONE	7147987	N/A	2021/01/14	Avneet Kour Sudan
Sulphate by Automated Colourimetry	KONE	7148010	N/A	2021/01/14	Deonarine Ramnarine

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BV Labs Job #: C107683
Report Date: 2021/01/15

RJ Burnside Associates Ltd
Client Project #: 300052287
Sampler Initials: JB

GENERAL COMMENTS

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
7147987	AKD	Matrix Spike [OOW152-01]	Orthophosphate (P)	2021/01/14		107	%	75 - 125
7147987	AKD	Spiked Blank	Orthophosphate (P)	2021/01/14		100	%	80 - 120
7147987	AKD	Method Blank	Orthophosphate (P)	2021/01/14	ND, RDL=0.010		mg/L	
7147987	AKD	RPD [OOW152-01]	Orthophosphate (P)	2021/01/14	NC		%	25
7147998	DRM	Matrix Spike [OOW152-01]	Dissolved Chloride (Cl-)	2021/01/14		110	%	80 - 120
7147998	DRM	Spiked Blank	Dissolved Chloride (Cl-)	2021/01/14		103	%	80 - 120
7147998	DRM	Method Blank	Dissolved Chloride (Cl-)	2021/01/14	ND, RDL=1.0		mg/L	
7147998	DRM	RPD [OOW152-01]	Dissolved Chloride (Cl-)	2021/01/14	6.0		%	20
7148010	DRM	Matrix Spike [OOW152-01]	Dissolved Sulphate (SO4)	2021/01/14		103	%	75 - 125
7148010	DRM	Spiked Blank	Dissolved Sulphate (SO4)	2021/01/14		104	%	80 - 120
7148010	DRM	Method Blank	Dissolved Sulphate (SO4)	2021/01/14	ND, RDL=1.0		mg/L	
7148010	DRM	RPD [OOW152-01]	Dissolved Sulphate (SO4)	2021/01/14	6.0		%	20
7148113	ADB	Matrix Spike	Total Ammonia-N	2021/01/14		90	%	75 - 125
7148113	ADB	Spiked Blank	Total Ammonia-N	2021/01/14		99	%	80 - 120
7148113	ADB	Method Blank	Total Ammonia-N	2021/01/14	ND, RDL=0.050		mg/L	
7148113	ADB	RPD	Total Ammonia-N	2021/01/14	0.71		%	20
7148131	C_N	Matrix Spike	Nitrite (N)	2021/01/14		105	%	80 - 120
			Nitrate (N)	2021/01/14		102	%	80 - 120
7148131	C_N	Spiked Blank	Nitrite (N)	2021/01/14		107	%	80 - 120
			Nitrate (N)	2021/01/14		101	%	80 - 120
7148131	C_N	Method Blank	Nitrite (N)	2021/01/14	ND, RDL=0.010		mg/L	
			Nitrate (N)	2021/01/14	ND, RDL=0.10		mg/L	
7148131	C_N	RPD	Nitrite (N)	2021/01/14	3.0		%	20
			Nitrate (N)	2021/01/14	3.5		%	20
7148428	SAU	Spiked Blank	Alkalinity (Total as CaCO3)	2021/01/14		96	%	85 - 115
7148428	SAU	Method Blank	Alkalinity (Total as CaCO3)	2021/01/14	ND, RDL=1.0		mg/L	
7148428	SAU	RPD [OOW152-01]	Alkalinity (Total as CaCO3)	2021/01/14	2.1		%	20
7148433	AFZ	Matrix Spike [OOW152-02]	Aluminum (Al)	2021/01/13		102	%	80 - 120
			Antimony (Sb)	2021/01/13		104	%	80 - 120
			Arsenic (As)	2021/01/13		102	%	80 - 120
			Barium (Ba)	2021/01/13		101	%	80 - 120
			Beryllium (Be)	2021/01/13		99	%	80 - 120
			Boron (B)	2021/01/13		103	%	80 - 120
			Cadmium (Cd)	2021/01/13		99	%	80 - 120
			Calcium (Ca)	2021/01/13		NC	%	80 - 120
			Chromium (Cr)	2021/01/13		98	%	80 - 120
			Cobalt (Co)	2021/01/13		97	%	80 - 120
			Copper (Cu)	2021/01/13		98	%	80 - 120
			Iron (Fe)	2021/01/13		99	%	80 - 120
			Lead (Pb)	2021/01/13		95	%	80 - 120
			Lithium (Li)	2021/01/13		103	%	80 - 120
			Magnesium (Mg)	2021/01/13		99	%	80 - 120

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BV Labs Job #: C107683
Report Date: 2021/01/15

RJ Burnside Associates Ltd
Client Project #: 300052287
Sampler Initials: JB

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Manganese (Mn)	2021/01/13		99	%	80 - 120
			Molybdenum (Mo)	2021/01/13		103	%	80 - 120
			Nickel (Ni)	2021/01/13		96	%	80 - 120
			Phosphorus (P)	2021/01/13		114	%	80 - 120
			Potassium (K)	2021/01/13		101	%	80 - 120
			Selenium (Se)	2021/01/13		100	%	80 - 120
			Silicon (Si)	2021/01/13		102	%	80 - 120
			Silver (Ag)	2021/01/13		96	%	80 - 120
			Sodium (Na)	2021/01/13		NC	%	80 - 120
			Strontium (Sr)	2021/01/13		98	%	80 - 120
			Thallium (Tl)	2021/01/13		94	%	80 - 120
			Titanium (Ti)	2021/01/13		101	%	80 - 120
			Uranium (U)	2021/01/13		102	%	80 - 120
			Vanadium (V)	2021/01/13		99	%	80 - 120
			Zinc (Zn)	2021/01/13		97	%	80 - 120
7148433	AFZ	Spiked Blank	Aluminum (Al)	2021/01/13		108	%	80 - 120
			Antimony (Sb)	2021/01/13		103	%	80 - 120
			Arsenic (As)	2021/01/13		101	%	80 - 120
			Barium (Ba)	2021/01/13		101	%	80 - 120
			Beryllium (Be)	2021/01/13		97	%	80 - 120
			Boron (B)	2021/01/13		102	%	80 - 120
			Cadmium (Cd)	2021/01/13		100	%	80 - 120
			Calcium (Ca)	2021/01/13		107	%	80 - 120
			Chromium (Cr)	2021/01/13		97	%	80 - 120
			Cobalt (Co)	2021/01/13		96	%	80 - 120
			Copper (Cu)	2021/01/13		99	%	80 - 120
			Iron (Fe)	2021/01/13		101	%	80 - 120
			Lead (Pb)	2021/01/13		94	%	80 - 120
			Lithium (Li)	2021/01/13		100	%	80 - 120
			Magnesium (Mg)	2021/01/13		102	%	80 - 120
			Manganese (Mn)	2021/01/13		99	%	80 - 120
			Molybdenum (Mo)	2021/01/13		103	%	80 - 120
			Nickel (Ni)	2021/01/13		94	%	80 - 120
			Phosphorus (P)	2021/01/13		115	%	80 - 120
			Potassium (K)	2021/01/13		102	%	80 - 120
			Selenium (Se)	2021/01/13		101	%	80 - 120
			Silicon (Si)	2021/01/13		106	%	80 - 120
			Silver (Ag)	2021/01/13		96	%	80 - 120
			Sodium (Na)	2021/01/13		101	%	80 - 120
			Strontium (Sr)	2021/01/13		99	%	80 - 120
			Thallium (Tl)	2021/01/13		93	%	80 - 120
			Titanium (Ti)	2021/01/13		102	%	80 - 120
			Uranium (U)	2021/01/13		101	%	80 - 120
			Vanadium (V)	2021/01/13		98	%	80 - 120
			Zinc (Zn)	2021/01/13		97	%	80 - 120
7148433	AFZ	Method Blank	Aluminum (Al)	2021/01/13	ND, RDL=4.9		ug/L	
			Antimony (Sb)	2021/01/13	ND, RDL=0.50		ug/L	
			Arsenic (As)	2021/01/13	ND, RDL=1.0		ug/L	

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BV Labs Job #: C107683
Report Date: 2021/01/15

RJ Burnside Associates Ltd
Client Project #: 300052287
Sampler Initials: JB

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Barium (Ba)	2021/01/13	ND, RDL=2.0		ug/L	
			Beryllium (Be)	2021/01/13	ND, RDL=0.40		ug/L	
			Boron (B)	2021/01/13	ND, RDL=10		ug/L	
			Cadmium (Cd)	2021/01/13	ND, RDL=0.090		ug/L	
			Calcium (Ca)	2021/01/13	ND, RDL=200		ug/L	
			Chromium (Cr)	2021/01/13	ND, RDL=5.0		ug/L	
			Cobalt (Co)	2021/01/13	ND, RDL=0.50		ug/L	
			Copper (Cu)	2021/01/13	ND, RDL=0.90		ug/L	
			Iron (Fe)	2021/01/13	ND, RDL=100		ug/L	
			Lead (Pb)	2021/01/13	ND, RDL=0.50		ug/L	
			Lithium (Li)	2021/01/13	ND, RDL=5.0		ug/L	
			Magnesium (Mg)	2021/01/13	ND, RDL=50		ug/L	
			Manganese (Mn)	2021/01/13	ND, RDL=2.0		ug/L	
			Molybdenum (Mo)	2021/01/13	ND, RDL=0.50		ug/L	
			Nickel (Ni)	2021/01/13	ND, RDL=1.0		ug/L	
			Phosphorus (P)	2021/01/13	ND, RDL=100		ug/L	
			Potassium (K)	2021/01/13	ND, RDL=200		ug/L	
			Selenium (Se)	2021/01/13	ND, RDL=2.0		ug/L	
			Silicon (Si)	2021/01/13	ND, RDL=50		ug/L	
			Silver (Ag)	2021/01/13	ND, RDL=0.090		ug/L	
			Sodium (Na)	2021/01/13	ND, RDL=100		ug/L	
			Strontium (Sr)	2021/01/13	ND, RDL=1.0		ug/L	
			Thallium (Tl)	2021/01/13	ND, RDL=0.050		ug/L	
			Titanium (Ti)	2021/01/13	ND, RDL=5.0		ug/L	
			Uranium (U)	2021/01/13	ND, RDL=0.10		ug/L	
			Vanadium (V)	2021/01/13	ND, RDL=0.50		ug/L	
			Zinc (Zn)	2021/01/13	ND, RDL=5.0		ug/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
7148433	AFZ	RPD [OOW152-02]	Aluminum (Al)	2021/01/13	19		%	20
			Antimony (Sb)	2021/01/13	NC		%	20
			Arsenic (As)	2021/01/13	NC		%	20
			Barium (Ba)	2021/01/13	3.9		%	20
			Beryllium (Be)	2021/01/13	NC		%	20
			Boron (B)	2021/01/13	1.7		%	20
			Cadmium (Cd)	2021/01/13	NC		%	20
			Calcium (Ca)	2021/01/13	6.4		%	20
			Chromium (Cr)	2021/01/13	NC		%	20
			Cobalt (Co)	2021/01/13	NC		%	20
			Copper (Cu)	2021/01/13	3.7		%	20
			Iron (Fe)	2021/01/13	NC		%	20
			Lead (Pb)	2021/01/13	NC		%	20
			Lithium (Li)	2021/01/13	NC		%	20
			Magnesium (Mg)	2021/01/13	0.72		%	20
			Manganese (Mn)	2021/01/13	0.34		%	20
			Molybdenum (Mo)	2021/01/13	2.2		%	20
			Nickel (Ni)	2021/01/13	NC		%	20
			Phosphorus (P)	2021/01/13	NC		%	20
			Potassium (K)	2021/01/13	0.41		%	20
			Selenium (Se)	2021/01/13	NC		%	20
			Silicon (Si)	2021/01/13	5.5		%	20
			Silver (Ag)	2021/01/13	NC		%	20
			Sodium (Na)	2021/01/13	1.0		%	20
			Strontium (Sr)	2021/01/13	2.0		%	20
			Thallium (Tl)	2021/01/13	NC		%	20
			Titanium (Ti)	2021/01/13	NC		%	20
			Uranium (U)	2021/01/13	NC		%	20
			Vanadium (V)	2021/01/13	NC		%	20
			Zinc (Zn)	2021/01/13	NC		%	20
7148441	SAU	Spiked Blank	Conductivity	2021/01/14		101	%	85 - 115
7148441	SAU	Method Blank	Conductivity	2021/01/14	ND, RDL=1.0		umho/cm	
7148441	SAU	RPD [OOW152-01]	Conductivity	2021/01/14	0.49		%	25
7148443	SAU	Spiked Blank	pH	2021/01/14		101	%	98 - 103
7148443	SAU	RPD [OOW152-01]	pH	2021/01/14	0.69		%	N/A
7148823	NS3	Matrix Spike [OOW152-04]	Dissolved Organic Carbon	2021/01/14		102	%	80 - 120
7148823	NS3	Spiked Blank	Dissolved Organic Carbon	2021/01/14		103	%	80 - 120
7148823	NS3	Method Blank	Dissolved Organic Carbon	2021/01/14	ND, RDL=0.40		mg/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
7148823	NS3	RPD [OOW152-04]	Dissolved Organic Carbon	2021/01/14	1.0		%	20

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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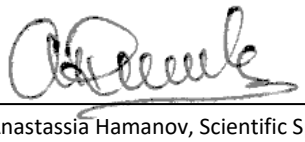
VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Anastassia Hamanov, Scientific Specialist

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Exceedance Summary Table – DW for Human Consumption

Result Exceedances

Sample ID	BV Labs ID	Parameter	Criteria	Result	DL	UNITS
No Exceedances						

The exceedance summary table is for information purposes only and should not be considered a comprehensive listing or statement of conformance to applicable regulatory guidelines.

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WELLINGTON NORTH
SEMPER PORRO

Staff Report

To:	Mayor and Members of Council Meeting of February 8, 2021
From:	Matthew Aston, Director of Operations Corey Schmidt, Environmental Services Manager
Subject:	OPS 2021-005 being a report on the water and wastewater technical update(s)

RECOMMENDATION

THAT Council of the Township of Wellington North receive Report OPS 2021-005 being a report on the water and wastewater technical update(s);

AND FURTHER THAT Council direct staff to post these reports on the Township website.

PREVIOUS PERTINENT REPORTS/BY-LAWS/RESOLUTIONS

2020 Capital Budget

BACKGROUND

As a part of the 2020 capital budget, technical updates to the existing Master Plans for drinking water and wastewater, in Arthur and Mount Forest, was approved. The attached are the resulting reports.

Township staff feel these reports should be added to the Township website.

Township staff feel the following are the priority projects, excluding existing linear infrastructure rehabilitation:

- Consideration for improvements to the Arthur drinking water infrastructure including storage, treatment and well supply (well exploration in Arthur was included as part of the 2021 capital budget);
- Consideration for when Phase 2 of the Arthur Wastewater Treatment Plant (WWTP) upgrades happen; and
- Continuing to work through the re-rating of the Mount Forest WWTP.

Some considerations:

- Arthur drinking water system would benefit from redundancy;
- Phase 2 of Arthur WWTP is designed and ready for construction; and
- Tons of risk related to re-rating of Mount Forest WWTP.

I think in the rear-view mirror, we need to keep in focus:

- Mount Forest will require new water storage within the next 5-10 years (update evaluates three alternatives, final selection of preferred alternative is likely subject to Schedule B Class Environmental Assessment);
- Mount Forest stand-pipe project (approved in 2021 Capital Budget) is required to buy Wellington North 5-10 years;
- Drinking water treatment in Arthur is challenge because of the lack of sanitary sewers local to our drinking water wells (Well Street, Jones Baseline) to address; and
- Dollars need to continue to be put forward re-rate the Mount Forest WWTP.

FINANCIAL CONSIDERATIONS

$100,000 in 2021 Capital Budget for new Arthur water supply
$75,000 in 2020 Capital Budget for Mount Forest Water Tower Design
$950,000 in 2021 Capital Budget for Mount Forest Stand-Pipe Rehabilitation

Both technical studies identify significant Future Capital Project Estimates

ATTACHMENTS

Water and Sanitary Systems Technical Study-Arthur September 2020 Triton Engineering Services Limited

Mount Forest Sanitary and Water Servicing Technical Update January 2021 B.M. Ross and Associates Limited

STRATEGIC PLAN 2019 – 2022

Do the report's recommendations align with our Strategic Areas of Focus?

☒ Yes ☐ No ☐ N/A

Which priority does this report support?

☐ Modernization and Efficiency
☒ Municipal Infrastructure
☐ Partnerships
☐ Alignment and Integration

Prepared By:	Matthew Aston, Director of Operations Corey Schmidt, Environmental Services Manager
Recommended By:	Michael Givens, Chief Administrative Officer *Michael Givens*

THE CORPORATION OF THE TOWNSHIP OF WELLINGTON NORTH

BY-LAW NUMBER 067-21

BEING A BY-LAW TO CONFIRM THE PROCEEDINGS OF THE COUNCIL OF THE CORPORATION OF THE TOWNSHIP OF WELLINGTON NORTH AT ITS SPECIAL MEETING HELD ON JUNE 2, 2021

WHEREAS Section 5 of the Municipal Act, S.O. 2001 c.25 (hereinafter called "the Act") provides that the powers of a Municipal Corporation shall be exercised by its Council;

AND WHEREAS Section 5(3) of the Act states, a municipal power, including a municipality's capacity, rights, powers and privileges under Section 9, shall be exercised by by-law, unless the municipality is specifically authorized to do otherwise;

NOW THEREFORE the Council of The Corporation of the Township of Wellington North hereby **ENACTS AS FOLLOWS**:

1. The action of the Council of the Corporation of the Township of Wellington North taken at its meeting held on June 2, 2021 in respect of each motion and resolution passed and other action taken by the Council of the Corporation of the Township of Wellington North at its meeting, is hereby adopted and confirmed as if all such proceedings were expressly embodied in this By-law.

2. That the Mayor and the proper officials of the Corporation of the Township of Wellington North are hereby authorized and directed to do all things necessary to give effect to the action of the Council of the Corporation of the Township of Wellington North referred to in the proceeding section hereof.

3. The Mayor and the Clerk are authorized and directed to execute all documents necessary in that behalf and to affix thereto the Seal of the Corporation of the Township of Wellington North.

READ A FIRST, SECOND AND THIRD TIME AND FINALLY PASSED THIS 2ND DAY OF JUNE, 2021.

ANDREW LENNOX, MAYOR

KARREN WALLACE, CLERK